AMERICAN SOCIETY FOR LASER MEDICINE AND SURGERY

ABSTRACTS

CUTANEOUS LASER SURGERY

#1

FRACTIONAL LASER-MEDIATED DELIVERY OF INGENOL MEBUTATE - PRELIMINARY RESULTS FROM AN *IN VITRO* FRANZ CELL STUDY

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Background: Ingenol Mebutate gel (IngMeb) is a new FDA approved field directed treatment against Actinic Keratosis (AK). A recent study on clinically typical AK's showed complete clearance rates of 34% for trunk and extremities, and 42% for face and scalp (Lebwohl *et al.*, N Engl J Med., 2012 Mar 15;366(11):1010-9). The epidermal permeability barrier, primarily constituted by the stratum corneum (SC), limits the uptake of topically applied drugs. Pre-treatment with fractional ablative laser (AFxL) generates micropores that increase the skin permeability. AFxL pre-treatment may improve the uptake of IngMeb and enable future treatment of hyperkeratotic lesions and add to the overall efficacy. The objective of this study is to investigate whether AFxL pre-treatment enhances the uptake of IngMeb in the skin.

Study: Penetration was investigated in an in vitro Franz cell model, using porcine skin. Prior to IngMeb application the skin was pre-treated with a fractional 2940 Er:YAG laser. Two settings were used, delivering 11.2 mJ/laser channel (1.7 W, 125 μs, 2 stacks) and 128 mJ/laser channel (1.3 W, 225 μs, 10 stacks) at different densities. The shape and depth of the micropores were evaluated in a dissecting microscope. After 21 h in the Franz cells, SC was tape stripped and liquid chromatography–mass spectrometry (LC-MS) was used to analyze IngMeb concentrations in SC, skin and receptor fluid.

Results: Superficial and mid-dermal, cone shaped pores were created at penetration depths of approximately 50 and 500 μm. Preliminary results from LC-MC analysis (n = 5) show that AFxL pre-treatment at 5% density with mid-dermal pores (500 μm) increases the epidermal/dermal uptake with up to 100%, compared to normal skin.

Conclusion: These initial data suggest that AFxL pre-treatment is likely to enhance the uptake of IngMeb in the skin. This might enable treatment of hyperkeratotic lesions as well as increase overall efficacy when treating AK's with IngMeb.

#2

SPLIT FACE COMPARISON OF THE EFFECTS OF VITAMIN CE FERULIC FORMULA SERUM TO DECREASE POST-OPERATIVE RECOVERY AND INCREASE NEOCOLLAGENOSIS IN FRACTIONAL ABLATIVE LASER RESURFACING FOR PHOTODAMAGE

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Background: New fractional ablative laser skin resurfacing is associated with shorter periods of recovery time in comparison with older ablative technology. However one deterrent is the seven days of downtime associated with the procedure. Previous studies have shown that application of vitamin C, E and ferulic acid improves wound healing and promotes the induction of collagen. The objective of this study was to prospectively evaluate the efficacy of vitamin C, E, ferulic acid decreasing post-operative downtime. Secondary objectives were to evaluate synergistic response of laser and topical application on the up regulation and formation of collagen through histological evaluation of mRNA and collagen I and III.

Study: A double blinded (patient and assessor) randomized (one side active vs vehicle) prospective IRB approved study with 15 subjects with moderate photodamage were chosen according to Glogau classification scale. Subjects were treated with immediate post-operative application of vitamin C, E, and ferulic acid to one side of face and vehicle to the other side of face after fractional laser therapy and daily for six months. Three blinded investigators evaluated photographs to evaluate the "day patient could return to work." Randomly 5 patients were chosen for preauricular biopsies at baseline, five days, 3 months and six months for H&E, RT-PCR for mRNA collagen I and III and collagen I & III levels. Patients were also evaluated daily for days 1–7 for photographs and patient questionnaires.

Results: Post-operative vitamin C, E, and ferulic delivery resulted in decreasing edema vs. vehicle on post-operative day 3 and decreased erythema vs. vehicle post-operative day 3, 4 and 5.

Conclusion: Overall vitamin C, E and ferulic acid is well tolerated immediately post fractional ablative laser. Data review show trends of decreasing downtime 24–48 hours with ability of patients to return to work and social life more quickly.

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#3

EFFECT OF TOPICAL CORTICOSTEROIDS ON THE INCIDENCE OF POST-INFLAMMATORY HYPERPIGMENTATION AFTER TREATMENT OF ATROPHIC ACNE SCARS IN ASIANS WITH ABLATIVE FRACTIONAL CO_2 LASER RESURFACING

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Background: Post-inflammatory hyperpigmentation is the most common adverse effect of laser treatments in dark-skinned individuals. Treatment of PIH is difficult because there are few, if any, therapeutic options that are consistently successful. Little is known about whether PIH can be prevented or minimized. The objective of the present study was to investigate the effect of short-term application of topical corticosteroids on the incidence of PIH after ablative fractional resurfacing in Asian patients.

Study: Forty subjects with skin phototype IV and atrophic acne scars were treated with a fractional fractional CO_2 laser. Post-operatively, one randomly selected face side of each patient was applied clobetasol propionate 0.05% ointment for the first two days, followed by petrolatum jelly for the rest of the week, and the other side was applied petrolatum jelly for seven days. Objective and subjective assessments on clinical outcome, wound healing process and the occurrence of PIH were obtained once weekly for the first month and at 2 and 3 months post-treatment.

Results: The sides treated with petrolatum jelly alone had significantly ($p < .001$) higher incidence of PIH (PIH incidence of 75%) after laser irradiation than the sides treated with topical corticosteroids and petrolatum jelly (PIH incidence of 40%). The clinical evaluation corresponded to the color reading. The PIH occurring on the petrolatum jelly-treated sides had significantly higher intensity ($p < .001$) and spread over a significantly larger area ($p < .001$), compared with the corticosteroids and petrolatum jelly-treated sides. In addition, the petrolatum jelly-treated sides were associated with longer duration of post-operative discomfort ($p = .004$). There were no significant differences in treatment outcome, duration of crusting, erythema and edema, and adverse effects between two post-operative regimens.

Conclusion: Short-term application of topical corticosteroids post-operatively is associated with a decreased risk of PIH after ablative fractional resurfacing.

#4

FRACTIONAL NON-ABLATIVE Q-SWITCHED 1064 nm Nd:YAG LASER TO REJUVENATE AGED SKIN: A PILOT CASE SERIES

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Background: Scientific research in the field of energy- and light-based procedures made it possible to develop a very new and innovative generation of lasers which combine the benefit of a non-ablative and a fractional laser device promising skin rejuvenation without harming the epidermis. With this pilot case series we performed one of the first systematic reports evaluating efficacy and safety of the fractional, non-ablative Q-Switched 1064 nm Nd:YAG laser device in the treatment of rhytids of the face, neck and chest.

Study: Seven healthy female subjects (Mean 53.8 ± SD 10.0) with visible signs of facial and neck skin aging were treated with fractional, non-ablative Q-Switched 1064 nm neodymium:YAG laser device (Pixel QS Nd:YAG, Alma Lasers™). Treated areas were the face, including the periorbital and perioral regions (particularly the upper lip), neck and chest. Treatments consisted of 3 sessions at 2–4 week intervals. Follow-up was performed monthly following the final treatment. The Alexiades-Armenakas Comprehensive Grading Scale of Skin Aging was employed to assess efficacy. Pain ratings were recorded by 10-point visual assessment scoring.

Results: Employing the validated, quantitative grading scale for rhytids of the face and neck, a 0.29 grade improvement or 11.3% improvement over baseline grade was observed in the 7-subject cohort that completed follow-up following a mean of approximately 2 treatments at approximately 1 month follow-up. No pain and rapidly resolving minimal erythema were noted in all subjects during treatment.

Conclusion: The results of this pilot case series suggest that the treatment with the fractional, non-ablative Q-Switched 1064 nm Nd:YAG laser device significantly improves superficial rhytides. With its outstanding safety it seems to be particularly suitable for the treatment of sensitive areas, such as periorbital, lip, neck and chest. The Q-switched Nd:YAG laser is a facile, safe and fast treatment for aesthetic skin rejuvenation.

#5

NOVEL LOW ENERGY LOW DENSITY NON-ABLATIVE FRACTIONAL TREATMENT OF MELASMA AND POST INFLAMMATORY HYPERPIGMENTATION

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Background: Hyperpigmentation, including melasma and post inflammatory hyperpigmentation (PIH), is a common complaint among dermatologic patients. Laser therapies utilized to date have failed to yield consistent and longstanding reduction in pigmentation, especially in individuals of darker skin types. We present the first report of a new low energy, low density nonablative fractional 1927 nm diode laser in the treatment of melasma and PIH.

Study: Single-center study in 30 women with Fitzpatrick Skin Types I–VI with a clinical diagnosis of melasma or PIH. Patients received up to six consecutive treatments at two week intervals with the Clear and Brilliant Permea fractional 1927 nm diode laser (Solta, Hayward, CA) with spot sizes of 110–180 um, energy of 5 mJ, and 5 to 7.5% treatment coverage. Treatment areas were clinically assessed for erythema and edema immediately post treatment as well as overall improvement in pigmentation at each subsequent visit. Standardized clinical images were obtained (VISIA, Canfield) before each treatment and at one month follow up visits. Blinded investigator evaluation was performed and a representative subset of images were analyzed using the VISIA system.

Results: Blinded physician assessment demonstrated that 44% of subjects experienced 76–100% improvement in pigmentation (Quartile scale: 0–25%, 26–50%, 51–75%, 76–100%). Objective VISIA measurements confirmed these observations, demonstrating a consistent reduction in absolute pigmentation.

Immediately post treatment, transient erythema and edema were observed in most patients. No adverse events, including post inflammatory hyper- or hypopigmentation were noted during course of treatment.
Conclusion: Treatment with a new low energy and density nonablative fractional 1927 nm diode laser resulted in significant reduction of hyperpigmentation in women of all Fitzpatrick skin types without untoward side effects including exacerbation of existing pigmentation.

#6

CLINICAL EVALUATION OF A NON-ABLATIVE 1940 nm FRACTIONAL LASER

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Background: Non-ablative fractional lasers cause little down time; however, some patients want more noticeable results with fewer treatments. The 1940 nm wavelength matches one of the water absorption peaks in the mid-infrared band of electromagnetic energy. The skin absorption is much stronger than other non-ablative wavelengths (1410–1550 nm) and weaker than ablative wavelengths. The objectives of this study were to characterize clinical efficacy using this technology to treat photodamaged skin in human subjects.
Study: Eleven patients with facial photodamage (1 male and 10 females) were enrolled and completed the study. The fractional 1940 nm laser was comprised of a thulium rod pumped by a pulsed alexandrite laser. The fractional patterns were generated by three separate handpieces (two dot and one grid geometries) whereby a larger beam was broken up into smaller microbeams by a diffractive microlens system. The percent coverage per pass was approximately 30% and 15%, respectively, for the two dot handpieces. The macro-spot size was 12 mm and a total energy applied was approximately 2–3 J ($\sim$ 6–10 mJ per mircobeam). Pulses of the 12 mm diameter handpiece were applied with 20% overlap. The microspot size for the dot handpieces was $\sim$ 0.35 mm. The grid pattern handpiece included 0.7 mm wide lines with 65% coverage. Each patient received 3 full-face treatments 4–6 weeks apart. Anesthesia was achieved by numbing cream and a cold air zimmer. Typical treatments were carried out with two passes. Outcome assessments included changes in pigment, rhytides, laxity, texture, and elastosis, using a global pigment scale, the Fitzpatrick Wrinkling and Elastosis Scoring Scale, and the Alexiades-Armenakas Comprehensive Grading Scale of Rhytides, Laxity, and Photodamage. Photographs of each patient from prior to treatment, 1 month post treatment and 3 months post treatment were analyzed by 3 blinded raters. A paired t-test was applied for each category comparing the pre treatment and 3 month post treatment results.
Results: 3 months after the final treatment, (a) mean texture scores were unchanged, (b) wrinkles were reduced by 15%, and (c) pigment improvement was 30%. Both the wrinkle and pigment reductions were statistically significant ($p = 0.05$). Clinical downtime was 3–5 days. Pain was variable (mean of 3/10) and side effects included two cases of mild focal vesiculation. No long-term side effects were noted. Histological analysis showed focal damage that extended about 200 μm deep to the surface.
Conclusion: The study demonstrated that the 1940 nm diode laser can achieve injury patterns capable of skin rejuvenation.

#7

FRACTIONATED ABLATIVE CO_2 LASER FOR THE TREATMENT OF RHINOPHYMA

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Background: Rhinophyma is a progressive and disfiguring proliferative disorder of the nose, which is related to chronic rosacea. Many different treatment modalities have been utilized both alone and in combination including: loop cautery, CO_2 laser, argon laser, dermabrasion, cryotherapy, radiotherapy, full-thickness excision, skin graft, flap reconstruction and cold scalpel. CO_2 resurfacing has been considered first line therapy but is often associated with a shiny, scarred appearance with patulous pores and loss of pigmentation. We report a technique using aggressive parameters with the fractionated ablative CO_2 laser, resulting in improvement of appearance with very few complications.
Study: Five patients who presented with rhinophyma of varying degrees were treated with a series of fractional ablative CO_2 laser treatments (Fraxel re:Pair, Solta Medical, Hayward, CA). These patients were treated with settings of up to 70 mJ, 70% density and 10–12 passes. All patients received HSV prophylaxis using either acyclovir 400 mg TID or valacyclovir 500 mg BID. Patients were rendered anesthetic by 1% lidocaine and epinephrine regional perinasal nerve block.
Results: All of the patients tolerated the procedure well with re-epithelialization at days 4–7 and self-limited edema and erythema. Patients with relatively early to moderate signs of rhinophyma proved optimal candidates for this treatment. There were no adverse events. Patients and physicians noted significant improvement and reduction in the rhinophyma without the typical scarring noted with most other treatments.
Conclusion: Rhinophyma treated with fractionated ablative CO_2 laser using relatively aggressive parameters achieved good cosmetic outcomes in this group of early to moderate cases of rhinophyma, while still retaining the benefits of a fractionated treatment such as faster healing times and fewer adverse events.

#8

NON-ABLATIVE FRACTIONAL TECHNIQUE WITH MICRO-COMPRESSION OPTICS FOR DEEP HEATING AND REMODELING OF SURGICAL SCARS: 2-YEAR REVIEW

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Background: Multiple fractional lasers including ablative and non-ablative have been reported to improve the texture, firmness and elevation of surgical scars. The use of optical mechanical coupling with point compression of optical prongs has demonstrated that energy may be delivered as deeply as 2000 microns in experimental models. The purpose of this study was to review records to determine if clinical outcomes were significantly improved by directing 1540 nm fractional non-ablative zones more deeply with compression optics into surgical scars.
Study: Surgical scar patient treatments from 2010–2012 were reviewed and patients ($N = 51$) treated using a fractional 1540 nm handpiece with a micro-compression optical tip were selected. The treatment was performed using a square array with 49 micro-pins each co-aligned with a micro-beam and separated by 2 mm (1540 nm XD optic, Palomar Medical). Average column depth for

1 pulse was 1150 microns with 3 stacked pulses showing 1900–2000 microns in heating depth. The total number of treatments was recorded as well as any side effects, comments regarding pain during the procedure and efficacy assessment performed via clinical images. Clinical outcome was assessed by review of images for texture and elevation as well as patient assessment.
Results: The median number of treatment was 3. The average age of the scars was 5.23 years. Treatments consisted of 4 passes using 50 mJ per fractional beam, pulse duration of 15 msec. Thicker scars were often treated using pulse stacking of up to 3 stacks for deeper penetration. Some scars had been previously treated by other modalities with minimal clinical improvement. Ninety percent of patients treated by micro- compression fractional non-ablative rated their scars as clinically improved. No topical anesthesia was employed, air cooling was utilized in 82% for added comfort. No epidermal injuries were reported.
Conclusion: The purpose of micro-compression optics is to displace water and blood from the upper 100–200 microns of the skin achieving lower temperatures of dermal-epidermal junction, decreasing overall scar thickness during treatment by flattening of collagen and lower scattering of light with deeper penetration. This approach results in a clinical significant improvement in scars with typically 3 treatments, is very safe and used as primary or adjunctive modality. It may be successfully employed when other modalities have not lead to optimal results.

#9

FRACTIONAL ABLATIVE RADIOFREQUENCY FOR THE TREATMENT OF ACNE SCARS-SAFETY AND EFFICACY STUDY

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Background: Fractional ablative radiofrequency (RF Pixel, Alma Lasers, Chicago, IL) based technology creates multiple, controlled, micro-perforations with a zone of thermal injury. The objective of this single-center study was to assess the safety and efficacy of fractional ablative radiofrequency in the treatment of acne scars.
Study: Ten subjects (Fitzpatrick Skin Types I-IV) with documented mild to moderate rolling and boxcar acne scars received treatment with the fractional ablative radiofrequency device under IRB approval. Subjects underwent a preauricular test-spot to establish optimal energy power 2 weeks prior to full face treatment. For anesthesia, subjects received topical 30% lidocaine and nerve blocks. Full face treatment consisted of 4 passes with a total energy of 360 W. Subjects were evaluated at 1, 5, 30, and 90 days post-treatment. Improvement was assessed by the investigator physician based on visual appearance and on fixed magnification photography and then rated on a 1 to 4 improvement scale: -1(exacerbation), 0(no change), 1(1%–25% improvement), 2(25%–50% improvement), 3(50%–75% improvement), and 4(75%–99% improvement). Both subjects and treating physicians rated treatment satisfaction. Subsequent rating of photographs was performed by four independent, blinded, board-certified dermatologists who did not perform the treatments.
Results: Both subject and treating physician satisfaction rated improvement very good to excellent. Patients tolerated the procedure moderately well with a mean pain score of 5.25 on 0–10 scale. There were no sequelae of dyspigmentation, prolonged erythema or scarring. The rating of photographic results viewed on computer monitors did not reveal improvement in acne scarring severity.
Conclusion: Fractional ablative radiofrequency treatments improves acne scars with a non-chromophore-dependent technology and is unaccompanied by any long-term side-effects or sequelae. Subjects tolerated the procedure well with minimal down-time and with moderate levels of procedure related pain. Subject and treating physician satisfaction illustrated very good to excellent results. However, review of results viewed on photographs did not demonstrate consistent changes brought about by the treatments. Photographs of subjects were taken in a standardized fashion with a handheld camera and subtle variations in lighting, distance and camera angle likely explain the differing results.

#10

IS DEEPER BETTER: A PROSPECTIVE STUDY OF DEEP vs SUPERFICIAL NON-ABLATIVE FRACTIONAL LASER TREATMENT OF ACNE SCARS AND PHOTO-AGING

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Background: Conventional wisdom has suggested that deeper non-ablative fractional treatments lead to better clinical outcomes than more superficial settings. However, there is a suggestion from the examination of molecular mechanisms that only minimal differences were noted between lower and higher micro beam settings. Superficial treatments are better tolerated with less pain and a better side effect profile than deeper treatments. We performed a prospective two-arm study utilizing two fractional compression 1540 nm handpieces (XD and XF) on an ICON™ system (Palomar Medical Technologies, Inc.) to compare coverage rate versus depth at equivalent total coagulated dermal volumes.
Study: Treatment parameters were based on analysis of in vitro porcine histology. 14 patients with acne scars and 4 patients with photo-aging were treated in a randomized split-faced study. One side received 20% coverage with the XF tip at 40 mJ, 15 ms (600 microns depth of dermal injury) and the other side received 7% coverage with the XD head at 70 mJ at 15 ms (1300 microns depth of dermal injury) plus 5% coverage to that side with the XF 40 mJ at 15 ms. Both sides had approximately equivalent total coagulated dermis volumes. Patients were treated with 3 monthly treatments and evaluated at 1 month and 3 months post final treatment with a blinded examination and photograph review.
Results: The blinded investigator evaluation and a blinded photo evaluation by three individuals failed to show significant difference between the two sides.
Conclusion: This study supports the earlier work on molecular mechanisms suggesting that lower fluences result in similar outcomes than deeper treatments when the non-ablative volume is kept constant. Earlier work suggests that a threshold depth of injury is important. However, after this point, total volume of tissue treated may best relate to clinical outcome.

#11

LONG-TERM EFFICACY FROM 1540 nm NON-ABLATIVE FRACTIONAL LASER RESURFACING WITH COMBO COMPRESSION

HANDPIECES FOR MATURE BURN SCARS - A RANDOMIZED CONTROLLED TRIAL WITH HISTOLOGICAL EVALUATION

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Background: Burn scars are difficult to treat. Increasing evidence appears for non-ablative fractional lasers (NAFXL) to remodel mature burn scar tissue, but optimal treatment settings remain to be established and there is a lack of long-term data. The aim of this study was to investigate long-term treatment outcome from combinations of two handpieces that deliver energy to deep (XD) and superficial (XF) skin layers, respectively.

Study: Seventeen of 20 included patients completed study (median age 37.5 years, Fitzpatrick skin types II–III, median scar age 6.5 years, involving trunk and extremities, 75% received prior skin transplants). Side-by-side test areas were randomized to (i) three monthly 1540 nm fractional laser treatments with XD and XF combo treatments (ii) no treatment. On-site response evaluations were performed at 1, 3, and 6 months after final treatment, using modified POSAS (Patient and Observer Scar Assessment Scale, 10 point scale including assessments of vascularity, pigmentation, thickness, relief and pliability). 3D-pictures were taken to support clinical data. Biopsies were taken before and 6 months after treatment from treated and untreated scar areas.

Results: Pre-operative test sites were similar and moderately uneven in treated (7 (5–7)) and untreated (7 (5–7)) test sites ($p = 1$). Post-operative NAFXL-treated skin appeared smoother than adjacent, untreated control sites. By overall assessments, scar tissue improved over time during the post-operative observation period (1 mth: 5 (5–6.76) ($p = 0.32$ vs untreated control); 3 mth: 5 (4–6) ($p = 0.02$); 6 mth: 4 (3–5) ($p < 0.01$). Meshed skin responded better to treatments than non-transplanted skin. Overall, patients were satisfied with treatment (78%). Preliminary histology data demonstrated remodeling of stratum corneum often accompanied by a thicker epidermal compartment. In most cases, collagen remodeling was visibly by higher vascularization with uniform dense interwoven fibres.

Conclusion: This study documents for the first time ever, a long-term and continuously improving efficacy from NAFXL for mature burn scars.

#12

THE EFFICACY OF MULTIPLE-PASS TATTOO REMOVAL IN A SINGLE SESSION IN ASIAN PATIENTS

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Background: Tattoo removal by Q-switched lasers has been widely performed for many years. Recently, some physicians have reported that multiple passes in a single session ("R20 method") is more effective than a single pass. Our objective was to evaluate the efficacy and safety of multiple-pass tattoo removal with topical perfluorodecalin (PFD) ("R0 method") in Asian patients.

Study: 23 tattoos in skin type IV patients were treated over half with a single pass using the conventional method, and the opposite half using 2 or 3 passes with the multiple-pass R0 method by Q-switched Ruby laser (QSRL). In R0, each pass was followed by PFD application and subsidence of at least 50% of immediate whitening (IW). Treatments were performed under local or topical anesthesia, and repeated 1–5 times at 4–8 weeks with QSRL (5.35 ± 0.64 J/cm^2, 20 nsec, 5 mm spot size). Efficacy for each side was assessed by the degree of tattoo lightening from photographs by two blinded physicians using a 4-point scale: 1 (0–25%), 2 (26–50%), 3 (51–75%), 4 (76–100%) 1 to 2 months after the final treatment.

Results: The percentage of lesions evaluated 1 to 4 was; 8.7%, 50.0%, 23.9%, 17.4% in conventional sides, and 4.3%, 21.7%, 37.0%, 37.0% in multiple-pass sides, respectively. Multiple-pass with PFD application was more effective with statistical significance ($p = 0.0002$). Adverse events of transient post-inflammatory hyperpigmentation (PIH) and hypopigmentation were seen in 30.4% and 26.1% of lesions on both sides of the lesions, but the degree of PIH was slightly stronger in multiple-pass sides. There were no adverse events by topical PFD itself.

Conclusion: Multiple-pass in a single session with PFD application, R0 method, was more effective than single-pass in tattoo removal in Asian patients. Further study is needed to optimize the parameters and intervals of treatments to safely increase the efficacy.

#13

COMBINATION OF ANTIANGIOGENIC AGENTS FOR INHIBITING REGENERATION OF PHOTOCOAGULATED BLOOD VESSELS IN AN *IN VIVO* MICROVASCULAR MODEL

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Background: Attenuation of angiogenesis associated with the skin's normal wound healing response after laser treatment of vascular birthmarks has shown varying degrees of success in pre-clinical and clinical studies. A combination of two or more antiangiogenic agents may result in synergistic effects on reducing the revascularization of photocoagulated blood vessels due to the activation of multiple angiogenic signaling pathways post-laser irradiation. Our objective was to study the safety and efficacy of combined honokiol and rapamycin for preventing photocoagulated blood vessels from regenerating.

Study: Honokiol is a pure compound isolated from Magnolia officinalis extracts, a medicinal herb. Honokiol regulates the nuclear factor kappa B activation pathway, an upstream effector of many pro-angiogenic factors, such as vascular endothelial growth factor and cyclooxygenase-2. Rapamycin is a specific mTOR inhibitor which abrogates hypoxia-mediated amplification of proliferation and angiogenesis. Topical ointment was formulated with 1% of each agent and a medical base. The animal model was the dorsal skinfold window chamber on hamster. Blood vessels in the window were irradiated with a 532 nm laser from the dermal side and ointment was applied to the epidermal side of the window daily for 14 days. The blood vessel structure and blood flow changes induced by laser and

angiogenesis were documented with digital photography and laser speckle imaging.
Results: The regeneration percentage of coagulated blood vessels was reduced from nearly 100% for control (laser irradiation only) to 11% for the combination of honokiol and rapamycin (n = 5 animals). This percentage was 39% when rapamycin-only ointment was used based on our previous data. Skin irritation was not observed.
Conclusion: Combination of antiangiogenic agents is a promising approach to improve laser therapy of cutaneous vascular lesions and a systematic study of other combinations of antiangiogenic agents is worthwhile.

#14

CLINICAL EVALUATION OF THE ROLE OF LASER SPECKLE IMAGING FOR IMAGE-GUIDED LASER SURGERY OF PORT WINE STAIN BIRTHMARKS

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Background: Laser speckle imaging (LSI) enables non-invasive characterization of blood flow in biological tissues. Our previous studies highlighted the potential of LSI as a tool to assess photocoagulation during laser treatment of port wine stain (PWS) birthmarks. Our study objective was to evaluate the efficacy of LSI both as a tool for image-guided surgery and as a means of assessing the correlation between observed decreases in blood flow and treatment efficacy.
Study: We collected LSI data during laser surgery of 56 treatment sessions for 24 subjects ranging from 2 to 66 years of age. Changes in Speckle Flow Index (SFI), our quantitative metric of skin blood perfusion, during a treatment session were calculated as a percent difference of post treatment SFI to pretreatment SFI values. Treatment efficacy was assessed as a blanching score (i.e., percent improvement) by two clinicians who performed blinded evaluation of digital color photographs taken prior to laser surgery sessions.
Results: The average change (n = 56) in SFI was a perfusion reduction of 32%. Based on clinician evaluation, 22 of the 24 subjects experienced some (5–75%) blanching of their PWS. For all subjects who experienced a blanching score of >20%, an intraoperative reduction in SFI of >25% was measured. For the subjects who experienced a blanching score of >50%, an intraoperative reduction in SFI of >38% was measured.
Conclusion: A decrease in blood perfusion is a necessary mechanism for the successful treatment of PWS. While treatment sessions associated with a large >40% reduction in SFI sometimes (3 out of 10) were not associated with a high blanching score, small <20% reductions in SFI, consistently (n = 4) were associated with a poor treatment outcome. Intraoperative LSI during laser surgery of PWS birthmarks, enables real-time, monitoring of skin perfusion dynamics, and potentially enables clinicians to use changes in SFI as a quantitative target to achieve.

#15

OPTIMIZING PARAMETERS FOR TREATMENT OF PORT WINE STAINS WITH THE 755 nm ALEXANDRITE LASER

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Background: Port wine stains (PWS) are primarily comprised of post-capillary venules, but vary in their vessel diameter and depth. A substantial subset of PWS is relatively recalcitrant to therapy with the pulsed dye laser. In such cases, the millisecond duration 755 nm alexandrite laser may provide improved clearance due its greater depth of penetration and relative specificity for deoxygenated hemoglobin. Fluences in the range of 60–80 J/cm^2 have been recommended as the appropriate treatment parameters, but may cause scarring and depigmentation, even in hypertrophic and nodular lesions. This paper evaluates the appropriate endpoints and treatment parameters for optimal outcomes in infantile and adult PWS.
Study: This is an observational study of nine patients with PWS, including 3 infants and 6 adults. Test treatments comparing the response of high fluence (60–80 J/cm^2)/small spot size (8 mm) to low fluence (25–30 J/cm^2)/large spot size (15 mm) treatment with a 3 ms pulse duration and cryogen cooling were examined by clinical assessment and serial photographs.
Results: The low fluence (25–30 J/cm^2)/large spot size (15 mm) combination provided effective clearance with a minimal risk of epidermal side effects, scarring or dyspigmentation. Optimal outcomes were obtained by performing a series of laser passes for macular lesions and pulse stacking in areas of hypertrophy. The immediate endpoint was transient darkening of the treated skin without the development of persistent deep purpura or tissue graying.
Conclusion: Use of the larger spot size provides increased depth of laser light penetration. Use of lower fluences with pulse stacking provides adequate vessel coagulation, possibly via the transient formation of met-hemoglobin, and permits the safe use of the alexandrite laser in the pediatric population. The 3 ms pulse duration 755 nm alexandrite laser, used with the low fluence (25–30 J/cm^2), large spot size (15 mm) combination and pulse stacking, provides improved efficacy with a low risk of adverse effects in recalcitrant pediatric and adult PWS.

#16

CLINICAL AND QUALITY OF LIFE IMPROVEMENT IN RADIATION INDUCED BREAST TELANGIECTASIAS TREATED WITH THE PULSED DYE LASER

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Background: Radiation dermatitis is a sequela of adjuvant radiation therapy for breast cancer. Clinical manifestations include telangiectasias that may be disfiguring and psychologically distressing. We reviewed cases of radiation-induced breast telangiectasias treated with the pulsed dye laser (PDL) to assess clinical efficacy and the quality of life (QoL) impact.
Study: A retrospective review of 11 patients treated for such was conducted at Memorial Sloan-Kettering. Radiation type, dose, distribution of telangiectasias, laser fluence, and percent clearance were assessed. Pre- and post-clinical photos were used to assess clearance by two blinded raters. Patient's comments were collected to assess QoL improvement.
Results: Most patients received 5000 cGy in 25 fractions to the chest. Patients presented, on average, 3.7 years after radiation, though most patients developed telangiecatasias one to two years

out. The 595 nm PDL was used on 9 patients and the 585 nm on two; the clinical end point being purpura. All experienced improvement in the telangiectasias. The mean number of treatments was 4.3 (2–9), with an average fluence of 4.2 (585 nm) and 7.8 (595 nm) Joules (4–8 J), 10 mm spot size, and pulse duration range of 3 to 6 milliseconds. The mean percent clearance was 72.7% (50–90%). No adverse effects were noted even with breast implants or flaps. All patients reported a QoL improvement, including improved confidence and aesthetic appearance. One patient commented that she was now able to change in front of her partner without embarrassment.
Conclusion: The PDL is efficacious and safe for treatment of radiation-induced breast telangiectasias even on reconstructed breasts. Clinical and QoL improvement were noted. Multiple treatments are required for greater than 50% clearance. Akin to a surgical scar, telangiecatasias serve as a reminder of cancer. Some patients stated the telangiectasias affected intimate relationships. To better elucidate the treatment's QoL effects, a prospective study was designed and instituted using validated outcome measures.

#17

TREATMENT OF FACIAL ERYTHEMA IN SKIN TYPES I-IV USING COMBINATION LONG-PULSE AND Q-SWITCHED 1064 nm Nd:YAG LASERS

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Background: Facial erythema is a common concern for many patients. There are both laser and IPL approaches for therapy. Patients with higher skin types are at increased risk of adverse outcome using some of these systems.
Study: Eleven patients with skin types I-IV who presented with facial erythema were treated with combination 1064 nm long-pulse and Q-switched lasers. A total of 21 sites were treated and evaluated. Evaluation was based on comparison of baseline and post treatment pictures. Two blinded evaluators were asked to score the severity of the erythema on a scale of 1–4 with one being mild and four being severe erythema. Percentage of improvement was measured on a scale of 0–100%. The evaluations were done on an average 4 months from the last treatment session.
Results: Immediate reaction was limited to transient erythema and occasional edema. All patients responded with a reduction of erythema with a mean of 74%. No adverse effects were noted.
Conclusion: Combination treatment with the long pulse and the Q-switched Nd:YAG lasers is an effective method for treatment of facial erythema. Patients with Skin Types I–IV can be safely treated for their facial erythema.

#18

TREATMENT OF SPIDER VEINS OF THE LOWER EXTREMITY WITH A NOVEL 532 nm KTP LASER

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Background: Lower extremity spider veins and matt telangiectasias are a common condition that is often difficult to treat. This study investigated spider vein treatment with a new, high-power, 532 nm Nd:YAG, KTP laser with contact cooling.
Study: This was a single-center study of twenty female subjects with Fitzpatrick skin types I-III and mean age of 48 (32 to 66). A dual 532/1064 nm laser (Excel V, Cutera, Brisbane, CA) was used at 532 nm wavelength with spot size of 5 mm, fluences of 13 to 15 J/cm^2, and pulse duration of 40 ms. A total of 79 separate areas with linear and branching spider veins of 0.5 to 1 mm in diameter were treated. Two treatments were performed 12 weeks apart. Standardized photographs were taken at baseline and 3 months following the final treatment. Treatment effect was assessed by two independent physicians reviewing digital photographs in a blinded fashion using a 5 point improvement scale (0 = 0%, 1 = < 25%, 2 = 26–50%, 3 = 51–75%, 4 = 76–100%). Pain levels (0–10 numeric rating scale) and adverse events were recorded.
Results: Based on blinded assessments of photographs by two independent reviewers, treatment resulted in a median improvement of 2.5 (one-sample Wilcoxon signed rank test, 95% CI: 1.9–2.9, p = 0.000). The reviewers were highly consistent (inter-reviewer reliability, kappa of 0.85), and highly accurate (inter-reviewer validity, kappa of 0.85) in identification of the pre- and post-treatment photos. Eighty-one percent of subjects had "moderate" to "very significant" improvement at 24 weeks. There was one case of post-inflammatory hyper-pigmentation (1.5%). All subjects tolerated the treatments extremely well (mean pain score of 2.9/10).
Conclusion: Treatment of spider veins of the leg with a novel 532 nm KTP laser was found to be safe and effective, with minimal discomfort and side effects in Fitzpatrick skin types I–III.

#19

BLEBS BE GONE: SINGLE TREATMENT RESOLUTION WITH A NOVEL 1064 nm Nd:YAG FOR VASCULAR BLEBS WITHIN PORT WINE STAINS

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Background: If left untreated, port wine stains (PWS) can thicken, darken and develop nodules or "vascular blebs" (blebs). These lesions are not only cosmetically unappealing, but can also spontaneously bleed. While pulsed dye lasers (PDL) and intense pulsed light devices (IPL) have been shown to be exceedingly safe and effective in the general treatment of PWS, they are not successful in treatment of these subsequently formed nodules. We evaluated a novel high energy 1064 nm Nd:YAG laser with a sapphire peltier cooled tip in the treatment of PWS-related vascular blebs.
Study: Single-center study of fourteen men and women, average age of 53.17 years (42–62 years), Fitzpatrick Skin Types I–III, with a clinical diagnosis of PWS and blebs. Subjects received treatment with the Excel V 532/1064 nm KTP/Nd:YAG enhanced cooling system (Cutera, Brisbane, CA), allowing for safer delivery of higher energies. We utilized the 1064 nm wavelength, 4 mm spot size, fluences of 110–150 J/cm^2, and pulse width of 20–55 ms. Treatment areas were clinically assessed for overall clearance, as well as improvement in texture and appearance.
Results: Thirteen subjects had PWS of the head and neck, half of which had periorbital involvement, ranging in size from 2 to 400sq cm (average 86.12 sq cm). One subject had arm and hand

involvement. Complete resolution of treated lesions was noted with 100% improvement in texture and appearance. No adverse events were noted.
Conclusion: We report an overwhelming successful laser treatment for vascular blebs in adults with port wine stains, with a novel 1064 nm Nd:YAG cooled tip device. The higher peak energy treatment was proven to be safe and effective with 100% clearance and no adverse events noted after one treatment session.

#20

REAL-TIME MELANIN MEASUREMENTS TO OPTIMIZE TREATMENT SETTINGS AND AVOID COMPLICATIONS

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Background: Eyeball assessment of epidermal melanin content is inconsistent and inaccurate. Overestimation leads to disappointing results; underestimation can lead to vesiculation and even scarring. Predictive value of real-time Melanin Index (MI) measurements for appropriate treatment settings was evaluated across 5 treatment centers in a study presented last year. Over 450 additional patients were treated at one of these centers (Scripps Clinic, San Diego) for further verification/ validation and optimization.
Study: Treatment settings (assessed by experienced operators) were compared to "skintel" settings provided by the system and based on MI readings (Icon™ and Skintel™ Melanin Reader, Palomar Medical, MA) to treat faces, arms, chests, and legs.. Outcomes were assessed via test spots and long term clinical responses. In most cases, test spots (1 cm^2) were performed at levels just below and above the recommended fluences to establish validity and reproducibility of the Skintel settings as a guiding factor in treatment parameter selection.
Results: New curves ((Skintel values in J/cm^2) vs. MI) were generated for two handpieces (MaxG and MaxYs). Overall, for MIs 10–14 (lighter skin), Skintel values were increased by 4 J/cm^2 for the Max G handpiece and up to 8 J/cm^2 for the Max Ys handpiece. For medium pigmentation (15–22 MI), Max G Skintel values were increased by 2 J/cm^2 for the face but unchanged off the face. For medium dark or tanned skin (MI 23–30) and for untanned constitutively dark skin (type V) (MI-30–40), previous Skintel values were optimal. Regional variations in epidermal tolerance were noted; central facial skin showed the greatest and extremities and chest skin the least epidermal tolerances. Individuals with different Fitzpatrick Skin Type but similar melanin content exhibited similar skin tolerance.
Conclusion: Real-time measurement of skin's melanin content accurately guides selection of appropriate and safe treatment settings. Refinement of the recommended settings based on large scale evaluations have increased benefit to risk ratios.

#21

SINGLE TREATMENT WITH 100-MICROSECOND ALEXANDRITE LASER CLEARS SELECTED ACQUIRED MELANOCYTIC NEVI IN TYPE IV ASIAN FACIAL SKIN

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Background: Acquired melanocytic nevi (AMN) are common on Asian facial skin. Many patients seek their removal primarily for cosmetic or superstitious reasons. Some patients also request removal of the nevi to pre-empt enlargement of the mole, or out of fears of malignant change. While the removal of pigmented lesions without prior histological confirmation in a Caucasian patient is undesirable due to concerns of potentially missing a melanoma, such procedures are considered acceptable by some Asian dermatologists as melanomas are rare in Asian skin. To show that the 755 nm Alexandrite laser stacked at the 100-microsecond longpulsed (μsAL) is an effective modality for the removal of selected AMNs.
Study: A retrospective analysis of all patients treated between January 2010 and April 2012 with the μsAL laser for small AMNs was conducted. Pre- and post-treatment facial photographs, and photographs of the individual lesions were analyzed by 2 independent dermatological surgeons for degree of clearance and complications. A telephone interview was conducted with the patients to assess their satisfaction with the procedure.
Results: A total of 18 patients with 53 lesions were included. 7/18 (38.9%) of patients had "excellent" results. No patients had "mild" or "poor" results. At 4 weeks post-treatment, 49/53 (92.5%) were totally cleared, with 14/53 (26.4%) reporting mild atrophy, and 11/53 (20.8%) reporting mild post-inflammatory hypopigmentation. The majority of lesions had negligible complications. 9/18 (50%) judged the procedure to be "excellent", and all patients reported that they would recommend this procedure to a friend seeking removal of small facial AMNs.
Conclusion: The Alexandrite laser at the 100 μs long-pulsed mode is an effective modality for the removal of small facial AMNs.

#22

A RANDOMIZED, SPLIT-FACE CLINICAL TRIAL OF LOW-FLUENCE Q-SWITCHED NEODYMIUM-DOPED YTTRIUM ALUMINUM GARNET (1064nm) LASER vs LOW-FLUENCE Q-SWITCHED ALEXANDRITE LASER (755nm) FOR THE TREATMENT OF FACIAL MELASMA: PRELIMINARY RESULTS

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Background: Melasma is an acquired, symmetrical pigmentary disorder occurring on sun-exposed areas of the face, typically encountered in Asian and Hispanic populations. Q-switched lasers have recently been found to be safe and effective for this often treatment-refractory condition. The aim of this study is to compare the clinical efficacy of a Q-switched neodmymium-doped yttrium aluminum garnet laser (QSNYL, 1064 nm) with a Q-switched alexandrite laser (QSAL, 755 nm) for the treatment of melasma.
Study: Twenty patients with moderate to severe facial melasma and Fitzpatrick skin type I to IV were randomized for split-face treatment with either low-fluence QSNYL or low-fluence QSAL in this prospective, single center, double-blind study. Subjects received 6 treatments to the face (forehead, cheeks, and/or chin) at 1-week intervals, with follow-up visits at 2, 12, and 24 weeks post-treatment. Digital photographs were taken at baseline and prior to each treatment, with Canfield Visia images obtained prior to baseline treatment and at follow-up visits. Two independent,

blinded investigators evaluated the Modified Melasma Area and Severity Index (MASI) at baseline, prior to the fourth treatment, and at each follow-up visit. Patient-evaluated improvement was assessed prior to the third treatment and at each follow-up visit.
Results: Nineteen patients (18 female, 1 male) began treatment and completed follow-up visits up to 12 weeks post-treatment. Modified MASI scores for QSNYL and QSAL patients were 8.5 and 8.6 at baseline, decreasing to 7.2 and 5.9 (5-week follow-up) and 4.9 and 5.7 (12-week follow-up), respectively. Subjects reported 25–49% improvement with both lasers at 5-week follow-up, with 50–75% (QSNYL) and 25–49% (QSAL) improvement at 12-week follow-up. No statistically significant differences in Modified MASI scores or subject evaluation of improvement were seen between groups at any visit. No severe side effects were reported.
Conclusion: Preliminary results demonstrate a trend toward superior treatment efficacy with low-fluence QSNYL than with low-fluence QSAL for melasma.

#23

FRACTIONAL PRIMING + Q-SWITCHED SEQUENTIAL LAYERING TATTOO REMOVAL

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Background: Tattoos and tattoo removal requests are increasing. Recently a new sequential Q-Switched laser layering technique was proposed to optimise tattoo pigment clearing. We wanted to further improve this concept adding a 2940 nm ablative fractional "priming" immediately before Q-Switched laser photo-acoustic ablation to allow an efficient escape of sub-epidermal gas-bubbles. This study aimed to assess safety and efficacy of a sequential combination of two and three 1064 nm Q-Switched laser passes dekivered after a 2940 nm fractional resurfacing.
Study: Twelve asymptomatic professional tattoos on 11 Fitzpatrick 1–2 patients were divided in half and randomized. Each tattoo received a standardized 2940 nm ablative fractional "priming" (0.25 mm spot, 0.6 ms, 28 J/cm^2, 5% coverage, ablation depth 100 microns) with a Dynamis SP laser (Fotona, Ljubljana, Slovenia), followed by two and three Q-Switched 1064 nm laser passes (4 mm spot, 6–8.5 J/cm^2, 6–7 Hz, 10–20% overlapping), spaced 5 min apart, with a QX-MAX laser (Fotona, Ljubljana, Slovenia). Digital photographs, and clinical F/U were scheduled every 30 days for three months. Photographic assessment was performed by two independent observers using a digitally modified 11 point 10% decrement scale tattoo images as reference. Efficacy endpoint was graded accordingly. Safety evaluation included observation of dyspigmentation and scarring. Subjective assessment evaluated treatment outcome and willingness to repeat the procedure.
Results: All double Q-Switched passes treatment showed a pigment reduction of $50 \pm 10\%$. Triple pass score was moderately better ($55 \pm 10\%$) but not significant enough to justify this procedure. Clinical results were rated good (75%) to excellent (25%) by two independent observers with 90% interrated reliability. Mild transient hyperpigmentation and isolated textural changes occurred in two triple-pass treatments. Study subjects' satisfaction was high except for the two patients who developed textural changes.
Conclusion: Ablative fractional priming followed by two Q-Switched 1064 nm laser passes was faster and more effective than conventional tattoo-removal treatments.

#24

PULSE IN PULSE INTENSE PULSED LIGHT TREATMENT: ITS EFFICACY AND SAFETY IN MELASMA PATIENTS

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Background: Recently a new type of IPL with PIP mode (Ecalt: E-toning, Union medical Co., LTD, Seoul, Korea) has been developed to achieve more efficacy and safety than conventional intense pulsed light with longer pulse duration. It emits maximum of 40 peaks of pulses during 1 ms. We compared the clinical efficacy and safety of IPL with PIP mode versus conventional IPL with laser toning in 12 female patients with melasma.
Study: Patients received total of 7 sessions at 1~2-week intervals. Half of face was treated with 1 pass of IPL and 6 times of low fluence of QS Nd:YAG laser. The other half was treated 2~3 passed of E-toning with energy density ranged from 13 to 15 J/cm^2. Outcome assessments included photography, global assessment (VAS 0~4) by investigators and subjects themselves and objective measurement of melanin index. Patients were followed up 6 months after the last treatment.
Results: All patients completed the study successfully. No adverse effects or unexpected side effects were seen in any patient. Results of global assessment about the treatment outcomes showed good to excellent on both sides but patients favored E-toning side due to less discomfort during and after treatments. The melanin index decreased significantly after the treatment comparing before the treatment on both sides. No patients report severe flare up of melasma 6 months after the last treatment.
Conclusion: This randomized split face study suggests that IPL with PIP mode can be considered as a safe and effective treatment modality in melasma patients.

#25

CONFIRMATORY STUDY OF PICOSECOND 755 nm ALEXANDRITE LASER

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Background: The gold standard of tattoo removal has been treatment with nanosecond pulsed Q-switched lasers, which require multiple treatments and result only in partial clearing. Previous studies demonstrated that picosecond Alexandrite laser treatments reduced the number of treatments to clearance and increased the clearance rate. This study further explores the safety and efficacy of the picosecond laser for the removal of tattoos.
Study: Twenty subjects with a total of 26 tattoos were enrolled in the study. Skin types I to IV and all pigment colors were represented. Treatments were scheduled approximately 4 to 8 weeks apart. Standardized photographs were taken at baseline, before each treatment and at 1 and 3 months post last treatment. Efficacy was assessed as percentage of pigment clearance based on 0–3 scale (<25, 26–50, 51–74, >75). Adverse events were also recorded by the treating physician. Thirty percent topical or 1% intralesional lidocaine was used for anesthesia, as requested.

Results: Subjects are allowed up to 10 treatments. Three of 20 subjects were lost to follow up. Assessments were made on 23 tattoos including 3 recalcitrant to prior treatment. Of the 23 tattoos, 15 cleared >75% and 6 had 51–74% clearance within 3 to 5 treatments. The remaining 2 subjects had predominantly red pigment and had less than 25% clearance by 3 to 4 treatments, as expected with 755 nm wavelength. Of the four tattoos with significant amounts of yellow pigment one cleared >75% and 3 cleared 51–74% by 5 treatments. Typical adverse effects reported were transient hypopigmentation and hyperpigmentation. Areas of hypertrophy were seen in one patient prone to keloidal scarring and in a tattoo at a high friction site, both of which are improving to date.
Conclusion: This study confirms and extends reports that the Alexandrite 755 nm picosecond laser is a safe and very effective tool for tattoos and clears 50% more rapidly than historical controls for most colors.

#26

TATTOO REMOVAL USING A NEW 1064 nm AND 532 nm LASER HAVING A CONTINUOUSLY VARIABLE SPOT SIZE

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Background: Most tattoo removal laser treatments are done with a 3–4 mm spot size that dramatically limits the depth of penetration of laser energy, resulting in incomplete removal and sometimes scarring. The major innovation of the laser is that it enables delivery of spot sizes increasing in 0.1 mm increments, throughout the range of spot sizes. Thus the largest spot size with a desirable fluence can be delivered.
Study: Twelve patients presented with 13 tattoos and received 4 laser treatments 8 week intervals, with photographs being taken before each treatment. The laser used is a high-powered Q-switched Nd:YAG/KTP laser with a continuously variable spot size in 0.1 mm increments (Revlite SI, Con-Bio, Cynosure, Inc.). One half of the tattoo was treated with the optimal fluence using the maximally available spot size ('max-on' setting), while the other half will be treated with the same fluence using a standard 4 mm spot size ('max-off' setting). Fluences with 1064 nm ranged from 4.2–8.7 J/cm^2 and with 532 nm ranged 1.6–2.6 J/cm^2. Two blinded physician evaluators rated the clearance of randomized photos of each half of the tattoo at each visit.
Results: Blinded evaluation of photographs revealed that 74% of tattoos had a greater clearance on the max-on side, 15% had an equal clearance for the max-on and max-off side and 11% had a higher clearance for the max off treatment areas. On average, the results showed that max-on treatment areas had 5% greater clearance ($p < 0.01$). The average clearance for all subjects was 72% clearance for the max-off side and 76% clearance for the max on-side 2 months after 4 treatments.
Conclusion: This high-energy Q-switched, Nd:YAG/KTP laser with a continuously variable spot size effectively removes tattoos, with greater removal when using a larger spot size. Lower treatment fluences accentuate the difference in spot sizes and may result in larger differences in clearance, thus opening the possibility of more effective treatment for patients with skin of color where lower fluences are used.

#27

Q-SWITCHED LASER INDUCED DEPIGMENTATION IN VITILIGO PATIENTS

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Background: Vitiligo is a common skin disorder which causes depigmented patches and thereby impairing a patients' quality of life. When the majority of the skin is depigmentated, and repigmentation is no longer effective, depigmentation is the treatment of choice. Q switched lasers, cryotherapy, and chemical agents have been used to achieve depigmentation. Hitherto, little literature is available on the long term effect of laser induced depigmentation in vitiligo patients. The aim of our study was to assess the efficacy, safety, and patient's satisfaction with Q-switched ruby (QSR) laser induced depigmentation in widespread vitiligo.
Study: A retrospective cohort study was performed on vitiligo patients who received 694 nm QSR laser therapy for depigmentation between 2000 and 2012 in our department. Patients were identified by screening the medical charts. The patients were asked to fill in a questionnaire and, when a baseline photograph was present, to visit our department for assessment of depigmentation. The main outcome measure was the degree of depigmentation and more than 75% depigmentation was defined as a good outcome.
Results: Of the 63 treated patients in our institute, 46 patients met the inclusion criteria. Until now, 18 patients were seen at our department. Preliminary results show that 50% of the patients had more than 75% depigmentation of the treated area. All patients with a good result showed disease activity. 86% of the treated patients were satisfied with the treatment and 93% would recommend the treatment to other patients. Chart review of 46 patients indicated that 42%, 29%, and 27% of patients had good, moderate and no effect. Reported side effects were temporary redness, pain, and crusting.
Conclusion: In conclusion, QSR laser treatment for depigmentation is a save treatment with >75% depigmentation in about half of the patients.

#28

USING LOW FLUENCE Q-SWITCHED 532/1064 nm Nd:YAG FOR FACIAL SKIN REJUVENATION AND DEPIGMENTATION IN ASIAN PATIENTS

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Background: There is still lack of reports analyzing general outcome, complication, and effect of covariate factors, as well as the combined therapy of 532/1064 nm Low Fluence Q-Switched Nd:YAG in Asian patients.
Study: We retrospectively reviewed all (n = 52) patients received 532 nm (spot size: 2–3 mm; 0.5–1.5 J/cm^2) and 1064 nm (spot size: 5–7 mm; 1.5–2.0 J/cm^2) Nd:YAG (Laseroptek, Korea) therapy from October 2011 to October 2012. Treatment is based on pre-treatment evaluation and discussion, 5 sessions by one month interval, and post-treatment assessments. Immediate Vitamin C sonophoresis was offered as an option before the treatments. Assessment of outcome and complication were done by patient, physician, and 3 independent blind reviewers. Patients were excluded if not completing self-evaluation form, loss of follow-up, or their photo being not optimal for evaluations. One male and

21 female patients were enrolled eventually, with mean age of 39.3 and mean follow-up time of 7.77 months.
Results: Eighteen (81.8%) patients have satisfactory result. Transient side effect is as follows: erythema in five (22.7%), puritis in three (13.6%), dryness in three (13.6%), and scaling in three (13.6%). There is no difference of transient side effect between sole 1064 nm and combined 532/1064 therapy. As for the incidence of post-inflammatory hyperpigmentation (PIH), mild and transient in three (13.6%), severe but less than 2 weeks in five (22.7%), and severe and persistent in one (4.55%). The incidence and severity of PIH is highly associated with the use of combined therapy. ($p < 0.05$) Age does not affect treatment outcome. ($p = 0.27$) Among patients with skin contexture complaints or skin pigmentary complaints, there is no outcome difference between sole and combined therapy ($P = 0.21$ and $P = 0.17$). Vitamin C sonophoresis is demonstrated to be protective for post-laser erythema, and improves outcome in the group with pigmentary complaints ($P < 0.05$).
Conclusion: We reported general outcome, complication, and effect of covariate factors in sole 1064 nm and combined 532/1064 nm therapy in non-selected Asian patient group. We found no difference in treatment outcome in both skin pigmentary and contexual complaints. We also demonstrate Vitamin C sonophoresis is an adoptable combined therapy in Nd:YAG therapy.

#29

USE OF A HOME HAIR REMOVAL DEVICE FOR THE SAFE TREATMENT OF SKIN TYPES V AND VI

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Background: Laser and IPL home hair removal devices are available for treatment of Skin Types I–IV. However, for those who have darker skin there are no home devices available. Patients with increased natural cutaneous pigment are at greater risk of hypo- or hyperpigmentation and scarring as possible undesired outcomes.
Study: A combined RF and IPL home device was studied for hair removal in Skin Types V-VI. Both efficacy and especially safety were evaluated. The device emits a simultaneous RF and 550–1200 nm IPL pulse up to 6 msec pulse duration with a unique cooling system. Two separate approaches were evaluated. The first, primarily evaluating safety, 17 patients received 3 treatments over bilateral regions using 3–4 J/cm^2 at an accelerated rate of every 2–4 days. Each area received 3–4 passes during each of the 3 sessions. The second, 14 patients received 7 weekly treatments of 3–4 J/cm^2 followed by one of the bilateral sides having no further treatment while the other receiving 3 additional monthly maintenance treatments. Evaluation including hair counts occurred at 2 and 3 months post last treatment or at the final maintenance. Treated areas include the axillae, arms and legs.
Results: Studied areas received a total 204 treatments during the first approach and 434 during the second. There were no apparent adverse transient effects and no scarring, skin texture or pigmentation changes in any of the treated areas. At 2 months post, in the first approach, the mean hair count reduction was 52%. For the second, the reduction at 3 months was 35% for non-maintenance side and 58% for maintenance.
Conclusion: A home hair removal device has been developed which can safely deliver effective therapy even to patients having increased pigmentation (Skin Types V–VI). This system has the potential to be used safely for all skin colors.

#30

CLINICAL STUDY OF A PHYSICIAN-DIRECTED HOME-USE NON-ABLATIVE FRACTIONAL DEVICE FOR TREATMENT OF PIGMENTED LESIONS

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Background: Laser non-ablative fractional treatment (NAFT) has become a treatment of choice for variety of skin conditions, including benign pigmented lesions such as solar lentigines. An in-office treatment program has obvious limitations in terms of total number of treatment sessions and interval between treatments. In this study, we investigated feasibility of at-home use of a laser NAFT device for treatment of pigmented lesions under a physician prescribed treatment plan. Potential benefits of this approach include possibility of multiple and frequent (e.g., daily) treatment sessions.
Study: 33 ITT subjects with solar lentigines were recruited. After evaluation by the investigator, they were issued prototype devices (LaserScript^{TM}, Palomar Medical Technologies Inc, Burlington, MA), along with instructions for use. Wavelength of 1410 nm and energies up to 30 mJ per microbeam were used. Subjects treated themselves for 4 weeks and were followed up to 3 months. Evaluations included standardized digital photography with subsequent grading of the lesions by three blinded evaluators using validated 5-grades pigmented-lesion scale (PLS).
Results: Treatments were well-tolerated with trace-to-moderate erythema being the most typical side effect. At 1-month post-treatment, at least 2/3 of blinded evaluators correctly identified the post-treatment image as "better" for 233 of 275 (84%) treated lesions. The average change in PLS score across all three evaluators was highly significant (paired t-test) at -0.7 ± 0.8 and significantly greater than the average change observed for the control untreated lesion (-0.2 ± 0.5, $n = 91$). There was high degree of grading uniformity between the evaluators.
Conclusion: The novel home-use NAFT device is a safe and effective modality to treat solar lentigines using more frequent treatments than with an in-office treatment protocol.

#31

NOVEL HOME USE DEVICE FOR WRINKLE REDUCTION - CLINICAL STUDY ON 62 USERS

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Background: Radiofrequency (RF) systems are used by physicians for immediate and long term non- ablative wrinkle reduction and skin tightening on the face and neck for nearly a decade. Multisource RF, uses multiple phase controlled RF sources to create a specific 3 dimensional thermal effect in the tissue. Using the repulsion and attraction forces between electromagnetic fields created in the tissue, the dermis is heated to 55 deg Celsius while the epidermis is kept at <42 deg Celsius, without the need for active cooling. Newa^{TM}, a novel home device, allows for the first time self operated wrinkle reduction using

multisource RF technology. Built-in realtime temperature measurement, motion sensing and impedance feedback mechanism control energy delivery.
Study: Study subjects were provided with the NewaTM device (EndyMed Medical Ltd., Cesarea, Israel). Subjects were instructed to perform treatments independently at home, 5 times a week, for 4 weeks. Subjects were scheduled for follow-up visits during the 4 weeks independent home treatment, and 1 and 3 months following treatment end. Three uninvolved board certified dermatologists assessed the results using the Fitzpatrick elastosis and wrinkle score (FWS).
Results: Sixty two women (37–72 years), completed the study course and follow-up visits. No unexpected adverse side effects were detected or reported. Analysis of results revealed improvement (post treatment downgrade of at least 1 score according to the Fitzpatrick scale) in 91.93% of study subjects (according to first reviewer); 96.77% (according to second reviewer) and 98.39% (according to the third reviewer) of study subjects. Downgrade in FWS continued 1–3 months after the end of the week treatment. Satisfaction questionnaires showed that 89.1% of users report visible wrinkle reduction with 72.7% reporting skin texture improvement as >50%.
Conclusion: The current study, shows that home use treatment using multisource radiofrequency is effective and safe. Objective and subjective assessment shows visible results in the majority of Newa^{TM} users with high satisfaction rates.

#32

HANDHELD INTENSE THERAPY ULTRASOUND PROSPECTIVE CLINICAL STUDY FOR LOWER FACIAL AND SUBMENTAL SKIN TIGHTENING

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Background: A prototype of a novel battery-powered handheld ITU device was clinically investigated with the primary goal of tightening lower facial and submental areas of the skin. Additionally, possible improvements in skin quality, such as firmness, fine line reduction, were investigated.
Study: Each subject received one treatment a day with the handheld ITU prototype device for 28 consecutive days. The ultrasound device operated at 5.9 MHz, cylindrically focused therapy lines were delivered at 2.7 W average power for 9.5 seconds per line. Approximately 120 lines were applied to mid-cheek and submental areas of the face for one treatment. Standardized digital photography at 0°, 45°, and 90° angles were taken at baseline, on the 1st day and weekly during the 28 day regimen. Independent clinical live assessments were performed at baseline and during the regimen (days 1,3,4,5, week 1,2,3,4,8 total). Photographs were also independently assessed using 4 point analog scale (no change, mild, moderate, and significant improvement).
Results: 24 subjects finished the study with following results:

- Tightening/lifting of submental areas:
  - Clinical live assessment yielded improvement in 83% of the subjects (20 out of 24) with statistical significance ($p = 0.05$)
  - Photographic assessment produced 79% improvement in subjects (19 out of 24)
- Self-assessment showed 96% satisfaction in 2 weeks and 88% in 4 weeks
- Additional improvements including combined firmness, fine line reduction, and pore size reduction by clinical assessment were statistically significant ($p = 0.05$) in 88% of the subjects.

Conclusion: The battery powered handheld ITU device is feasible for a statistically significant ($p = 0.05$) improvements for both lower facial and submental tightening and skin quality improvements. Transient side effects were limited to erythema and slight edema within 1–24 hours post treatment.

#33

A COMPARISON OF LOW FLUENCE, MULTIPLE PASS 810 nm DIODE LASER HAIR REMOVAL vs STANDARD SINGLE PULSE TECHNIQUE

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Background: Laser hair removal has become an increasingly popular method to remove unwanted or excessive hair. We have assessed the relative efficacy and discomfort associated with competing hair removal techniques. By comparing a low fluence, a high average power 810 nm diode laser using an 'in-motion' technique with a market-leading 810 nm device with a single-pulse, vacuum-assisted technique, this study has determined the relative pain induction intensities and the long term (6–12 month) hair reduction efficacy of these lasers.
Study Design: Prospective, randomized, side-by-side comparison of either the legs or axillae was performed comparing the Soprano XL 810 nm diode in Super Hair Removal (SHR) mode (Alma Lasers) vs. the LightSheer Duet 810 nm diode laser (Lumenis). Five laser treatments were performed 6 to 8 weeks apart with 1, 6, and 12 month follow-ups for hair counts. Pain was assessed in a subjective manner by the patients on a 10 point grading scale. Hair count analysis was performed in a blinded fashion.
Results: Out of the 20 subjects, 68% reported less pain and discomfort with the Soprano vs. the Duet over the 5 treatments visits. Both lasers were similarly effective in reducing hair counts. At 6 and 12 months post-treatment, efficacy was not completely maintained but was similar across all groups.
Conclusion: This data supports the hypothesis that using diode lasers at low fluences and high average power with a multiple pass technique is an effective method to remove hair with less pain and discomfort, while maintaining good efficacy. Some hair regrowth was observed with both laser technologies during the follow-up period.

#34

THE GROWTH OF HUMAN SCALP HAIR MEDIATED BY VISIBLE RED LIGHT LASER AND LED SOURCES IN MALES

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Background: Low level laser therapy (LLLT) has been used to promote hair growth. A double-blind RCT was undertaken to define the safety and physiologic effects of LLLT on males with androgenic alopecia.
Study: 44 males (18–48 yo, Fitzpatrick I-IV, Hamilton-Norwood IIa-V) were recruited. A transition zone scalp site was selected;

hairs were trimmed to 3 mm height; the area was tattooed and photographed. The laser group received a "TOPHAT655" unit containing 21, 5 mW lasers and 30 LEDS, in a bicycle-helmet like apparatus. The placebo group unit appeared identical, containing incandescent red lights. Patients treated at home for QOD × 16 weeks (60 treatments, 655 ± 5 nm, 67.3 J/cm^2 irradiance/25 minute treatment), with follow up and photography at 16 weeks. A masked 2.85 cm^2 photographic area was evaluated by another blinded investigator. The primary endpoint was the percent increase in hair counts from baseline.
Results: 41 patients completed the study. (22 laser, 19 placebo). No adverse events or side effects were reported. Baseline hair counts were 162.7 ± 95.9 (N = 22) in placebo and 142.0 ± 73.0 (N = 22) and laser groups respectively (P = 0.426). Post Treatment hair counts were 162.4 ± 62.5 (N = 19) and 228.7 ± 102.8 (N = 22) respectively (P = 0.0161). A 39% percent hair increase was demonstrated (28.4 ± 46.2 placebo, N = 19; 67.2 ± 33.4, laser, N = 22) (P = 0.001) Deleting one control group subject with a very high baseline count and a very large decrease, resulted in baseline hair counts of 151.1 ± 81.0 (N = 21) and 142.0 ± 73.0 (N = 22) respectively (P = 0.680). Post treatment hair counts were 158.2 ± 61.5 (N = 18) and 228.7 ± 102.8 (N = 22) (P = 0.011), resulting in a 35% percent increase in hair growth (32.3 ± 44.2, placebo, N = 18; 67.2 ± 33.4, laser, N = 22) (P = 0.003).
Conclusion: LLLT of the scalp with the TOPHAT655 device significantly improved hair counts in males with androgenetic alopecia.
ClinicalTrials.gov Identifier: NCT01437163

#35

SMOKE PLUME FROM LASER HAIR REMOVAL: GAS-CHROMATOGRAPHY ANALYSIS

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Background: Laser hair removal is one of the most popular aesthetic procedures, which produces a smoke plume that is characteristically malodorous. The purpose of this study is to identify the content of the smoke plume produced by laser hair removal.
Study: Smoke plume produced by laser hair removal was analyzed using gas chromatography with mass spectroscopy.
Results: This study identified a cocktail of volatile organic hydrocarbons produced during laser hair removal, some of which are known carcinogens including benzene, phenol, and 1H-Indole.
Conclusion: From this preliminary study, we advocate the use of smoke evacuator system for all physicians who regularly perform laser hair removal. Further studies are needed to investigate other methods of optimizing the elimination of smoke plume from laser hair removal.

#36

TRASER: ACUTE PHASE VASCULAR AND FOLLICULAR CHANGES

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Background: A TRASER (Total Reflection Amplification of Spontaneous Emission of Radiation) is a novel device that utilizes the energy from a flashlamp to induce the spontaneous emission of photons from a fluid or solid (crystal) fluorescent medium. This study was designed to evaluate acute phase clinical and histological changes of skin treated with two different fluorescent media selected for their peak emissions tuned for vascular and hair follicle targets.
Study: A skin type II Caucasian was subjected to repeated pulses with a TRASER using Pyrromethene 556 tuned to a narrow spectrum peaking at 544nm, with a 12 mm spot, pulse duration of 1 ms, and fluences of 6.0 to 9.5 J/cm^2. Follicular structures were targeted with the dye cell switched to Sulforhodamine 640 Chloride, peaking at 654 nm, with a 12 mm spot, pulse duration of 20 ms, and fluences of 14.0 to 20.0 J/cm^2. The clinical observations were assessed by two physicians. Biopsies were performed of representative treatment areas at approximately 60 and 30 minutes respectively for the vascular and hair regions, and sent for vertical sections, stained with H&E.
Results: A characteristic threshold purpuric response was noted at 7.2 J/cm^2. The histological changes consistently showed intravascular thrombosis of virtually all the vessels in the fields of view, including the small sub-dermal plexus of capillaries down to the larger vessels approaching the subcutaneous fat. There was no evidence of extravasation of red blood cells. Acute follicular changes similar to those described with standard hair removal lasers were noted. These were limited to the target structures, and without any damage to surrounding components.
Conclusion: This is the first demonstration of clinical and histological acute phase changes associated with use of a TRASER with wavelengths optimized for vascular and follicular targets. These findings support the notion that one TRASER may well be able to replace several vascular and hair removal devices.

#37

STUDY AND COMPARISON BETWEEN SINGLE AND DUAL WAVELENGTH LASER (755 AND 1064 nm) IN HAIR REMOVAL IN PHOTOTYPES I-IV: A CLINICAL AND PATHOLOGICAL STUDY

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Background: Laser hair removal is an accepted modality for long-term hair reduction. Several devices can be used. Currently, we treat with a single wavelength with some limitations in efficacy due to inherent laser-tissue interactions. A dual-wavelength treatment can increase efficacy and have more applications than single wavelength. A comparative evaluation of long-pulse alexandrite and long-pulse Nd:YAG laser systems used individually and in combination for forearm hair removal is presented to evaluate efficacy and safety clinically (hair count), pathologically (punch-biopsy) and with confocal microscopy.
Study: Twenty-four subjects phototypes I to IV with unwanted forearm hair received 2 sessions (3 months apart) with a single laser emitting both dual and single-wavelength pulses. Patients were included in one of six treatment groups with varying blend (0, 25, 50, 75 and 100%) of Alexandrite and Nd:YAG wavelengths. Hair counts performed on digital photographs, three mm punch-biopsies and confocal skin analysis were performed before, immediately after and 3 months after the first treatment.
Results: Wavelength blending presented in all cases better hair clearance percentages than Nd:YAG or Alexandrite alone. A particular blend (54% Nd:YAG + 46% Alexandrite) showed the

highest clearance. These results were supported by digital hair count, histology and confocal microscopy. Side effects were minimal and did not differ by treatment.
Conclusion: Wavelength blending is a novel approach for hair removal that combines the benefits of the Alexandrite and Nd:YAG lasers with better hair clearance percentages than Nd:YAG or Alexandrite alone. Its synergy gives more option for customizing treatments to individual patients of all skin types, color and coarseness of hair.

#38

EVALUATION OF A HOT-WIRE HAIR REMOVAL DEVICE COMPARED TO RAZOR SHAVING

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Background: We describe a blinded, controlled, prospective clinical study of a hot-wire device promoted for hair removal and the reduction or delay of hair regrowth compared to a shaving control.
Study: Twenty-two subjects were treated by trained clinical staff with the hot-wire device two times per week for eight weeks and followed for three months post treatment. An adjacent site was shaved on the same schedule to provide a control. Independent hair counts were made from high-resolution, well-indexed photographs taken at baseline, weekly during treatment, and at each monthly follow-up visit. Blinded visual and quantitative assessments were also performed on the photographs for differences in hair thickness and hair color between the hot-wire and shaving sites.
Results: Mean baseline hair count for the shaving site was 79.4, which remained stable during the treatment phase, then climbed substantially after stopping treatment to 98.8, 100.1, and 104.6 at 1, 2, and 3 months post-treatment, respectively. The hot-wire site had a mean baseline hair count of 86.0, which remained stable during the treatment phase, then climbed substantially after stopping treatment to 104.0, 106.4, and 109.0 at 1, 2, and 3 months post-treatment, respectively. There were no statistically significant differences between the shaving and hot-wire sites in either hair count reduction or percentage hair count reduction at any time point ($p > 0.15$). In terms of hair characteristics, no difference in hair color or hair thickness was seen between the shaving and the hot-wire sites during the treatment phase or follow-up period in either visual or quantitative assessments.
Conclusion: Relative to shaving, the hot-wire device does not produce lessened hair density, decreased hair re-growth rate, greater duration of effect, nor induce changes in hair thickness and color. We conclude that the hot-wire device does not offer any benefit as compared to shaving.

#39

TREATMENT OF HYPERTROPHIC SCARS USING LASER ASSISTED CORTICOSTEROIDS vs LASER ASSISTED 5-FLUORURACIL DELIVERY

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Background: Scarring is a major source of morbidity in patients. Fractional lasers have proven effective in the treatment of scars and these ablative channels may be used immediately post-operatively to deliver drugs. We have completed a study on laser assisted corticosteroid delivery after fractional ablative laser showing synergistic improvement of scars. The mechanism of action of corticosteroids is diminishing collagen synthesis, decreasing mucinous ground substance, and inhibiting collagenase inhibitors that prevent the degradation of collagen. An adverse event seen with triamcinolone acetonide is sporadic post-operative telangiectasia, erythema and a risk for scar atrophy. Recent research revealed 5- fluorouracil (5-FU) significantly inhibited cell proliferation of fibroblasts, G2/M cell cycle arrest and apoptosis but not immediate cell death of fibroblasts. The lack of tissue necrosis is a particular benefit as atrophy should be prevented. The purpose of this study was to compare efficacy and side effect profiles of triamcinolone acetonide vs. 5-FU in same patient when used immediately post fractional ablative laser to decrease hypertrophic and keloid scars.
Study: In this prospective study 20 patients were treated with both corticosteroid vs. fluorouracil immediately post fractional ablative laser. Fractional ablative carbon dioxide laser was used at the same energy settings three treatment sessions one month apart. The primary outcomes objective was using caliper measurements and photographic improvements in scar appearance at three months post-treatment, as evaluated by independent investigators.
Results: The caliper data revealed an average decrease in height of scars by 0.415 mm and an average decrease of length by 0.455 mm. This data revealed no statistical significant difference in the height and length of hypertropic scars. The width of the scar increased on the triamcinolone acetonide arm.
Conclusion: This study found that both laser assisted delivery of triamcinolone acetonide and 5-fluorouracil improves hypertrophic and keloid scars. 5-fluorouracil had less adverse events.

#40

THE USE OF A FRACTIONAL ABLATIVE MICRO-PLASMA RF DEVICE IN TREATMENT OF STRIAE

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Background: To evaluate the efficacy of a fractional ablative micro-plasma RF device in the reduction of the appearance of abdominal striae.
Study: Five female patients (age range 30–60) with abdomen striae alba ($n = 4$) and striae rubra ($n = 1$) were enrolled in the study. Skin type distribution among the 5 patients was two type II, one type III, and two type IVs. The device (Accent XL, Alma Lasers Inc.) is a radiofrequency fractional platform (40.68 MhZ) that deploys multiple conical pin electrodes on a moving handheld 6 cogs roller. These pin electrodes (200 μm size) are configured to deliver micro-plasma sparks that perforate about 6% of the skin surface per pass. Four treatments were performed every two weeks with settings based on test spots performed two weeks prior to a full treatment session. Eight "passes" were applied on the entire striae-affected area. Power ranged from 40 W–80 W. Anesthesia was achieved with a 1 hour application of 5% lidocaine cream and refrigerated air. Photographs were taken with a Nikon digital SLR camera (Model D90) equipped with a Canfield twin flash with and without polarization. Assessment of striae was based on clinical severity of the lesions on a 1–4 scale, with "4" being the most severe. The raters agreed on a standard severity score based on review of photographs from previously published

similar studies of striae. Raters were blinded to the temporal order of the photographs. Side effects including erythema, edema, and pigmentation changes were assessed and recorded. Biopsies from another study with the same device and same RF parameters showed 150 μm wide conical "cater-type" wounds extending about 150 μm deep to the skin surface. A questionnaire was administered to patients with possible subjective responses ranging from 0–4, with 0 being no improvement and quartiles from 1–4 (1= 1–25%, 2= 26–50%, 3= 51–75%, and 4= >75% improvement, respectively).
Results: Three months after 4 treatments a mean improvement of 20% was achieved (mean severity score changed from 2.9 to 2.5). Micro-wounds were approximately 200 μm wide on the surface, initially presenting as small gray "dots" and evolving into black dots lasting about 2 weeks. Mean pain was 2/10. Erythema and edema persisted for about one day. No pigmentation abnormalities were observed at the final evaluation. However, 2 patients showed hyperpigmentation which persisted for as long as one month. The results from the patient questionnaire revealed a mean score of 2.4/4, thus falling in the range of good to very good.
Conclusion: Fractional ablative micro-plasma RF roller device is an effective and safe modality for the improvement in the appearance of abdomen striae.

#41

EVALUATION OF A PICOSECOND 755 nm ALEXANDRITE LASER AND DEFRACTIVE LENS ARRAY FOR SCARRING

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Background: We evaluated a 755 nm Alexandrite picosecond laser, delivering sub-nanosecond pulse durations, with a specialized optic in the treatment of scarring, included facial acne scars. Fractional ablative and non-ablative laser technology is readily employed in the treatment of scars, however the shorter pulse duration and defractive lens array may be more efficient in the improvement of scarring and result in better outcomes.
Study: Single-center study of subjects with clinical evidence of scarring including facial acne scars. Subjects received three consecutive treatments with the Picosure 755 nm Alexandrite laser (Cynosure Westford, MA) and defractive lens array allowing for greater surface area and pattern density per pulse. Spot size of 6 mm, fluence of 0.71/cm^2, and pulse width of 750ps were utilized. Treatment areas were clinically assessed for overall physician satisfaction (4 point scale: 0-'not satisfied'; 3-'extremely satisfied') and overall improvement in texture and appearance (4 point scale: 0-0-25% improvement; 3–>75% improvement).
Results: Eleven women and four men, average age 43.14 years (21–73 years), Fitzpatrick Skin Types I-VI, with clinical evidence of scarring were enrolled. Ten individuals had facial acne scarring. Physician assessment demonstrated greater than 50% improvement in texture and appearance in ten of fifteen, or 66.7%, of subjects after three consecutive treatments. The average overall physician satisfaction was 2.6/3, or "satisfied" to "extremely satisfied" (0- "not satisfied"/3- "extremely satisfied"). No adverse events were noted.
Conclusion: Two thirds of subjects receiving three consecutive treatments with the Picosure 755 nm Alexandrite laser and defractive lens array had greater than 50% improvement in texture and appearance of acne scars. The device was found to be safe and effective, with high level of physician satisfaction. Compared with existing treatment modalities for facial acne scarring, pre-procedure anesthesia was not required and downtime was limited to transient erythema.

#42

TREATMENT OF ATROPHIC SCARS USING LASER AND LASER ASSISTED POLY-L-LACTIC ACID

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Background: Scarring is the skin's natural and inevitable response to trauma. The treatment of atrophic scars remains a challenging therapeutic dilemma. Therapies such as dermabrasion, chemical peels and traditional laser resurfacing have been utilized in the past, often with unsatisfactory results. Recently however, fractionated ablative lasers have emerged as invaluable addition to the therapeutic armamentarium. These lasers create microscopic columns of tissue destruction leading to a wound healing response and dermal remodeling. Poly-L-lactic acid is an injectable filler agent which is typically injected into the subcutaneous or supraperiosteal plane for the purpose of facial volume correction. Once implanted the material stimulates fibroblast proliferation and neocollagenesis. Through the creation of microscopic columns of ablated tissue ablative fractional resurfacing creates many small perforations in the epidermis and dermis. While the intact stratum corneum is largely impermeable to compounds larger than 500 Da, recent work has shown that after ablative fractional resurfacing the channels created allow for deeper penetration and greater bioavailabilty of topically applied or injected medications. This unique property was exploited and the poly-L-lactic acid material was applied topically and intralesionally to atrophic scars following ablative fractional resurfacing.
Study: Prospective study of 15 subjects with atrophic scars from injury, surgical or traumatic injuries. Patients were treated with 1 or 2 laser treatments followed by immediate delivery of poly-L-lactic acid. Three blinded investigators evaluated photographs taken at baseline and after treatment. Scores were assigned using a quartile improvement score to evaluate overall improvement, degree of atrophy improvement and texture.
Results: Combination fractional ablative laser therapy and post-operative poly-L-lactic acid delivery resulted in moderate improvement of atrophic scars. No adverse events were reported.
Conclusion: Atrophic scars represent a reconstruction challenge. The atrophic scars improved with the combination of fractional laser and same session poly-L-lactic acid.

#43

WE'RE NOT STRETCHING THE TRUTH: TREATMENT OF STRIAE WITH A PICOSECOND 755 nm ALEXANDRITE LASER AND DEFRACTIVE LENS ARRAY

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Background: To date there is a dearth of effective treatments for striae offering reproducible long term benefits. The deeper penetration of the 755nm, increased surface area and greater pattern density per shorter pulse may be more efficient in the improvement in texture and appearance of these lesions. We evaluated a 755 nm picosecond laser, delivering sub-nanosecond pulse durations with a defractive lens array in the treatment of striae.
Study: Single-center study of subjects with clinically evident striae on physical examination and two-dimensional photography. Photography was obtained at baseline and each subsequent follow up visit. Striae were treated with the 755 nm Alexandrite laser (Cynosure Westford, MA) using a defractive lens array, with a spot size of 6mm, fluence of 0.71 J/cm^2, and pulse width of 750ps. After the third consecutive treatment, clinical assessment was performed for physician satisfaction (4 point scale: 0-"not satisfied"; 3-"extremely satisfied") and overall improvement in texture and appearance (4 point scale: 0-0-25% improvement; 3–>75% improvement).
Results: Forty women and five men, average age 32.9 years (18–63 years), Fitzpatrick Skin Types I–VI, with clinical evidence of striae were enrolled. Physician assessment demonstrated greater than 50% improvement in texture and appearance in nearly half, or 46.2%, of subjects after three consecutive treatments. The average overall physician satisfaction was 2/3, or "satisfied" (0-"not satisfied"/3- "extremely satisfied"). Average pain score was 2.9/10, and transient post inflammatory hyperpigmentation was noted in a minority of patients.
Conclusion: Forty-five subjects receiving three consecutive treatments with the Picosure 755 nm Alexandrite laser and defractive lens array had greater than 50% improvement in texture and appearance of striae. The device was found to be safe and effective, with high level of physician satisfaction.

#44

ABLATIVE FRACTIONAL 10600 nm CO2 LASER THERAPY FOR THE TREATMENT OF VARIOUS TYPES OF SCARS: A RANDOMIZED CONTROLLED TRIAL

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Background: Ablative fractional laser therapy (AFLT) is the gold standard for treating acne scars now days. For other types of scars evidence is limited. The aim of our study was to evaluate the effectiveness and safety of the ablative fractional 10600 nm carbon dioxide (CO_2) laser in the treatment of various types of scars.
Study: An intra-individual single-blinded randomized controlled split lesion trial was performed. Adult patients received three laser treatments at 8-week intervals for scars existing at least one year. Primary endpoint was the Physician Global Assessment (PhGA) and secondary endpoints were the Patient Global Assessment (PGA) and assessment of adverse effects.
Results: Twenty-one out of twenty-five patients (85%) with hypertrophic and atrophic scars due to surgery, acne, burns or miscellaneous etiology completed the 6 month follow up. Five of these patients received only 1 of 3 laser treatments, due to lack of motivation (n = 2) or due to adverse events (n = 3). The PhGA showed 25–50% improvement in the treated site of the scar in six patients (24%) and >50% improvement in one patient (4%). However, three of these patients had similar improvement of the control site as well. The PGA showed moderate to good improvement in eight (32%) patients of which two also showed similar improvement of the control site. Adverse events included ulcer formation (n = 3), persistent erythema (n = 14) and hyperpigmentation (n = 8).
Conclusion: In this trial involving various types of scars, blinded PhGA and PGA could not confirm the efficacy of ablative fractional CO_2 laser. We presume that different types of scars have a different response to AFLT. More research is necessary to provide evidence for this laser in the treatment of other scars than acne scars.

#45

FRACTIONAL LASER-ASSISTED PHOTODYNAMIC THERAPY OF THICK ACTINIC KERATOSES ON DORSAL HANDS OF ORGAN TRANSPLANT RECIPIENTS - A RANDOMIZED TRIAL

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Background: Actinic keratoses (AKs) are precursors of SCC and often widespread in organ transplant recipients (OTRs). Photodynamic treatment (PDT) is a well-documented treatment of AKs, but with inferior efficacy in immunosuppressed patients. Intensified ablative fractional laser (AFXL)-assisted PDT is effective in immunocompetent patients. This study aimed to evaluate the efficacy of AFXL-assisted PDT compared to AFXL alone in immunosuppressed OTRs.
Study: The study was an open intra-patient randomized clinical trial, including 10 OTRs with a total of 680 keratotic AKs and warty like lesions on the dorsal hands. After initial targeted ablation of localized keratotic lesions, the hands were randomized to receive one field treatment with AFXL alone (1 hand) and AFXL-PDT (1 hand). AFXL field treatment was given with a fractional CO2 laser at 30 W, 0.12 mm spot size, 1.32–2.06 ms, 40–60 mJ, 4.3–5.2% coverage; settings depending on severity of skin atrophy. After laser exposure, MAL was applied under occlusion for 3 hours and illuminated with red diode light of 37 J/cm^2. Blinded clinical assessments were performed at 4 months postoperatively, the primary endpoint being complete response (CR) of treated lesions.
Results: AFXL-PDT cleared AKs and warty-like lesions significantly better than AFXL alone. The overall CR for all AKs treated by AFXL-PDT was 63% compared to 29% in the AFXL alone group ($p < 0.0001$). Thin lesions responded better to treatment than thick lesions: CR from AFXL-PDT was 74% (thin grade 1 AKs), 54% (grade 2 AKs) and 40% (thick grade 3 lesions). The majority of patients responded with intense postoperative inflammation, such as swelling, erythema, and crusting from AFXL-PDT. Patients preferred AFXL-PDT over AFXL alone due to better efficacy ($p = 0.01$).
Conclusion: Single treatment with AFXL-PDT is effective and significantly better than AFXL alone in immunosuppressed OTRs, but also associated with intense postoperative skin reactions.

#46

CRYOLIPOLYSIS FOR THE TREATMENT OF MALE PSEUDOGYNECOMASTIA

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Background: Pseudogynecomastia is a condition hallmarked by abnormally-enlarged male breasts. Incidence is estimated to be between 10–20%; typically correction is done by surgery or liposuction. Alternative non-surgical fat removal techniques could be desirable. CoolSculpting® (ZELTIQ, Pleasanton, CA) is a non-surgical body contouring technique, which reduces fat while sparing surrounding tissues. FDA clearance exists for reduction of fat in the abdomen and flanks. In this study, the safety/efficacy of cryolipolysis is investigated for treatment of pseudogynecomastia.
Study: Prior to treatment, topical anesthetic was applied to the areola/nipple complex under occlusion. For this study of n = 18 patients, 50% treated bilaterally and 50% treated unilaterally (untreated side serving as the control). Subjects received a stacked cryolipolysis treatment. Follow-up visits took place 2 and 4 months post-treatment. Safety was evaluated from subject reporting of side effects and adverse events. Efficacy was assessed by: standardized ultrasound measurement of fat thickness, blinded review of clinical photographs, and analysis of patient questionnaire data.
Results: Preliminary data from 3 month follow-up visits indicate the procedure is safe, effective, and well-tolerated by most subjects. No significant adverse events were reported. Typical side effects, such as erythema, bruising, and decreased sensitivity, were transient and self-resolving. 17/18 subjects completed treatment. Survey data revealed that most patients felt the procedure improved their appearance, reduced social embarrassment, and was tolerated with minimal discomfort. Ultrasound measurements indicate average fat-layer reduction of 18.3%. Standardized photography showed visible reduction in breast contour; blinded photo-review found that 80% of baseline photos were correctly identified from the post-treatment photos.
Conclusion: This study demonstrated the feasibility of using cryolipolysis for safe, effective, and well-tolerated treatment of pseudogynecomastia. Preliminary data show 18.3% fat layer reduction 2 months after the first treatment. Complete study results in n = 18 subjects treated with a second cryolipolysis treatment will be presented, demonstrating full treatment effect with 5 month follow-up.

#47

COMBINED PULSED DYE LASER AND Nd:YAG LASER FOR THE TREATMENT OF BASAL CELL CARCINOMA

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Background: Basal cell carcinoma (BCC) is the most common form of skin cancer. Current standard of care is surgical excision. While there are rare, aggressive forms of BCC, the majority of tumors are small and amenable to more conservative therapies. Prior investigations indicate that >80% clearance of these lesions can be achieved by selectively targeting vasculature within these tumors with a pulsed dye laser (PDL). The goal of this study was to evaluate the use of a sequential pulse of both PDL and Neodymium:Yttrium-Aluminum-Garnet (Nd:YAG) laser. While the PDL has excellent vascular selectivity, we hypothesized that the deeper penetrating Nd:YAG laser, also selective for vasculature, may have a synergistic effect with PDL and offer greater clinical efficacy given its greater depth of penetration.
Study: Subjects with BCCs of various histologic subtypes on the trunk and extremities, less than 2.5 cm in diameter, with positive margins were selected for this prospective, single center pilot clinical trial. Subjects received four laser treatments, spaced two to four weeks apart, using sequentially emitted pulses of pulsed dye laser (PDL) and Nd:YAG laser. The primary study endpoint was histologic evaluation of excision specimen for tumor clearance.
Results: 8 subjects with 10 BCCs were enrolled in this study. A variety of histologic subtypes were represented including nodular, micronodular, and superficial BCCs. Histologic clearance of lesions was achieved in 8/10 lesions. The two BCCs with residual lesion on excision were both of the superficial histologic subtype. For tumors =1 cm, 8/9 (89%) of tumors were clear on surgical excision. In general, treatments were well tolerated and adverse events were limited to transient post-inflammatory hyperpigmentation, with overall excellent cosmesis.
Conclusion: Sequential PDL/Nd:YAG appears to be a safe and effective treatment modality for those with low-risk BCCs, in particular, smaller tumors (=1 cm) with predominantly nodular or micronodular histologic subtypes.

#48

NOVEL TREATMENT OF SEBACEOUS HYPERPLASIA WITH 1720 nm LASER

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Background: Sebaceous hyperplasia is a common benign proliferation of sebaceous glands. Multiple treatment methods have been applied in the past to include electrodessication, ablative and visible light lasers, applications of acids and PDT. Often, however, only the superficial component of the lesion is treated, leading to rapid recurrence. Human fat has absorption peaks at 1210 nm and 1720 nm. We report the first use of novel 1720 nm laser in the treatment of sebaceous hyperplasia in human subjects.
Study: Five patients with sebaceous hyperplasia underwent a test spot treatment followed by 2 full treatment sessions using the 1720 nm laser (Del Mar Medical technologies, Del Mar CA, USA). All patients presented with at least twenty 0.5–1.5 mm umbilicated yellow papules consistent with sebaceous hyperplasia. The energy was delivered through a 400 μm fiber (0.22 numerical aperture) with a mean fluence of 45 J/cm^2, spot size of 750 μm, pulse duration of 50 ms. Power was measured through a built-in power meter. The desired endpoint was a change from a pre treatment granular yellow appearance to a creamy white smooth surface. Test spots were performed after photographs were taken with a Nikon digital SLR camera (Model D90) equipped with a Canfield twin flash with and without polarization. Photos were taken prior to treatment, at each treatment session, and 3 months following the last treatment. A biopsy was taken immediately after treatment in one patient. Diameter was measured by using the background ID tape that was scored in mm. Height was measured by scoring a lesion as flat or raised. The color was either yellow or flesh color. The grading system used the following scale to assess global improvement: 0 = no improvement, 1 = 1% to 25% improvement, 2 = 26% to 50% improvement, 3 = 51% to 75% improvement, 4 = 76% to 99% improvement, and 5 = complete removal. Pre-treatment photographs and 3-month follow up photographs were compared to assess efficacy.

Results: The lesional endpoint during irradiation was a change from a pre treatment lobular yellow appearance to a creamy white smooth surface. Damage to adjacent normal skin showed no change until the pulse duration exceeded twice that of the sebaceous hyperplasia. Four weeks after the final treatment 3 dermatologists blinded to the date of the photographs and uninvolved with the study evaluated the photos and scored them based on a global assessment comprised of 1) lesion diameter, 2) lesion height, and 3) lesion color. Many lesions resolved almost completely after one treatment and no additional treatment was required. There was a mean global improvement of 3.9 based on color, diameter and height of the lesions. Crusts were noted by all patients and resolved by 10 days. No scarring or pigmentation changes were noted at the final follow period. The one biopsy showed damage to the sebaceous glands that extended to 800 μm deep to the surface. The very deep portion of the lesion (800 μm to 2 mm below the surface) was unaffected.
Conclusion: This novel device achieved nearly complete clinical clearance of sebaceous hyperplasia lesions. Noting the microscopic persistence of very deep portions of a representative lesion, recurrence might occur and longer term follow up studies are planned.

#49

COMBINATION ALA-PDT AND ABLATIVE FRACTIONAL ERBIUM LASER (2940 nm) ON THE TREATMENT OF SEVERE ACNE

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Background: Scaring is a major complication in severe acne patients and difficult to treat in clinical medicine. 5-aminolevulinic acid (ALA) photodynamic therapy (PDT) is a novel treatment on controlling the lesion. Fractional laser resurfacing is a promising treatment option because of its unique wound healing response and depth of penetration.
Study: Prospective, single-arm, pilot study. Forty subjects with severe acne were treated with 15% ALA-PDT for 4 times at 10-day intervals. Then they accepted ablative fractional erbium laser 5 times at 4-week intervals. Three independent investigator evaluated subject outcomes at 3, 6, 12 months post-treatment (primary outcome), respectively; patients also provided subjective assessments of improvement (secondary outcome).
Results: Significant reductions in acne score ($P < 0.01$) were obtained at follow-up visits after 3, 6, 12 months. After 6 month, the lesion manifestation got overall improvement in 60% of subjects; improvements were moderate to excellent in 30%. After 12 month, 90% of subjects had improved hypertrophy/atrophy scar; 72% of subjects got moderate to excellent improvements. Patients\' self-reports also revealed moderate to excellent improvements (on average) in acne and scar area, and significant improvements in self-esteem at 6 months post-treatment.
Conclusion: PDT can control the inflammation and modulate the local immunity to improve the acne. Fractional resurfacing is a promising new treatment modality for scars and can induce fibrosis formation and remodeling. The combination therapy is a promising approach for severe acne.

#50

A RETROSPECTIVE ANAYLSIS OF THE TREATMENT OF AXILLARY HYPERHIDROSIS WITH A NOVEL MICROWAVE TECHNOLOGY

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Background: Up until now, the treatment of axillary hyperhidrosis was limited to topical solutions, neurotoxin injections and complicated surgery (ETS). Topical preparations and neurotoxin injections treat this condition on a temporary basis, while surgery carries significant risk and morbidity. A new non-invasive microwave based technology (miraDry) promises long-term relief for axillary hyperhidrosis. We evaluated the efficacy and safety of this treatment in twenty patients. The objective of this study was to evaluate the safely, tolerability, and efficacy of new microwave technology (miraDry) for treatment of axillary hyperhidrosis.
Study: Twenty patients were treated with miraDry. Patients were numbed in axillae through injections of lidocaine 1% with epinephrine 1:100,000. Patients were treated at 5800 mHz with varying settings of 2.4 seconds to 2.7 seconds. Patients were evaluated at 3–7 months following the treatment regarding their outcomes.
Results: We have devised a novel hyperhidrosis lifestyle index which we hope to be able to present at the meeting. According to this index, the patients had hyperhidrosis severity index of 4.4 on a scale of 1–10. After the first treatment, patients reported a decline of 52.35% in sweating in axillae. Patients who underwent both treatments reported 96.7% decrease in their severity of hyperhidrosis. A pain score of 3.4 (scale 1–10) was reported by the patients during treatment following local anesthesia with injections of lidocaine with epinephrine. There was no incidence of scaring or infection in this cohort.
Conclusion: This non-invasive procedure utilizing microwave energy is a safe and effective modality for the treatment of axillary hyperhidrosis.

#51

SINGLE-CENTER, PROSPECTIVE STUDY ON THE EFFICACY AND SAFETY OF MICRO-FOCUSED ULTRASOUND WITH VISUALIZATION FOR THE NON-INVASIVE TREATMENT OF MODERATE TO SEVERE FACIAL ACNE

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Background: Acne is a very prevalent skin disorder, affecting more than 85% of adolescents and often continuing into adulthood. The objective of this pilot study was to evaluate micro-focused ultrasound with visualization (MFU-V, Ulthera, Mesa, AZ) for the efficacy and safety for non-invasive treatment of moderate to severe combination inflammatory and comedonal facial acne.
Study: In this IRB-approved study, ten subjects with moderate to severe acne (at least 20 each of inflammatory papulopustular and comedonal lesions), were treated with MFU on the forehead, temples, medial cheek and chin regions. Subjects received three treatments approximately 14 days apart with both a 1.5 mm/10 MHz and 1.0 mm/10 MHz transducer. Subject's pain was measured immediately post treatment. Standardized photography was used immediately pre-treatment and at 14, 30,

60, 90 and 180 days post-treatment. The primary efficacy endpoint was measured by reduction in total count of inflammatory and non-inflammatory lesions by the non-treating physician at 60 days after the third treatment compared to baseline. Other secondary efficacy endpoints utilized the Global Acne Grade score (mGAGS), and sebumeter measurement of multiple sites in the treatment zone. Subject satisfaction was collected at 60 and 180 days post treatment three. Safety was assessed, based on adverse events incidence.
Results: Ten subjects, ranging from 18–26 years of age were treated. At interim analysis time point, 80% of subjects had a decrease in total lesion count at 60 days and 100% of subjects showed a decrease at 180 days post treatment 3 compared to baseline. The percent of subjects experiencing a reduction in sebum production on the forehead, cheeks and chin at 60 days was 88.9%, 100% and 66.7% respectively, as assessed by sebumeter measurement (Courage-Khazaka, Koln, Germany). 100% of subjects experienced a reduction in sebum production at 180 days with an average reduction of 47.6% on the forehead, 26.6% on the cheeks and 43.4% on the chin. All subjects noticed an improvement at 60 and 180 days with "reduction in number of acne lesions" and "clearer skin" the most reported improvement at both follow-up time points. 100% of subjects were satisfied or very satisfied at 60 days and 180 days. No serious adverse events were reported. No treatment related adverse events reported.
Conclusion: Data from this pilot study suggests that MFU-V technology could be a promising novel treatment option for the reduction of acne lesions in subjects with moderate to severe combination inflammatory papulopustular and comedonal acne.

#52

RANDOMIZED, DOUBLE-BLIND, CONTROLLED PILOT STUDY OF THE EFFICACY AND SAFETY OF MICRO-FOCUSED ULTRASOUND FOR THE TREATMENT OF AXILLARY HYPERHIDROSIS

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Background: The objective of this study was to further evaluate the efficacy and safety of micro-focused ultrasound (MFU) for treatment of primary axillary hyperhidrosis.
Study: Twenty hyperhidrotic adults (hyperhidrosis disease severity scale (HDSS) score of 3 or 4 and gravimetrically measured sweat production of >50mg/5 min) were enrolled. Following lidocaine and epinephrine injection, active-treated subjects (N = 12) received bilateral treatments consisting of 240 lines with the 4 MHz–4.5 mm transducer, and240 lines with the 7 MHz–3.0 mm transducer. Sham received the same treatment but with energy turned to zero joules (N = 8). All subjects received 2 treatments 30 days apart. Efficacy post-treatment (37, 44, 60, 90, and 120 days) was measured by percentage of subjects reaching HDSS scores of 1 or 2, and sweat production reaching <50 mg/5 min as well as qualitative reduction shown by starch iodine test. Adverse events were collected.
Results: Average age was 34 (range 21–52), 30% female, 30% Caucasian, 50% Hispanic/Latino, 15% African American, 5% Asian. There was a significant difference ($p < 0.005$) between sham and active by HDSS with response rates of 67–83% across all post-treatment time points for active versus 0% for sham. Response rates by gravimetric method of 67–92% across all post treatment time points for active versus 0–13% for the sham were also significantly different ($p < 0.001$). 83–91% of active subjects were satisfied or very satisfied at all post-treatment time points versus 0% in sham. No serious adverse events were reported. AE's were infrequent, mild and transient: (slight tenderness, edema, paraesthesia and bruising).
Conclusion: Preliminary results suggest micro-focused ultrasound appears to be highly efficacious and safe for the treatment of axillary hyperhidrosis. Given the positive results of this study additional work is being conducted to further optimize this application including a histology study and a pivotal clinical trial.

#53

RARE SIDE EFFECTS ASSOCIATED WITH CRYOLIPOLYSIS

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Background: Cryolipolysis, the noninvasive destruction of fat cells by controlled cooling, is a clinically proven, non-invasive methodology for fat reduction. Since its launch in 2009, over 470,000 treatments have been performed worldwide with transient and generally mild side effects. We report common as well as two, newly detected rare side effects: subcutaneous induration (SI) and paradoxical hyperplasia (PH).
Study: Data was collected through a post-marketing surveillance program of the device manufacturer (Zeltiq Aesthetics, Inc.)
Results: The common, transient, expected side effects of cryolipolysis are erythema, edema, mild discomfort and decreased sensation. In addition to late onset pain, two new rare side effects, subcutaneous induration (SI) and paradoxical hyperplasia (PH), have been observed. SI is the development of nodules or generalized firmness of the treatment area. It occurs as painless lesions 2 weeks to 2 months post treatment and self resolves in 3–6 months. The incidence rate is ~ 0.0077%. PH manifests as enlargement confined to the treatment area which is a smooth, non-tender bulge with consistency that is typically firmer than surrounding tissue. The incidence rate is ~0.0032%, with a strong trend to greater frequency in males. The onset of PH is typically 2–3 months but may occur up to 5 months post treatment. Diagnostic testing in available cases reveals increased adipose tissue. Histology showed hyperplasia of adipose and fibrous tissues. Surgical measures, including liposuction and abdominoplasty were performed in some cases.
Conclusion: Cryolipolysis is a generally safe and well tolerated procedure. SI and PH are new, rare side effects with incidence rates of 0.0077% and 0.0032%, respectively. No common demographic or medical risk factor for PH has been identified at this time.

#54

1320 nm Nd:YAG LASER FOR IMPROVING THE APPEARANCE OF ONYCHOMYCOSIS

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Background: Onychomycosis is a therapeutic challenge due to systemic medications that are limited by their toxicities. This has led to the investigation of light-based technologies for alternative treatments that are safe and effective. These studies tend to be

small and are often limited by their design. The objective of this study was to determine the safety and efficacy of four treatments with the 1320 nm Nd:YAG laser in improving the appearance of onychomycosis.
Study: This study was a 24-week, single-center, randomized, placebo-controlled study. Ten subjects were enrolled with culture proven bilateral great toenail onychomycosis. Subjects received 4 treatments with the 1320 nm Nd:YAG laser to the treatment toenail on days 1, 7, 14, and 60. The control toenail received a sham treatment of cryogen cooling only. Mycologic cultures were obtained at 3-month follow-up visits.
Results: 50% of mycologic cultures were negative at 3 month follow-up after 4 laser treatments. Toenails had improvement in subungual debris, hypertrophy, and yellowing. Patient satisfaction was upheld as assessed by the Nail Quality of Life Questionnaire.
Conclusion: The 1320 nm Nd:YAG laser may be a safe and effective therapy for improving the appearance of onychomycosis. Additional therapy may be necessary to enhance long-term results. Further investigation needs to explore the optimal treatment settings as well as the most effective treatment schedule.

#55

LONG TERM (3 YEAR) EVALUATION FOR THE TREATMENT OF CELLULITE - A MULTICENTER STUDY

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Background: Cellulite is seen in more than 85% of post pubertal women. To date methods to treat cellulite produce either little or temporary improvement and require multiple treatments. This study investigates a minimally invasive single treatment approach using a Nd:YAG 1440 nm wavelength laser and specialized fiber to evaluate the long term efficacy of this treatment.
Study: Subjects at two clinical sites presenting with unwanted cellulite on the thighs were enrolled in an IRB study and were instructed to maintain their current weight throughout the course of the study. After administering tumescent anesthesia to the treatment area, a pre-defined laser dose was delivered to the hypodermal fat layer via 1440 nm Nd:YAG laser and side-firing optical fiber housed in a temperature sensing cannula (Cellulaze, Cynosure, Inc.). Dose per subject was determined by the subject's grade of cellulite, age and skin condition. Standard post operative care procedures were followed including a compression garment worn for 1–2 weeks post treatment. High resolution digital photographs were taken before treatment, 3 months, 6 months, 1–1.5 years and 2–3 years post treatment. Photographs were randomized, blinded and rated by blinded evaluators. Adverse events were monitored and subject and physician satisfaction were rated.
Results: 27 Caucasian and Hispanic females age 41(+/−8) years, with BMI 28 (+/−6) and Fitzpatrick skin types II-V tolerated the treatment well. Events were typical and resolved prior to the six month visit. Weight change was not significant and showed no correlation with the level of improvement in cellulite.. Blinded evaluators ratings showed a statistically significant improvement 3 months post treatment which maintained up to 3 years Satisfaction continued at the 2–3 year follow up visit with 82% of subject and 100% physician being satisfied or very satisfied.
Conclusion: A single treatment using 1440 nm pulsed laser with a specialized side firing fiber improves the appearance of cellulite correlating with high satisfaction rates up to 3 years post treatment.

#56

NON-INVASIVE FAT REDUCTION OF THE INNER THIGHS USING A PROTOTYPE CRYOLIPOLYSIS APPLICATOR

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Background: Cryolipolysis is FDA-cleared in the United States for reduction of fat in the abdomen and flanks and the system received Health Canada approval and is CE marked as a Class IIa medical device. Previous studies showed fat reuction in abdomens, saddle bags, love handles, and backs. Inner thighs are also an area of interest but currently, there is not a commercially-available applicator optimized for this treatment site. This study evaluates the feasibility of using a vacuum applicator to achieve effective inner thigh treatment.
Study: A prototype vacuum applicator was used to treat 11 subjects in a single-side inner thigh study. Treatment was delivered to the larger thigh while the contralateral thigh served as a control. Subjects received a single 60-minute cryolipolysis treatment (CoolSculpting®, ZELTIQ Aesthetics, Pleasanton, CA). Safety was assessed by phone follow-up at 1 week. Office visit follow-ups were conducted at 8 and 16 weeks. Efficacy was evaluated by ultrasound imaging of fat thickness, before and after photo evaluation, and patient satisfaction surveys.
Results: A visible reduction in inner thigh contour following treatment. Preliminary results support the safety of inner thigh treatment with no adverse events reported and minimal and expected side effects. Clinical efficacy was demonstrated at 16 weeks with ultrasound measurements showing 89% of subjects attaining some level of fat layer reduction. The mean fat layer reduction percentage in the inner thigh was 18%, corresponding to 3 mm reduction. Patient surveys revealed 91% patient satisfaction. Before and after images revealed.
Conclusion: Cryolipolysis appears to be a safe and effective technique for fat layer reduction in the inner thighs usuing a prototype vacuum applicator.

#57

DYNAMIC MONOPOLAR RF REDUCTION OF ARM FAT BY DUPLEX ULTRASOUND IMAGING AND 3D IMAGING

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Background: RF energy has been previously described for reduction of cellulite and abdominal fat. The primary endpoints have been circumferential reduction. The purpose of this prospective, IRB supervised study was to measure whether fat reduction on a small circumference area could be achieved by monopolar RF and whether changes could be measured using much more objective and reproducible criteria than circumferential tape measurements.
Study: Twenty patients (N = 20 ITT) complaining of "flabby arms" were enrolled for a series of 4 treatments administered 2 weeks apart using a dynamic monopolar device (Exilis™, BTL, Prague, CR) with grounding pad placed on upper back. Patient's

arms served as their own control as only one arm was treated. Treatment regimen was as follows for the posterior arm: cooling at 20–25°C; power at 80–90 W; treatment time for 6 minutes, a second pass for more superficial heating with cooling off, treatment time of 3 minutes. Measurements at baseline, treatment #2,3,4 and 1 and 3 months post included for treated and non-treated control: arm volume by Vectra 3D imaging (Canfield), duplex ultrasound at specific landmarks (Terason T3000 high resolution duplex ultrasound with 12L5 Linear array transducer), and circumference (using spring loaded tape measure). Patient self-assessments on quartile scale were also recorded.

Results: Measuring with the arm in a fixed sling and the center of the transducer at mid-point on the posterior arm using existing fascial patterns, fat layers ranged from 1.83 to 2.82 cm at baseline. At 3 months post-treatment, median fat reduction on the untreated control arm was −0.02 cm but for treated was reduction by −0.57 cm. T-test between 2 independent means was statistically significant ($p < 0.005$) for treated arms. Volumetric cylinder measurements using 3-D arm volume calculations using a fixed point on the skin demonstrated baseline volumes of 500–700 cc with reductions of volume of up to 45cc correlating with ultrasound reduction on treated arms. No correlation was seen with tape measure circumferential readings which were statistically not significant. Two patients judged themselves as non-responders and ultrasound demonstrated no change in fat layer.

Conclusion: Dynamic monopolar RF is an excellent modality for fat reduction on the posterior arm as measured by high resolution Duplex ultrasound and is highly statistically significant. Complete 360 degree modeling of the upper arm is possible permitting calculation of the volume of a cylinder as a second objective measurement showing correlation with ultrasound. Circumference measurements of small cylindrical structures such as the upper arm are unreliable and prone to user error.

#58

EVALUATION OF HIGH-INTENSITY FOCUSED ULTRASOUND FOR THE REDUCTION OF SUBCUTANEOUS ADIPOSE TISSUE USING MULTIPLE TREATMENT TECHNIQUES

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Background: High-Intensity Focused Ultrasound (HIFU) is a relatively new, non-invasive alternative to liposuction for the localized reduction of subcutaneous adipose tissue (SAT). HIFU produces heat capable of disrupting SAT and contracting collagen to produce a desired body contouring effect. The focused-depth nature of this modality passes ultrasound through the skin to the treatment zone without any undesired heating of the superficial tissue. This study was performed to evaluate the efficacy of multiple treatment techniques for circumferential waist reduction.

Study: 126 subjects received HIFU (Liposonix®, Solta Medical, Inc., Hayward, CA) treatments under IRB approval. Two techniques were employed: grid repeat with total dosage delivered over multiple staggered passes, and site repeat with total dosage delivered via multiple treatment cycles consecutively on a single site. A total fluence of 150–180 J/cm^2 was delivered with 30 J/cm^2 or 60 J/cm^2 delivered per treatment cycle. Efficacy was assessed utilizing validated circumferential waist measurements.

Results: HIFU treatment resulted in an average circumferential reduction of >2.5 cm by 12-weeks post-treatment. Reported pain scores were 3.2 ± 2.0 and 6.1 ± 2.1 (0–10) during treatment with 30 J/cm^2 and 60 J/cm^2, respectively. However, there was no statistical difference in circumferential reduction between the 30 J/cm^2 and 60 J/cm^2 subgroups ($p > 0.05$), and between the grid repeat and site repeat treatment techniques ($p > 0.05$). Histology demonstrated a comparable adipose injury at 1-week with 30 and 60 J/cm^2, and resolution at 12-weeks.

Conclusion: HIFU technology is a non-invasive treatment for localized body contouring with minimal down time and adverse events. This study demonstrated that HIFU was an effective single treatment modality for reduction of circumferential waist SAT. While there was a significant decrease in pain scores in the 30 J/cm^2 subgroup, efficacy was not dependent on the fluence per treatment cycle, but rather on total fluence delivered. This is the first description these two techniques produced a statistically equivalent SAT reduction, allowing the user increased latitude of treatment regimen options.

#59

EFFICACY OF LOW-LEVEL LASER THERAPY FOR UPPER ARM CIRCUMFERENCE REDUCTION: A MULTICENTER DOUBLE-BLIND, RANDOMIZED, SHAM-CONTROLLED TRIAL WITH LONG-TERM FOLLOW-UP

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Background: Low-level laser therapy (LLLT) administers energy that causes no detectable temperature rise or macroscopically visible changes in tissue structure. A LLLT device (635 nm) has been cleared for non-invasive reduction of hip, waist and thigh circumference. Skepticism remains regarding the efficacy and long term effects of this modality. In order to evaluate the clinical efficacy of LLLT in a clinical model without significant confounding variables, a randomized, double-blind study utilizing an upper arm circumference model was conducted.

Study: Subjects were randomized to receive three 20-minute (LLLT) ($N = 31$) or sham treatments ($N = 31$) to the upper-arms weekly for 2 weeks and the circumference was measured at 1 and 2 weeks, 2 weeks post-treatment and a subgroup of subjects was assessed after a mean of 7.6 months. Study success criterion was proportion of subjects achieving a combined reduction in arm circumference =1.25 cm measured at three equally spaced points for each of the right and left upper arms, separately. Secondary outcome measures included subjective satisfaction ratings.

Results: Among LLLT-treated subjects, 58% met study success criteria *vs*. 3% of sham-treated subject ($p < 0.000005$). The mean combined change in arm circumference was -2.01 and -3.70 after three and six LLLT treatments, respectively, *vs*. 0.11 and −0.31 cm for sham ($p < 0.01$). These results remained unchanged 2 weeks post-treatment (−3.44 cm *vs*. −0.24; $p < 0.01$) as well as in subjects available for long term follow-up assessment ($N = 34$) (mean 7.6), (−3.25 cm vs.1.10; $p < 0.01$). Significantly more LLLT-

treated subjects reported greater satisfaction, improved appearance and results that exceeded expectations. There were no reports of treatment-related AEs.
Conclusion: LLLT produces significant and long-lasting reductions in upper-arm circumference without pain or side effects. The upper arm reduction model provides a system to evaluate fat reduction and body shaping and dramatically limits confounding variables.

#60

EFFICACY OF A HIGH-INTENSITY FOCUSED ULTRASOUND DEVICE FOR NON-INVASIVE BODY CONTOURING

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Background: High-intensity focused ultrasound (HIFU) is a non-invasive technology for body contouring. HIFU is focused within the subcutaneous adipose tissue, causing coagulative necrosis and cell death. The objective of this study is to evaluate the effectiveness of a HIFU device for sculpting of the abdomen.
Study: The system has a set focal depth of 1.3 cm. 12 subjects with adipose thickness no less than 2.5 cm who met the screening criteria were recruited. Each subject received one treatment to the abdomen. The total fluence used per site was 150–165 J/cm^2 with a mean of 161 J/cm^2. The waist circumference at iliac crest and the point of maximum circumference were recorded at baseline, 4, 8 and 12 weeks post-treatment, as well as their weight and BMI. Subjects' rating on comfort level and satisfaction were collected via questionnaires at every follow-up. Standardized photographs were also taken with the Canfield System® at each visit.
Results: 7 out of 12 subjects were satisfied with the outcome and 9 out of 12 would recommend this treatment to their friends and family. There was statistically significant improvement in the waist circumference measured at both the iliac crest (*p-value 0.013, 0.002, 0.005*) and maximum waistline (*p-value 0.003, 0.034, 0.023*) at 4, 8, 12 weeks post-treatment. Spearman's rho for correlation of energy level vs. improvement showed that at 12 weeks post-treatment follow-up, the improvement significantly correlated with the total fluence per treatment (*p-value 0.041*). The higher the total fluence delivered, the larger the decrease in waist circumference.
Conclusion: High-intensity focused ultrasound effectively decreases waist circumference in Chinese. The higher the total fluence delivered, the larger the decrease in waist circumference was observed.

#61

QUANTITATIVE AND QUALITATIVE BLINDED EVALUATION OF OUTCOMES OF SINGLE CELLULITE TREATMENT POST SIX MONTHS

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Background: Cellulite gives the skin surface an orange peel or mattress-like appearance thought to be caused by expansion of subcutaneous fat, fibrotic septae and, dermal laxity. Until recently, treatment of cellulite has been temporary lasting. A new minimally invasive single treatment device was introduced for the treatment of cellulite. This study evaluated the long term efficacy of a single cellulite treatment using 2D and 3D photography to assess dimple change and contour irregularities.
Study: Women aged 20–55 years with moderate cellulite on their thighs and buttocks were enrolled in a prospective IRB approved study. Tumescent anesthesia was injected into the treatment area and subjects received a single laser treating using the 1440 nm laser with a bi-directional fiber subcutaneously. Photography and 3D analysis was conducted at 2, 3, and 6 months post treatment. Blinded evaluators graded changes using before and after photographs. Adverse events, subject and physician satisfaction were recorded.
Results: 15 female subjects with cellulite (grades II–III) responded to treatment with post treatment events resolving by 2 months. The average decrease in dimple depth was 42% ($n = 30$ $p = .00015$) at 3-months and 49% ($n = 30$ $p = .00032$) at 6-months follow-up. The percent improvement for both dimples and contour irregularities by 2D photography was 53%. When 3D depth values were translated to severity according to the dimple severity conversion, 57% of moderate dimples and 79% of mild dimples resolved at 6 months. Patients and subjects were satisfied with the treatment. Average scores at 3-months were 5.2 for physician evaluations and 4.1 for subjects, at 6-months 5.0 for physicians and 4.9 for subjects (1–6 scale).
Conclusion: All subjects showed improvement in dimples and contour irregularities. Both subjects and physicians were satisfied with treatment outcomes.

#62

A PROSPECTIVE COMPARATIVE TRIAL OF HIGH-INTENSITY FOCUSED ULTRASOUND vs CRYOLIPOLYSIS FOR TREATMENT OF FLANK SUBCUTANEOUS ADIPOSE TISSUE

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Background: Non-invasive body sculpting procedures are becoming increasingly popular for the reduction of focal deposits of abdominal adipose tissue due to their tolerability, low side effect profile, and proven efficacy. High-intensity focused ultrasound (HIFU) and cryolipolysis are two such treatment methods. The aim of this study was to compare the efficacy of HIFU and cryolipolysis in the treatment of subcutaneous flank fat.
Study: 8 healthy, female patients with localized, subcutaneous adipose tissue of their bilateral flanks were assigned to treatment with either HIFU (Liposonix, Medicis Technologies Corporation, Bothell, WA) or cryolipolysis (CoolSculpting, Zeltiq Aesthetics, Pleasanton, CA) for each flank in a single treatment session in this prospective, single-center study. Treatments utilized total HIFU energy doses of 40 to 50 J/cm^2 and CoolSculpting 6.2 handpieces, respectively. Weight and widest-point waist circumference were recorded at baseline and at 4 monthly follow-up visits. Two independent, blinded investigators evaluated overall improvement of each treatment area using an 8-point grading scale (−1= worsened, 0= unchanged, 1= <10% improvement, 2= 10–25% improvement, 3= 26–50% improvement, 4= 51–75% improvement, 5 = 76–90% improvement, 6= >90% improvement) with the aid of digital photographs obtained at baseline and at 4-month follow-up.
Results: Treatment with HIFU and cryolipolysis led to respective mean improvement scores of 1.81 and 1.69, nearly a 10–25%

improvement from baseline. However, there was no statistically significant difference in improvement scores between treatment groups. Patients had no significant change in weight or widest-point weight circumference from baseline at 4-month follow-up.
Conclusion: HIFU and cryolipolysis were equally effective in producing modest reductions in flank subcutaneous adipose tissue in this small, single-center, prospective study.

#63

OPERATOR INDEPENDENT FOCUSED HIGH FREQUENCY ISM BAND FOR FAT REDUCTION: PORCINE MODEL

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Background: Selective fat reduction has been clearly shown for various methods and energy modalities including cryolipolysis and high intensity focused thermal ultrasound. Mathematical modeling of focused high frequency of the EM spectrum has indicated that selective heating of fat is possible using wavelengths not previous explored. The purpose of this study was to demonstrate in the porcine model that selective heating of fat is possible with a non-contact, operator independent device.
Study: High frequencies of the ISM RF band were utilized to reduce abdominal fat in a porcine model. Practical application of mathematical modeling allowed an auto-feedback loop to be developed to allow operator independent adjustment of energy to maintain subcutaneous fat at 45–46 C while overlying skin remained at 40–41C.
Results: Treatments of Vietnamese pigs were performed under anesthesia in a veterinary facility. Gross and microscopic histologic results demonstrated a marked reduction in adipocytes of the treated area after 4 treatments of 15 minutes each, with incremental fat diminution after each treatment. A final 70% reduction of the abdominal fat layer was seen in the treated areas. Duplex ultrasound revealed a reduction of fat layer from 7.6 mm to 2.9 mm. Histologic evaluation revealed that epidermis, dermis and adnexal structures such as hair follicles were unaffected by the treatment, while adipocytes were significantly affected and reduced.
Conclusion: A new model of contact free fat reduction using high frequency waves has been successfully achieved in a porcine model. This has very positive implications in the development of an operator independent, contact free device for reduction of fat in clinical practice.

#64

NOVEL TREATMENT OF PERIORAL RHYTIDES BY SUBCISION COMBINED WITH Er:YAG LASER RESURFACING

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Background: Perioral rhytides result from sun exposure, repetitive muscle activity, descent of the midface and osteocutaneous ligament laxity. Many techniques exist to tighten skin in the perioral area. However, a strategy to predictively manage deep rhytids in the awake patient remains elusive. Resurfacing and fractional laser technologies have advanced the treatment of the aging perioral region. Subcision is a well-established technique for treatment of depressed acne scars. We present a novel approach to perioral rhytides that combines subcision and Er:YAG laser resurfacing.
Study: Twenty five patients presented for treatment of perioral region (upper and lower lips) to smooth deep ryhtides and tighten perioral skin. Under local anesthesia, a 3 mm spatulated Byron liposuction cannula was used to subcutaneously undermine the upper and lower lip aesthetic units. Following subcision, the lips were resurfaced using a Sciton^{TM} Er:YAG laser. The skin was initially covered with a Flexan dressing which was removed on post-treatment day three. Thereafter, skin care consisted of Aquaphor twice daily as needed.
Results: All patients tolerated the procedure well. Erythema resolved completely on average in 40 days. There were no cases of infection, hypopigmentation or abnormal scarring. Significant improvement of perioral rhytides was observed in all patients. Mean follow up was 6 months (range 1.5–24 months).
Conclusion: We present a novel technique to improve deep perioral rhytides. Subcision releases the dermal attachments of deep rhytides to the underlying orbicularis oris muscle. Laser resurfacing after subcision allows for a significant skin tightening effect resulting in marked improvement of perioral rhytides. We believe this is a novel, simple, safe and effective approach to the treatment of perioral aging.

#65

CLINICAL OUTCOME OF A RANDOMIZED SPLIT-FACE TREATMENT WITH A NOVEL CONSUMER 1440 nm SKIN REJUVENATING LASER

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Background: A novel 1440 nm non-ablative fractionated diode laser device for the treatment of photodamage was developed for consumer use. This study was designed to demonstrate safety and efficacy of the home-use laser device for the treatment of facial photodamage.
Study: Thirty-four subjects were enrolled in a randomized, split-face study. Each side of the face was randomly assigned to either daily treatments with densities of 72 or 150 microbeams/cm^2 or biweekly treatments with densities of 175 or 350 microbeams/cm^2. Subjects self-treated at the study site for 12 weeks, followed by a 1 month follow-up. An independent, blinded dermatologist evaluated and scored photographs of each side of the face utilizing a 9-point scale for wrinkles, dyschromia, and diffuse redness. A live assessment of tactile roughness was assessed by the investigator using a 9-point scale. Tolerability was assessed daily during the treatment phase using a 10-point scale for pain and adverse events were monitored throughout the study.
Results: All treatment regimens resulted in clinically significant results. Efficacy in the 72 microbeams/cm^2 daily treatment group was of key interest. Results from this group showed 75% of subjects had at least a 1 point improvement in wrinkles, dyschromia and diffuse redness 1 month post treatment. All subjects showed at least a 1 point improvement in tactile roughness (mean 2.5). Mean pain scores started at 2.9 in the first

week, declined to 1.6 by the second week, and dropped to 0.1 by the last week of treatment. All expected adverse device effects were reported as trace or mild and most resolved within minutes after treatment.
Conclusion: The study showed that the novel consumer 1440 nm skin rejuvenating diode laser is safe for consumer use and well-tolerated. Physician assessed efficacy showed clinically significant improvement in wrinkles, dyschromia, diffuse redness, and tactile roughness.

#66

HEAT MEDIATED TISSUE TIGHTENING FOR CORRECTION OF BREAST PTOSIS

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Background: Mastopexy has been frequently turned down by patients with breast ptosis because of the unattractive scarring associated with skin excision. Recurrence of ptosis following mastopexy is fairly common. To design a long lasting scarless breast lift that achieves the goals of elevating the nipple-areola complex, and improving bottoming out of the lower pole.
Study: 50 female patients were enrolled in an IRB approved prospective study using RF mediated tissue tightening applied to the subcutaneous tissue of their ptotic breasts. Qualifying patients had preoperative mammograms, standardized 2D photos, 3D Vectra photos, and high resolution ultrasound imaging. Procedure: tumescent fluid 200–300 cc per breast was infused in a radial manner through 3 punctate access ports. The RF device using the FaceTite handpiece was used to deliver an average of 23.7 kilojoules of energy within the subcutaneous layer only in a radial manner. No liposuction or tissue removal was performed. Postoperative support bras were worn for 6 months.
Results: Patients were followed up at 6 weeks and at 3 month intervals for 6–12 months. Canfield Vectra measurements of sternal notch to nipple distance showed a mean elevation of 2.7 cm at 6 months. Significant improvement of bottoming out was noted by independent examiners in 96% of treated patients. Independent reviewers noted that 6 week results were more modest than results at 3 or 6 months. Patients seen at 1 year maintained or slightly improved. Complications included 1 hematoma and one patient who requested a surgical reduction of her preoperatively large areolae.
Conclusion: Initial results of the 'scarless' breast lift using heat-mediated tissue tightening are promising. Results were rated as good to excellent by 92% of patients treated. Further studies using other heat mediated devices are warranted. Long term follow-up including high resolution ultrasound examinations and mammograms of treated patients is continuing.

#67

CLINICAL APPLICATION OF FOCUSED, NON-THERMAL ULTRASOUND ON RYTIDES

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Background: This paper describes a proof of principle study intended to establish that mechanical stimulation, as opposed to thermal damage, can be used as an effective treatment of skin wrinkles. Unlike lasers and light-based treatments that rely on tissue heating to treat wrinkles, treatments with focused, non-thermal, ultrasound are capable of wrinkle reduction through mechanical stimulation of tissue without causing the unwanted side effects associated tissue heating.
Study: 23 subjects (F: 83% M: 17%), aged 44.4 ± 7.1 years were enrolled in a single center, prospective study for treatment of wrinkles of the forehead, peri-ocular, and glabellar regions. Subjects received thirty weekly treatments applied with the PWG-20, a focused, non-thermal ultrasound device (Julia Therapeutics, Wellesley MA). Treatment was performed nominally for eight minutes per square centimeter, with broadband ultrasound pulses at a central frequency of 5-MHz sustained by input power of sixteen watts. Photos of the treated areas were taken prior to treatment, at the 10^{th}, 20^{th}, and 30^{th} treatments, and at one and three months follow up visits. Three blinded observers evaluated and graded "before" and "after" photos using an improvement scale of 0 (none) to 4 (excellent).
Results: 21 of 23 subjects completed all treatments and follow-up visits. 66% of all evaluations indicated a response to treatment. 71% of 180 forehead evaluations and 66% of 284 peri-orbital evaluations resulted in improvement. The remaining 115 evaluations consisted of treatment of vertical lines of the glabella, which, as a group, did not respond in a statistically significant way. Among responders, the average improvement was 2.07. Overall efficacy (all data points) was statistically significant as measured by single-sample Z-Test, with $p < 0.000001$. The evaluation of variation between blinded observers resulted in a 0.66 Pearson correlation coefficient. Significant improvement was noted at all evaluation visits. There was no statistically significant difference between outcomes at T10 and T30. Treatments were well tolerated with little or no discomfort and edema lasted less than 24 hours. Three subjects experienced blisters due to an isolated equipment malfunction.
Conclusion: The PWG-20 focused, non-thermal ultrasound device provides significant improvement to wrinkles with little discomfort and modest, short-duration edema. This novel modality offers a large number of device and treatment variables to improve and optimize outcomes. Additional studies are recommended to improve device design and clinical application and to optimize treatment.

#68

2 YEAR QUANTITATIVE DATA ON IMPACT OF LASER TREATMENT TO INCREASE SKIN THICKNESS AND ELASTICITY

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Background: Due to intrinsic and photo aging, an average of 6% loss of dermal mass occurs per decade of life. Loss of skin elasticity and dermal thickness is a known contributor to the underlying structure of cellulite. A growing number of treatments to increase skin thickness and elasticity warrant quantitative methods to reliably measure the efficacy of these treatments to differentiate modalities used.
Study: This study quantitatively assessed a minimally invasive laser treatment's affect on skin thickness and elasticity during a procedure for cellulite. Fifty female subjects were treated in the thighs and/or buttocks with a single treatment using a pulsed Nd:YAG 1440 nm wavelength laser (Cellulaze, Cynosure Inc, Westford, MA). A three step approach was used including the heating of the dermal layer to stimulate collagen production.

Quantitative measurements were taken at 2, 3, 6 and 24 months using the DermaLab Elasticity Module System and the DermaScan C Ultrasound system. (Cortex Technology, Hadsund, Denmark).
Results: Forty four subjects had an average improvement of 25% in skin elasticity at 2 months that increased to an average of 33% at 24 months and an average of 15% increase in skin thickness at 2months that continued at the same level to 24 months.
Conclusion: Due to the inevitable loss of dermal mass as one ages, it is important to establish quantitative measurements to determine long term efficacy of increasing and maintaining skin thickness and elasticity for this laser treatment and to compare to other modalities.

#69

A SINGLE-CENTER, PROSPECTIVE STUDY ON THE EFFICACY OF MICRO-FOCUSED ULTRASOUND WITH VISUALIZATION FOR THE NON-INVASIVE TREATMENT OF SKIN WRINKLES ABOVE THE ELBOW

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Background: With the increased popularity of minimally invasive cosmetic treatments, the objective of this study was to evaluate the efficacy and safety of micro-focused ultrasound with visualization (MFU-V) for tightening lax skin above the elbow.
Study: Twenty subjects were treated bilaterally with MFU-V (Ulthera, Inc.) above the elbows in order to lift and tighten the skin. Subjects were treated with boh 4.5 mm/4 mHz and 3 mm/7 mHz transducers. Subject's pain was measured by numeric rating scale (NRS) immediately post treatment. Standardized photographs were taken prior to treatment and at 90 and 180 follow up visits. Efficacy measures, including masked-observer ratings, physician and subject global aesthetic improvement scales (PGAIS and SGAIS) were completed at 90 and 180 days, subject satisfaction was collected at 90 and 180 days. Safety, based on AE incidence, was assessed.
Results: Twenty female subjects, mean age 54 years (range 35–65 years), with a mean BMI of 23.2 (range 17.8–29.3) were treated. At the time of this interim analysis, overall improvement in SGAIS was 87.5% and 90.9% at 90(N = 15) and 180(N = 11) days, respectively, compared to baseline. The overall improvement in PGAIS was 93.8% and 90.9% at 90 and 180 days, respectively. Subject-reported improvements at 90 and 180 days reached 86.7% and 90.0%, respectively, with the most commonly reported improvements being reduction of skin wrinkling and sagging. No serious adverse events were reported. No treatment related adverse events reported.
Conclusion: There are few options available to treat skin laxity in his area. This pilot study suggests that MFU-V is a safe and promising nonsurgical option for the treatment of skin laxity above the elbow.

#70

A SINGLE-CENTER, PROSPECTIVE STUDY OF THE EFFICACY AND SAFETY OF MICRO-FOCUSED ULTRASOUND WITH VISUALIZATION FOR LIFTING, TIGHTENING, AND SMOOTHING OF THE BUTTOCKS AND THIGHS

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Background: There are several non-invasive options available for sculpting the buttocks and thigh, however few address tightening, smoothing and lifting of the overlying tissue in this anatomical region. The objective of this study was to evaluate the efficacy and safety of micro-focused ultrasound with visualization (MFU-V) for lifting and tightening and smoothing of the buttocks and thighs.
Study: Thirty subjects were treated unilaterally with MFU-V to the lateral region of the buttock and posterior thigh with an optional "balancing" treatment to the opposite side at 180 days post initial treatment. Treatment consisted of using both 4.5 mm/4 MHz and 3 mm/7 MHz transducers. Subject's pain was measured immediately post treatment with a numeric rating scale (0–10). Standardized photographs were taken prior to treatment and at 90 and 180 follow up visits. Efficacy measures, including masked-observer ratings, physician and subject global aesthetic improvement scales (PGAIS and SGAIS), and subject satisfaction were completed at 90 and 180 days. Safety, based on AE incidence, was also assessed.
Results: 28 subjects completed evaluation; all female, ranged from 35–65 years (mean 29) with a mean pre-treatment BMI of 24.9 (range 20.8–29.9). No appreciable weight gain or loss noted at 90 days. At interim analysis time point, SGAIS and PGAIS was 86.4% and 100% improved to very much improved at 90 days and 180 days, respectively compared to baseline. 72.7% of subjects noticed an improvement at 90 days, most noting less sagging and smoother skin texture and 85.7% at day 180. 68.2% and 86.4% of subjects were satisfied or very satisfied with results at 90 days and 180 days respectively. No serious adverse events were reported. No treatment related adverse events reported.
Conclusion: MFU-V is a promising nonsurgical option for the lifting, tightening, and smoothing of the buttocks and thighs. This technology holds promise as an additional tool and may potentially be combined with other body sculpting technologies to optimize treatment of this anatomical region.

#71

CLINICAL EVAULATION OF A NOVEL BIPOLAR SUBLATIVE RADIOFREQUENCY DEVICE USING A COMBINATION OF TWO MULTI-ELECTRODE ARRAYS FOR FULL FACE TREATMENT TO IMPROVE SKIN WRINKLES, TEXTURE AND DYSCHROMIA

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Background: Non-ablative radiofrequency (RF) aesthetic technology can safely and effectively treat mild to moderate wrinkles and textural irregularities of the skin. Recently developed technology permits the use of bipolar RF energy, delivered via a matrix of electrodes from a disposable applicator tip, to create deep, fractional dermal tissue coagulation in the region of the electrode matrix while minimizing epidermal disruption. This elicits a wound healing response in the zones of thermal coagulation from the less affected tissue surrounding the matrix points. The purpose of this study was to determine the effects of using a combination of 2 different electrode pin tips for full face treatment.
Study: This was an IRB approved prospective study of 15 females with skin phototypes 1–3, average age 53 ± 5 (range 44–59) years, exhibiting Fitzpatrick Degree of Elastosis Score (ES) of 3–6. A commercial sublative fractional bipolar radiofrequency device

which supports the RF applicator (Syneron eMatrix™) was used in this study. Two pin tip configurations were used in a single treatment session, a 64-pin tip for the full face and a new 44-pin tip configuration for the periorbital and peri-oral areas. Each subject received 3 full facial treatments at 4 week intervals with follow-up evaluations conducted at 1, 3 and 6 months after last treatment. Standardized photographs and the Global Aesthetic Index (GAI) were used to evaluate the clinical effects. Photographs were scored by blinded assessment of 3 evlauators. RF energy of 45–60 mJ per pin for 2–3 passes was delivered over the forehead and cheeks with 64-pin tips and the peri-orbital, peri-oral and nose areas with 44-pin tips. Subjects were asked to rank the pain level immediately after treatment using 0–10 scale (0 = no pain to 10= intolerable pain).
Results: All subjects exhibited temporary erythema and edema post treatment with no severe or lasting complications. Preliminary results show that all subjects exhibited overall improvement in wrinkles and texture at 3 and 6 month follow up. At the 3 month follow-up, 73% (8 of 11) exhibited improvement of the peri-orbital and peri-oral zones, and at the 6 month follow-up visit 75% (6 of 8) had improvement of the peri-orbital and peri-oral zones. Additionally, at the 6 month follow-up visit 88% (7 of 8) subjects had improvement in the appearance of pores and skin tone. The subject average treatment pain level was 7.0 ± 1.9.
Conclusion: This study demonstrated that the non-invasive sublative fractional RF technology, using a matrix of multi-electrode pins can safely and effectively treat facial wrinkles, texture, pores and dyschromia with minimal down time and risk. The new 44 pin tip configuration proved to be an added benefit for the versatility of treatment in contoured and smaller facial areas.

#72

SAFETY AND EFFICACY EVALUATION OF A NOVEL INFRARED, RADIOFREQUENCY AND FRACTIONAL RADIOFREQUENCY DEVICE

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Background: We sought to evaluate a novel device with non-ablative infrared light, bi-polar radio frequency (RF) energy and fractional RF.
Study: The Syneron eTwo wuses the Sublime™ applicator delivering a combination of infrared (700–2000 nm) and bi-polar RF energy and the Sublative™ applicator which delivers fractionated bi-polar RF. Under IRB approval patients aged 35–60, exhibiting Fitzpatrick Elastosis Scores of 2–6 were enrolled. Each subject received three treatments at 4 week intervals and follow-up evaluations at 1, 3 and 6 months post the final treatment. A treatment consisted of a pass of the face with the Sublime applicator followed by 2–3 passes with the Sublative applicator. The 44 pin tip and the 64 pin tip were both used with energies of 40–62 mJ/pin. The investigator and subject rated improvement on the 5-point GAI scale and subjects' satisfaction and overall improvement were recorded.
Results: 20 subjects completed 3 treatment sessions. Immediate response included temporary erythema, edema and crusting lasting 3 ± 2, 2 ± 1 and 4 ± 2 days respectively. At the 1 month follow-up visit, GAI score improvement was attained by all subjects, with 19% demonstrating marked improvement. Self-assessments were 100% reported overall improvement, 73% reported a significant reduction in fine lines, and 87% were satisfied. At the 3 months the investigator GAI score all subjects had at least moderate improvement, with 71% attaining marked improvement. From the subject self-assessments, 100% reported an overall improvement, while 71% reported improvement in fine lines/wrinkles and 86% (6/7) were satisfaction. 6 months results were not fully analyzed at the time of submission.
Conclusion: This study demonstrated that the combined non-invasive Sublative and Sublime technologies can safely and effectively treat facial wrinkles.

EXPERIMENTAL AND TRANSLATIONAL RESEARCH (FORMERLY BASIC SCIENCE)

#75

MINIMALLY INVASIVE OXYGEN SENSOR TO MONITOR MYO AND HEMOGLOBIN SATURATION IN MUSCLE OF MARINE MAMMALS

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Background: Marine biologists have used minimally invasive physiological tags to study the diving response of mammals, such as changes in oxygen saturation of swimming muscles. Relative changes in tissue oxygen saturation have been monitored using a dual-wavelength continuous method, in reflectance mode. This is a steady-state method based on the Beer-Lambert law, valid when optical absorption is dominant and scattering is negligible. Because scattering in tissue is significant, there is a need to develop a new generation of sensors that measure oxygen saturation accurately. We aim to design and build a compact, calibration-free sensor to quantify absolute changes in the absorption of oxygen-binding proteins in tissue; namely, myoglobin and hemoglobin. To this end, we implemented a near-infrared, dual-wavelength (670 and 808 nm), frequency-domain method in reflectance mode to probe tissue oxygenation.
Study: We modulate laser-diodes at a radio frequency (RF) of 70 MHz to perform frequency-domain measurements. An avalanche photodiode (APD) is used as photosensitive device. The APD is capable of responding to RF, below 0.6 GHz. A minimum usable photocurrent gain of 2 orders of magnitude is obtained by means of the avalanche effect. A maximum usable gain of 1000 is plausible provided that APD temperature remains constant. We designed a high voltage (80–150 V) circuit to control APD gain. A high-bandwidth (~100 MHz) transimpedance amplifier converts photocurrent into voltage. Overall detector gain oscillates between 600–6000[kV/W] and enables detection of feeble optical signals; i.e. ~10–100 nW. We employ a 2.7 GHz gain/phase detector to perform the frequency-domain measurements. Gain/phase data are sent to an analog-to-digital converter and logged for future reference.

Results: We validated sensor performance: APD photocurrent and overall transimpedance gain correspond to design specifications. We performed frequency-domain measurements with the integrated gain/phase circuit on an anesthetized Hampshire sheep. *In-vivo* testing reveals that the frequency-domain sensor can be employed to quantify myo- and hemoglobin saturation by means of the dual-wavelength measurements. Results show good agreement with a blood gas analyzer.
Conclusion: A compact, calibration-free sensor able to account for tissue scattering and measure light absorption accurately would further advance the understanding of the physiology of marine mammals.

#76

A NOVEL ULTRAVIOLET FLUORESCENCE IMAGING TECHNIQUE AS A NON-INVASIVE AND RAPID METHOD TO MONITOR EPIDERMAL GROWTH

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Background: Fluorescence excitation spectroscopy has been used to measure epidermal proliferation. In skin, the ultraviolet endogenous fluorescence is dominated by tryptophan which can be used as a marker for cell proliferation. Tryptophan has an absorption peak around 295 nm, and its emission peak is around 340 nm. Imaging and quantifying the endogenous fluorescence of tryptophan can provide a new modality to visualize cellular processes. In this study we used a novel UV fluorescence imaging system ($QView_{skin}$). It includes a xenon arc lamp with a 300 nm narrow band filter and a UV-sensitive camera with a 340 nm filter. The advantages of this new system are to cover surface area and to quantify the acquired images.
Study: To demonstrate that changes in fluorescence intensity are related to cellular proliferation/epithelialization we conducted cellular and tissue experiments. First, we imaged and compared the fluorescence of keratinocytes and fibroblasts in different cell cycle stages and in various growth mediums. To confirm the correlation between fluorescence and proliferation of the cells, we measured the expression of the nuclear protein Ki67, which is associated with cellular proliferation. Next, we implanted 1 mm pig skin biopsies into acellular matrix and imaged the fluorescence up to 4 week and compared it with histology (H&E staining).
Results: Our results demonstrated that dividing keratinocytes expressed a higher fluorescence intensity compared to fibroblasts. Fluorescence intensity imaging correlated well with Ki67 expression. Furthermore, the addition of growth factors to the medium was reflected as an increase in measured intensity. Imaging of skin samples show radial expansions of the fluorescence signals. The time-evolution of surface fluorescence profiles correspond to the development of new epidermis formation (shown in H&E).
Conclusion: These results suggest that the endogenous UV fluorescence correlates with the proliferation of keratinocytes and formation of new epidermis. This new system might be relevant for trauma patients to rapidly and non-invasively monitor epidermal formation in their wounds, without any further preparation of the wound site.

#77

FLUORESCENCE IMAGING OF SEBACEOUS GLAND PORPHYRINS *IN VIVO* INDUCED BY ALA, USING LONG WAVELENGTH EXCITATION

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Background: Sebaceous glands (SG) are invisible dermal structures implicated in skin disorders. SG accumulate fluorescent porphyrins after application of aminolevulinic acid (ALA). Red fluorescence is usually seen, with blue light excitation. Because blue light penetrates poorly, SG are not well seen under these conditions. We studied the potential for visualizing SG using longer wavelength (~500 nm) Q-band excitation of porphyrin fluorescence.
Study: A digital camera (Nikon D700) was fitted with fluorescence emission filters isolating the ~635 nm porphyrin emission band. Xenon flashlamps were filtered for sequential blue ~400 nm and green ~500 nm excitation. Images were captured at fixed distance and magnification, with a stable fluorescent material included in every image for calibration purposes. Using Matlab software, an image subtraction algorithm was written, e.g. to generate R = aG - B, where R is the resultant image, G is the image of green-light excitation, B is the image of blue-light excitation, and a is a constant set to yield R = 0 where no sebaceous gland is present. Proof-of-principle experiments used ~1 mm pieces of a fluorescent acrylic sheet placed superficially or deep (underneath) samples of porcine dermis ex vivo. An IRB-approved pilot study was performed, imaging two human subjects after application of 20% ALA to sebaceous skin sites.
Results: Excitation at ~500 nm produced weaker, qualitatively different images than ~400 nm excitation. Proof of principle was demonstrated: in dermis, the acrylic material was invisible and poorly seen by blue light excitation, but seen with ~500 nm excitation, and enhanced by image subtraction. In vivo, the subtraction algorithm reduced epidermal fluorescence and revealed focal follicular fluorescence that might correspond to SG. A limitation is that biopsies were not performed (due to no subject benefit).
Conclusion: We present the first images of in vivo porphyrin fluorescence from ~500 nm excitation, and a novel approach for imaging deep tissue structures.

#78

FRACTIONAL LASER-ASSISTED DELIVERY OF METHYL AMINOLEVULINATE: IMPACT OF LASER CHANNEL DEPTH AND INCUBATION TIME

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Background: Pre-treatment of skin with ablative fractional lasers (AFXL) enhances the uptake of topical photosensitizers used in photodynamic therapy (PDT). Distribution of photosensitizer into skin layers may depend on depth of laser channels and incubation time. This study evaluates whether

depth of intradermal laser channels and incubation time may affect AFXL-assisted delivery of methyl aminolevulinate (MAL).
Study: Yorkshire swine were treated with CO_2 AFXL at energy levels of 37, 190 and 380 mJ/laser channel and subsequent application of MAL cream for 30, 60, 120 and 180 min incubation time. Fluorescence photography and fluorescence microscopy quantified MAL-induced porphyrin fluorescence (PpIX) at the skin surface and at five specific skin depths (120, 500, 1000, 1500 and 1800 μm).
Results: Laser channels penetrated into superficial (~300 μm), mid (~1400 μm) and deep dermis/upper subcutaneous fat layer (~2100 μm). Similar fluorescence intensities were induced at the skin surface and throughout skin layers independent of laser channel depth (180 min; $p < 0.19$). AFXL accelerated PpIX fluorescence from skin surface to deep dermis. After laser exposure and 60 min MAL incubation, surface fluorescence was significantly higher compared to intact, not laser-exposed skin at 180 min (AFXL-MAL 60 min vs. MAL 180 min, 69.16 vs. 23.49 a.u.; $p < 0.01$). Through all skin layers (120–1800 μm), laser exposure and 120 min MAL incubation induced significantly higher fluorescence intensities in HF and dermis than non-laser exposed sites at 180 min (1800 μm, AFXL-MAL 120 min vs. MAL 180 min, HF 14.76 vs. 6.69 a.u. and dermis 6.98 vs. 5.87 a.u.; $p < 0.01$).
Conclusion: AFXL pre-treatment accelerates PpIX accumulation, but intradermal depth of laser channels does not affect porphyrin accumulation. Further studies are required to examine these findings in clinical trials.

#79

PRETREATMENT WITH ABLATIVE FRACTIONAL LASER CHANGES KINETICS AND BIODISTRIBUTION OF TOPICAL 5-AMINOLEVULINIC ACID AND METHYL AMINOLEVULINATE

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Background: ALA and MAL are porphyrin precursors licensed for PDT. Previous studies have established the concept of fractional laser-mediated drug delivery. The aim of this study was to evaluate kinetics and biodistribution of two widely used photosensitizing prodrugs on intact skin and disrupted skin due to ablative fractional laser (AFXL) pretreatment.
Study: Two Yorkshire swine were exposed to CO_2 ablative fractional laser (10.6 μm wavelength, 30.5 W, 3 ms, four stacked single pulses, 366 mJ total energy per laser channel) and subsequent topical application of ALA and MAL cream formulations (20%, weight/weight). Porphyrin fluorescence was quantified by fluorescence photography (30, 90 and 180 min) and fluorescence microscopy at specific skin depths down to 1800 mm (180 min).
Results: PpIX gradually formed over time, but ALA and MAL behaved differently on intact skin and AFXL-disrupted skin. On intact skin (no AFXL), MAL induced higher skin surface fluorescence intensities than ALA for short-term applications ($t = 30$ min, 21.1 vs 7.7 AU, $p = 0.005$) but reached similar fluorescence intensity levels for long-term applications ($t = 180$ min, 56.6 vs 52 AU, $p =$ ns). AFXL created 1850 μm deep channels that significantly enhanced PpIX fluorescence from both ALA and MAL. On AFXL-exposed skin, MAL induced higher surface fluorescence intensities than ALA on the short-term ($t = 30$ min, 26.4 vs 14.1 AU, $p < 0.001$), whereas ALA over time overcame MAL and induced the highest fluorescence intensities obtained ($t = 180$ min, 98.6 vs 112.0, $p < 0.001$). In deep skin layers, ALA induced higher fluorescence intensities of hair follicles than MAL (180 min, 1.8 mm skin depth, 35.3 vs 46.7 AU, $p = 0.043$). There was no porphyrin fluorescence in placebo cream or untreated skin sites.
Conclusion: AFXL pretreatment changes kinetics and biodistribution of ALA and MAL. It appears that MAL favors short-term applications, whereas ALA favors targeting deep structures. Future clinical studies are needed on diseased skin.

#80

EFFECTS OF MECHANICAL INDENTATION GEOMETRY ON SKIN OPTICAL PROPERTIES AND NIR REFLECTANCE MEASUREMENTS OF THE HUMAN BRAIN

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Background: Mechanical optical clearing is a technique that uses mechanical force to reversibly alter tissue optical properties and has been shown to influence diffuse reflectance measurements. Previous work has shown that interstitial water transport is the likely underlying mechanism of this effect. The goal of this study was to determine how indenter geometry affects optical property change and NIR diffuse reflectance measurements of cerebral tissue.
Study: A coupled mechanical/optical model has been developed previously to simulate tissue water movement and subsequent altered light transport. A poroviscoelastic model was fit to stress relaxation data from *ex vivo* porcine skin samples ($N = 8$). A simulated hemispherical indenter compressed a 2 mm-thick skin layer to −35% relative strain. Tissue water content was converted to absorption and scattering coefficients using spectrophotometric data acquired previously. Monte Carlo simulations were performed using TIM-OS, an open-source software package. Two glass indenters were modeled in contact with a planar slab model of the human head consisting of skin, bone, and brain layers. Optical property distributions (730 nm) and tissue deformation were applied to the scalp while literature values were used elsewhere. An isotropic source at one indenter emitted photons while the back of the other indenter was considered a reflectance detector. Indenter diameter was varied as 1, 3, and 6 mm spaced 30 mm apart.
Results: Indentation to −35% strain for 1, 3, and 6 mm indenters predicted maximum reductions in scattering of 30% and 22%, and 14%, respectively, with larger indenters creating broader cleared regions and requiring lower applied loads. Reflectance increased with indenter size, likely due to both indenter focusing and optical clearing.
Conclusion: Indenter geometry affects measured reflectance signals in a simulated multi-layered tissue structure due to mechanical optical clearing, tissue thinning, and focusing effects. Mechanical indenter geometry can be tuned to select optimal applied load and optical clearing efficacy.

#81

AN INTEGRAL MODEL FOR SELECTIVE PHOTOTHERMOLYSIS, LINKING DAMAGE INTEGRAL, CELL VIABILITY, AND EFFICACY

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Background: Efficacy of treatment in photoepilation is often predicted using opto-thermal models of the thermal response of the follicular compartments as a function of optical- and hair and skin parameters. However, their predictive power depends on the link between physics and physiology. The objective of this study was to create a novel approach in opto-thermal modeling, significantly improving its predictive power by linking a model outcome to clinical efficacy and physiological damage.

Study: We designed a scalable geometry of the skin and follicular compartments, including the cortex, medulla, germinative matrix, and dermal papilla, based on relevant histological data. The opto-thermal response was calculated using the proprietary Monte-Carlo- and the Finite-Element-Method. In parallel, ex-vivo human facelift skin obtained few hours post surgery, was treated using a set of selected parameters. Control and treated follicles were extracted, cultured for 10 days, and subsequently sacrificed at different time points for histological cell viability analysis using H&E staining and TUNEL method. More importantly, in-vivo clinical efficacy of photoepilation was evaluated for the same treatment parameters.

Results: The identified histological damage was traced-back in the opto-thermal model and used to monitor the thermal response. We applied the Arrhenius damage integral to express damage severity. Based on an optimization algorithm, we obtained the constants in the damage integral using clinical efficacy data from previously tested treatment parameters. More importantly, we essentially derived new constants for the damage integral applicable for short optical pulses, i.e. millisecond scale.

Conclusion: We show significant correlation between the damage integral and clinical efficacy, which indicates strong predictive power of our novel approach in opto-thermal modeling. In contrast to temperature measurement method, often applied to validate models, we directly linked physics to cell viability analysis and most importantly, to clinical efficacy. Our tool can further be used to explore efficacy of the upcoming photoepilation devices.

#82

THERMO-ELASTIC RESPONSE OF CUTANEOUS AND SUBCUTANEOUS TISSUES TO RADIOFREQUENCY HEATING IN HYPERTHERMIA TREATMENTS

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Background: Cutaneous and subcutaneous tissues are commonly considered layered structures in terms of RF energy deposition. The subcutaneous structure of tissue consists of a fine collagen fiber septa network with clusters of adipocytes. This configuration affects the distribution of energy deposition. During RF heating, tissues deform elastically due to changes in temperature. In this work, we modeled the electro-thermal heating of cutaneous and subcutaneous tissues, including interlobular fiber septa, and their elastic response to hyperthermia treatments.

Study: We used the finite element method to model the two-dimensional, time dependent, electro-thermo-elastic response of a three-layer tissue (skin, subcutaneous fat and muscle), including the fiber septa structure. We studied two geometries, one with a low spatial distribution of fiber septa, which is assigned to cellulite, and one with a high spatial distribution, that is, no cellulite. Fiber septa architecture was constructed by processing sagittal images obtained from micro-MRI.

Results: Our analysis shows that the fiber septa architecture affects the distribution of the static electric field within the subcutaneous fat. There is greater electric power absorption in some of the fiber septa filaments than in the fat lobules, favoring the flux of electric current density and the selective heating of subcutaneous fat and fiber septa. Neglecting the fiber septa network within the fat tissue (homogenous fat tissue layer) resulted in a 4 degree Celsius difference (lower). The thermo-elastic response of the fiber septa is shrinkage, which agrees with clinical observations.

Conclusion: Our results demonstrate that the architecture of the fiber septa significantly affects the distribution of the static electric field within the subcutaneous fat, contributing to enhance the selective heating of adipocytes. Knowing the architecture of the fiber septa is relevant for planning RF-based therapies or treatments for fat related disorders.

#83

IMPACT OF PULSE DURATION FROM NANOSECONDS TO PICOSECONDS ON THE THERMAL AND MECHANICAL EFFECTS DURING LASER INTERACTION WITH TATTOO TARGETS

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Background: The use of sub-nanosecond duration laser pulses often called picosecond pulses has long been thought to be the next breakthrough in tattoo removal. The technical challenges in bringing this technology to fruition have kept picosecond lasers out of the aesthetic laser market. Recently lasers that can operate in a practitioner's office have begun to be investigated. It is believed that improvement in performance is the result of the introduction of mechanical stresses created in the tattoo target as a result of irradiation with short duration pulses. In this presentation the creation, magnitude, and role of these stresses in the target are analyzed theoretically.

Study: The analysis of both heat and stress evolution in a tattoo target are investigated by solving both the heat transfer equation and the acoustic propagation equation. Both of these are solved for tattoo targets under realistic conditions. The analysis includes laser pulse durations from 50 ps to 50 ns. The results yield some new insights into both selective photothermolysis and mechanical stress in tattoo targets in this complex regime.

Results: The analysis clearly indicates that the use of picosecond duration pulses results in greater thermal response in the tattoo target. In addition these pulses create mechanical stress not possible with nanosecond pulses. These stresses are found to be sufficient to introduce an additional mechanism capable of fracturing tattoo particles and may be responsible for the improved clinical performance.

Conclusion: While the contribution picosecond lasers will offer is still under evaluation, it is evident their performance surpasses current commercial technology. The analysis shows that the improvement in performance is the result of the introduction of

mechanical stresses created in the tattoo target as a result of irradiation with short duration pulses.

#84

DETERMINATING PHOTOTHERMAL DAMAGE THRESHOLDS IN CEREBRAL TISSUE OF LASER ENERGY DELIVERED THROUGH THE FIBEROPTIC MICRONEEDLE DEVICE

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Background: Minimally-invasive surgical techniques such as laser-induced thermal therapy (LITT) and convection-enhanced delivery (CED) have been developed for treatment of malignant glioma (MG). A fiberoptic microneedle device (FMD) was developed to leverage advantages of LITT and CED to increase volumetric dispersal of locally-infused chemotherapeutics through sub-lethal photothermal heating. This study sought to determine photothermal damage thresholds of 1064 nm light delivered through the FMD.

Study: FMDs capable of co-delivering laser energy and fluid agents were fabricated through a novel technique of off-center fusion splicing and coupling with a 30G syringe needle. FMDs were inserted 2.5 mm into the brain parenchyma of anesthetized male rats with fluoroptic temperature probes placed within 1 mm of the FMD tip. Irradiation (no infusion) was conducted at laser powers of 0 (sham), 100, 200, 500, or 750 mW. Evans blue-serum albumin conjugated complex solution (EBA) and laser energy co-delivery was performed in a second set of pilot experiments with identical FMD placement as the first.

Results: Steady-state temperatures of 38.7 ± 1.6 and $42.0 \pm 0.9^{\circ}$C were measured for the 100 and 200 mW experimental groups, respectively. Histological investigation demonstrated needle insertion damage alone for sham and 100 mW irradiations. At 200 mW, observable damage was limited to a small penumbra of cerebral cortical microcavitation and necrosis that immediately surrounded the region of FMD insertion. Irradiation at 500 and 750 mW exhibited extensive regions of brain tissue pallor resulting from coagulative necrosis and intraparenchymal hemorrhage resulting in obliteration of the tissue architecture. Co-delivery of EBA and laser energy presented increased volumetric dispersal relative to infusion-only controls.

Conclusion: Fluoroptic temperature sensing and histopathological assessments demonstrated that a laser power of 100 mW results in sub-lethal brain hyperthermia, and the desired sub-lethal target energy range is likely 100–200 mW. The preliminary FMD-CED experiments confirmed the feasibility of augmenting fluid dispersal using slight photothermal heat generation, demonstrating the FMD's potential to increase the dispersal of CED.

#85

TOPICAL RAPAMYCIN SUPPRESSES THE ANGIOGENESIS PATHWAYS INDUCED BY PULSED DYE LASER

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Background: Pulsed dye laser (PDL) is the most effective treatment for port wine stain (PWS) birthmarks. However, regeneration and revascularization of photocoagulated blood vessels may result in poor therapeutic outcome. We have recently shown that topical rapamycin (RPM), an angiogenesis inhibitor, can suppress transcriptional levels of angiogenic genes, such as hypoxia-inducible factor-1alpha (HIF-1a), vascular endothelial growth factor (VEGF) and ribosomal protein S6 kinase (S6). Here, we further attempt to address the anti-angiogenesis effects mediated by topical RPM by accessing the protein levels of these genes and phosphorylation levels of S6 kinase and AKT.

Study: Two separate skin areas on each hamster ($n = 9$) were irradiated by PDL. After PDL exposure, topical RPM was applied daily to half of the randomly selected test sites. PDL, PDL + RPM and normal skin were biopsied on day 3 after PDL exposure. The total protein was extracted from biopsied skin samples and quantified. Immunoblot was performed to quantify protein levels of hypoxia-inducible factor-1alpha (HIF-1a), vascular endothelial growth factor (VEGF) and ribosomal protein S6 kinase (S6). The phosphorylation levels of S6 and AKT were also evaluated by immunoblot.

Results: The protein levels of HIF-1a, VEGF and S6 significantly increased after PDL exposure as compared to the normal hamster skin. Topical application of 1% RPM suppressed the PDL-induced increase in protein levels of those genes on day 3 post PDL exposure. The phosphorylation levels of S6 and AKT increased after PDL exposure but the increases were suppressed by the topical application of RPM.

Conclusion: The increase in expression of HIF-1a, VEGF and S6 after PDL-exposure suggests that angiogenesis pathways play very active roles in the process of skin blood vessel regeneration and revascularization. Topical application of 1% RPM can suppress the angiogenesis pathways and, therefore, reduce the regeneration and revascularization of photocoagulated blood vessels.

#86

ENHANCED TRANS-EPIDERMAL DELIVERY USING FRACTIONAL RADIOFREQUENCY ABLATION AND ULTRASONIC PRESSURE: *IN VIVO* RAT MODEL PILOT STUDY

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Background: Fractional ablative technology has become a popular modality for skin permeation to facilitate trans-epidermal drug delivery for aesthetic applications. The study objective was to analyze trans-epidermal enhancement following fractional ablative skin permeation in a rat model.

Study: Fractional radiofrequency (RF) ablation for skin perforation followed by ultrasound (US) for acoustic-pressure (Legato, Alma Lasers Ltd.), were studied in five different pre-set conditions and parameters: normal skin (control); topical Evans blue (EB); topical EB + US; topical RF + EB; topical RF + EB + US. Frozen sections from skin biopsies were taken at 0-min and 15-min incubation time. Penetration area (penetration depth + width) and coloration between distances of penetration were analyzed by advanced imaging software. Reflectance

intensity by spectroscopy was measured under two wavelengths conditions: 665 nm (EB-sensitive) and 772 nm (EB-insensitive). The 665/772 nm ratio was used as a penetration indicator - low ratio denoted to higher EB penetration and high ratio to low EB penetration. High resolution digital microscopic photography was used for subjective qualitative analysis.
Results: At 0-min incubation time, EB penetration was significantly higher at 70 W vs 40 W ($p < 0.01$). At 15-min, EB penetration was significantly higher when compared to 0-min for 70W vs 40 W, respectively. EB color intensity vs distance (depth and width) were significantly higher for the RF + EB + US (99.66 ± 23.67 pixels) vs RF + EB (52.33 ± 25.34 pixels) and RF + EB + US (80.83 ± 15.41 pixels) vs RF + EB (66.83 ± 28.56 pixels), respectively ($p < 0.05–0.01$). Similarly, topical EB (2.1 ± 0.4) and topical EB + US (1.8 ± 0.3) spectrometry reflectance intensity ratios were high, indicating low EB penetration. In contrast, RF + EB + US (0.4 ± 0.02) vs RF + EB (1.4 ± 0.08) ratios were low, indicating significant higher EB penetration for the former ($p < 0.01$). Histology frozen sections of high resolution digital photographs were in agreement with the objective measurements.
Conclusion: US acoustic pressure following ablative RF permeation significantly enhances the amount of EB penetration as evidenced by depth, width and color intensity.

#87

FEMTOSECOND LASER HIGH INTENSITY IRRADIATION AS A PROPOSAL FOR ADJUVANT TREATMENT IN BURNED SKIN - AN *IN VIVO* MODEL

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Background: Burns cause changes in the anatomical structure of skin associated with trauma. The conventional treatment is the use of topical natural or synthetic skin graft. An alternative is the laser ablation process for burned tissue necrosis removal. It allows fast controlled tissue removal, no mechanical contact and access to difficult areas. The purpose of this study is to evaluate the feasibility of using high intensity femtosecond lasers as an adjuvant treatment of skin burned patients.
Study: After local Ethical Committee in Animal Research approval, 20 Wistar rats were divided into 4 groups, according to sacrifice period (days 3, 5, 7 and 14 post-burn). Three regions of the back of the animals were exposed to steam source causing deep dermal burns. On the third day after burn, one of the regions was ablated with high intensity ultrashort-laser pulses ($\lambda = 830$ nm, 90fs, 2 kHz and 10 μJ/pulses), the other received surgical debridement, and the last was considered the control burn. The regions were analyzed by optical coherence tomography (OCT) for determining the optical attenuation coefficient of skin during healing and histology on the same time periods was used as a golden standard evaluation.
Results: The results showed that with the laser irradiation conditions used it was possible to remove debris from deep dermal burn. The skin ablation threshold was 2.3 μJ/cm^2. With 5 scans of 11.4 μJ/cm^2, total thickness removal was about 450 μm. The techniques used to characterize the tissue allowed to verify that all treatments promoted appropriate wound healing. On the fourteenth day, the regeneration curve showed that the optical attenuation coefficient relative of laser ablated tissue converges to the values of healthy skin.
Conclusion: The irradiation conditions of this study allow to conclude the feasibility of using femtosecond lasers of very high intensity as an adjunct in the treatment of skin burned patients using an *in vivo* model.

#88

EFFECT OF LASER-GENERATED SHOCKWAVES ON *EX VIVO* PIGSKIN

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Background: Persistent bacterial infection prolongs hospitalizations, leading to increased healthcare costs. Biofilm production is one mechanism of bacterial resistance. Our team investigates the use of laser-generated shockwaves to delaminate biofilm from infected wound surfaces. To safely employ this technique we must establish damage thresholds in tissue. The primary aim of this study is to determine the effect of the laser-generated shockwaves on porcine tissue samples which serve as a model for human skin.
Study: The system uses a Q-switched, Nd:YAG laser (Continuum) with an output from 100–500 mj/pulse using energies of 118, 149, 228, 264, 350, 400 and 498 through air with a 3 mm spot size. Previous studies by our team showed that these energies can delaminate biofilm off a variety of surfaces. A laser pulse irradiates the titanium coated mylar which generates a transient wave that is coupled through a liquid layer to the surface of ex vivo pigskin. The tissue was then fixed and sent to histology for analysis. There were two tissue samples per energy level and two control samples. A pathologist was blinded and asked to score the tissue sections on the basis of their overall appearance (O) and linear/slit-like spaces roughly parallel to the surface of the skin (S) on a scale from 0 to 3.
Results: No visible difference was seen between control and laser-shocked samples. Nine tissue samples received an O score of 2, and 8 received an S score of 2. There was no correlation between the scores received by the samples and the energy with which they were shocked. The sample that had the highest S score of 3 was the control, which appears to be due to sectioning artifacts.
Conclusion: The laser-generated shockwaves which are used to delaminate biofilm do not have an adverse effect on healthy pigskin.

#89

RELATIONSHIP BETWEEN SKIN PIGMENT AND PAIN IN RESPONSE TO LOW FLUENCE 810 nm LASER TREATMENT

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Background: The purpose of this study was to determine the relationship between skin pigment and pain/discomfort in response to low-fluence 810 nm laser treatment at different anatomical sites. Skin color, i.e., melanin content, is an important aspect of safety/efficacy of light-based hair removal devices. It was

hypothesized that pain/discomfort in response to 810 nm light was dependent on skin color in a fluence- and site-dependent manner.
Study: A total of 80 subjects were recruited with the following Fitzpatrick Skin Types: N = 20 Type III, IV, and V; N = 10 Type II and VI. Skin color measurements were taken using two different non-invasive instruments, CORTEX DSM II ColorMeter and MEXAMETER MX18, at test sites and the back of each subject's left hand. An 810 nm diode laser with four settings, i.e., 0, 3, 5 and 7 J/cm^2, was used. Treatment occurred on two body areas, underarms and lower legs, with 4 treatment sites per body area. Treatment of the sites within each body area proceeded with increasing power (fluence), always starting with the sham setting. The order of treatment of the four treatment sites within each body area was randomized to account for potential differences in sensitivity at each site. Following each treatment, subjects completed a self-assessment questionnaire. The self-assessment questionnaire included a Visual Analog Scale (VAS) to assess pain and discomfort.
Results: Skin color measures, i.e., melanin content, increased with Fitzpatrick Skin Type with considerable overlap among Skin Types II, III and IV. Pain/discomfort was fluence dependent and greater in darker skin types. Underarm was more sensitive to laser treatment compared to lower leg. A threshold for pain based on skin color was established in this study.
Conclusion: These data methodically illustrate the relationship between melanin content, fluence and pain/discomfort such that for a given melanin range increasing fluence increases the reported discomfort.

#90

NOVEL HERBAL FORMULA SUPERIOR TO PETROLATUM IN CUTANEOUS HEALING IN TWO STUDIES

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Background: Skin resurfacing via lasers or chemical peels are effective anti-aging treatments. These studies compare healing of pure petrolatum vs an herbal formula comprising meadowfoam, avocado, safflower and rose hip oils.
Study: Two split-face studies, one with 15 subjects who underwent micro-laser resurfacing; and another with 11 subjects with stratum corneum removed via tape stripping or chemical peel. In the first study, the post care regimen included acetic acid soaks followed by 100% petrolatum to one-half of the face, while the other half of the face received only the herbal formula, without soaks. In the second study, the barrier repair formula was applied to one-half of the face and 100% petrolatum applied to the other half. Board certified dermatologists assessed re-epithelialization and erythema. Subject preference was tabulated.
Results: In the first study, the herbal formula improved re-epithelialization and reduced visible erythema faster than pure petrolatum in 75%. In the second study, the herbal formula induced rapid normalization of stratum corneum barrier function by 89.6% reduction of trans-epidermal water loss 45 minutes after application, as compared to 43.1% reduction with pure petrolatum.
Conclusion: This novel herbal blend of meadowfoam, avocado, safflower and rose hip oils stimulates regeneration of lipid lamellae to optimum stratum corneum barrier permeability via the body's own natural healing mechanism, with superior cutaneous healing as compared to 100% petrolatum. Subjects also preferred the herbal formula over pure petrolatum.

#91

LIGHT EMITTING DIODE THERAPY AND CRYOTHERAPY IN SKELETAL MUSCLE RECOVERY AFTER ECCENTRIC EXERCISE

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Background: In the last years, phototherapy has becoming a promising tool to improve skeletal muscle recovery after exercise. However, few studies have compared phototherapy with other modalities commonly used with this aim. And to the best of our knowledge none study have combined phototherapy with any other therapeutic modality. We aimed to analyze effects of light emitting diode therapy (LEDT) and cryotherapy when used as single or combined therapeutic modality after eccentric exercise.
Study: Fifty male healthy signed a written declaration of informed consent. Volunteers performed a standardized protocol of eccentric exercise for elbow flexors in isokinetic dynamometer, immediately after exercise volunteers were treated with placebo LEDT, cryotherapy + placebo LEDT, LEDT, cryotherapy + LEDT or LEDT + cryotherapy. Cryotherapy was performed using a pack with water and ice (10°C) for 20 minutes, and LEDT was performed using a multi-diode cluster probe (34 diodes, 660 nm, 10 mW; and 35 diodes, 850 nm, 30 mW) with the following parameters: continuous output, 0.05 W/cm^2 (660 nm) and 0.15 W/cm^2 (850 nm), 1.5 J/cm^2 (660 nm) and 4.5 J/cm^2 (850 nm), 41.7J (0.3 J from each red LED, 0.9 J from each infrared LED), treatment time of 30 seconds in a single point of biceps brachii muscle. Delayed onset muscle soreness (DOMS) and maximal voluntary contraction (MVC) assessments were performed before, immediately after (between exercise and treatments), one, 24, 48 and 72 hours after exercise.
Results: Regarding MVC and DOMS, treatment with LEDT, LEDT + cryotherapy and cryotherapy + LEDT were significantly better ($p < 0.05$) than placebo LEDT and cryotherapy + placebo LEDT at one, 24, 48 and 72 hours after exercise. This lead us to believe that positive effects are due LEDT and not necessarily to combination of LEDT with cryotherapy, since cryotherapy as single treatment does not improved outcomes at none time-point tested.
Conclusion: We conclude that LEDT is more efficient in improvement of skeletal muscle recovery after eccentric exercise, and that combination with cryotherapy do not change efficacy of LEDT.

#92

EFFECT OF LASER ACUPUNCTURE ON CLINICAL IMPROVEMENT, PULMONARY FUNCTIONS AND LIFE STYLE OF EGYPTIAN CHILDREN WITH BRONCHIAL ASTHMA

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Background: Laser acupuncture is widely used as an alternative treatment for chronic illnesses. The lack of satisfactory success of current bronchial asthma therapy has resulted in an increasing number of patients seeking complementary and alternative medicine approach. The present study evaluate the effect of biostimulation by low power laser on the traditional Chinese acupuncture points as complementary modality in the treatment of Egyptian children with chronic bronchial asthma.

Study: Fifteen asthmatic boys and 10 asthmatic girls 7–18 years of age (10.6 ± 2.8) were selected from the outpatient chest clinic and Acupuncture clinic. Clinical evaluation and spirometric values were recorded before and after laser application. Each patient received direct contact 10 laser sessions (3 sessions/week) on 12 traditional Chinese acupuncture points Lu-5,7&9, Li-4, Sp-6, St-36 (alternatively one side in each session), Bl-13& 23 (bilaterally) and Cv-17, Gv-14. Low power laser continuous mode irradiation used is Gallium-Aluminum-Arsenide laser (soft laser) 202 is a semiconductor (diode) manufactured by scientific-and-production algemation Petrolaser Itd. Parameters used were wave length 808 nm, power 99 mW, beam spot size 0.2 cm, power density 6.3 w/cm^2, energy density 2 J/cm^2. Session time was 4 minutes with 24 Joules per session.
Results: 18 patients were suffering daytime and nocturnal symptoms, ended with one patient suffering nocturnal symptoms ($p < 0.001$). Also, 24 out of 25 patients reported better exercise tolerance ($p < 0.001$). FEV1, FVC, PEF % of the predicted increased from 81.8 ± 25.2, 85.4 ± 21.5, 71.8 ± 22.9 to 98.5 ± 28.1, 104.3 ± 26.2, and 84.3 ± 24.1 respectively ($p < 0.001$). ACQ improved from 13.9 ± 3.8 to 23.3 ± 3.6 ($p < 0.001$) and 92% of patients became well controlled. Inhaled steroids dose decreased from 200–450 to 0–200 ug/day. All patients stopped SABA rescue ($p < 0.01$, 0.001).
Conclusion: Low power laser acupuncture is a safe and effective management in asthmatic children.

#94

A LASER-BASED OPTICAL ELECTRODE FOR NON-INVASIVE DETECTION OF NEURAL ACTIVITY

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Background: Current technologies for monitoring neural activity either use different variety of electrodes (electrical recording) or introduce exogenous contrast agents and genetically modified markers (optical imaging). Here we demonstrate a laser-based optical method for non-contact and contrast agent free detection of nerve activity using a phase-resolved optical coherence tomography (pr-OCT) system.
Study: Recent advances in phase-resolved OCT have enabled the detection of subnanometer transient structural changes in nerves during action potential propagation. In this study, a lateral compound eye of *Limulus polyphemus* was functionally stimulated and the thickness change in its associated optic nerve was detected optically using the developed pr-OCT system. Electrophysiology was used as a control recording method to evaluate the optical method. In final step, KCl was added to deactivate the propagation of action potential and the recordings from both methods were compared.
Results: The results show that pr-OCT was able to detect and measure rapid transient changes in thickness of nerve that accompany neural spike propagation. The optically detected signals had timing and duration similar to the propagating electrical signal recorded in electrophysiology. No averaging over multiple trials was required, indicating the capability of single-shot detection of nerve impulses. As a control experiment, addition of KCl in the Ringer's solution completely deactivated the impulse propagation and absence of neural activity was verified in both optical and electrical recording.
Conclusion: This study has demonstrated that OCT is capable of detecting action potentials in functionally stimulated nerve. The strengths of this OCT-based optical electrode are that it is a contactless method and does not require any exogenous contrast agent. With improvements in accuracy and sensitivity of the developed optical electrode, in future, it will play a complementary role to the existing recording technologies.

#95

REAL-TIME 3D VOLUME RENDERING OF MULTI-FUNCTIONAL SPECTRAL-DOMAIN OPTICAL COHERENCE TOMOGRAPHY FOR DETERMINATION OF BURN BOUNDARY AND DEPTH

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Background: Multiple methods have been performed for burn injury assessment such as biopsy, histopathology, ultrasound, laser Doppler flowmetry etc. Polarization-sensitive optical coherence tomography (PS-OCT) can measure 3D skin birefringence non-invasively. It has been reported thermal damaged skin tissue imaged by PS-OCT can be identified from normal tissue as it indicates significantly smaller birefringence. However, limiting processing speed of a CPU card creates a bottleneck to the real-time display of 2D PS-OCT image and especially volume rendering, which is significant for burn boundary and depth determination.
Study: Here we realized real-time volume rendering of simultaneous intensity, PS-OCT and Doppler OCT images, and application for burn boundary and depth identification. The real-time acquisition and processing program was written in Visual C++ in Microsoft Visual Studio 2008. Raw data acquired from cameras were copied from CPU to GPU for 2D image processing and volume rendering, final volume images are displayed on OpenGL windows.
Results: The volume update rate of all intensity, PS-OCT and Doppler OCT images is 2 volumes per second with volume size of $256 \times 64 \times 1024$ voxels. Chicken muscle tissue was thermally damaged using a soldering iron tip with 540 $^{\circ}F$ at three regions for 1, 2 and 3 seconds respectively. The burn boundaries are clearly identified from real-time displayed volume rendering images and the burn depths are 279, 419 and 512 microns respectively. A thermal injured human finger was imaged and volume rendered results clearly showed the burn boundary and calculated burn depth of 235 microns.
Conclusion: Real-time volume rendering of simultaneous intensity, PS-OCT and Doppler OCT images was realized for determination of burn boundary and burn depth. Thermally damaged chicken sample and human finger were imaged to demonstrate the capability of the system for burn boundary identification.

#96

AUTOFLUORESCENCE PROPERTIES OF MURINE STEM CELLS DURING EARLY DIFFERENTIATION PHASES

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Background: Pluripotent cells are at the basis of developing strategies in regenerative medicine. In this view, a careful monitoring of cell morphofunctional properties from the early differentiation phases is required to lead to the successful maturation into the ultimate tissue phenotype. This work aims to characterize the autofluorescence properties of a model of murine embryonic stem cells, to investigate the potential to detect metabolic changes during differentiation.
Study: Autofluorescence imaging (exc: 360–400 nm), microspectrofluorometry (exc. 366 nm), spectral fitting analysis to estimate each fluorophore contribution, MGG staining techniques were applied to analyze cells in culture: undifferentiated pluripotent, early differentiating, Embryonic Bodies (EB) undergoing differentiation or selected as hematopoietic precursor or differentiated elements.
Results: Changes in morphology and distribution patterns in terms of colonies, cell budding from their edges or isolated, depending on the differentiation phases are observed. Fitting analysis indicates that NAD(P)H, bound and free, accounts for up to 80% of the whole emission, the free form prevailing on the bound one. Bound and free NAD(P)H decrease during early differentiating phases, while the bound form almost doubles in hematopoietic precursor/differentiated elements as compared to EB. The redox ratio is lowest in undifferentiated cells, lipofuscins decrease during differentiation, and Porphyrins are higher in differentiating EB and in hematopoietic precursor cells. These data reflect the increase in the aerobic metabolism during differentiation, consistently with a decreased autophagy of cell organelles (i.e. mitochondria, a strategy to keep the undifferentiated homeostasis state), higher mitochondrial activity with more numerous NADH binding sites, synthesis of heme as prostetic group of proteins, i.e. cytochromes.
Conclusion: These data open interesting perspective for the monitoring of stem cells differentiation under living conditions without labelling with exogenous agents (inducing perturbations when used in vivo, or not always available for veterinary, i.e. immunophenotyping), by exploiting endogenous fluorophores as intrinsic biomarkers of cell morfofunctional changes.

#98

THERMAL STRESS INDUCES DIFFERENTIAL CELL DEATH MECHANISMS IN HEPATOCELLULAR CARCINOMA: *IN VITRO* AND *IN VIVO* PILOT STUDY

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Background: Image-guided thermal ablation is an important treatment option in the multidisciplinary care of patients with hepatocellular carcinoma (HCC). The aim of the present study was to determine the mechanisms of thermal stress induced cell death in HCC *in vitro* and *in vivo* using US-guided laser ablation.
Study: The rat HCC (N1S1 and AS30D) and hepatocyte (Clone9) cell lines were heat stressed in calibrated water baths (37C to 60C, 2 and 10 minutes) and assessed for viability, cytotoxicity and caspase 3/7 activity at 6 and/or 24 hours post-heat shock using the ApoTox Glo Triplex Assay ($N = 3$). Rats with orthotopic N1S1 tumors stably expressing firefly luciferase (N1S1*luc2*) underwent pre-ablation MRI and 2D/3D bioluminescence imaging to assess tumor size, location and function ($N = 12$). Rats were randomized to US-guided laser ablation (3W–45sec; intentional subcurative treatment; $N = 6$) or sham ($N = 6$) followed by post-ablation 2D/3D caspase 3/7 bioluminescence imaging using Z-DEVD-aminoluciferin at 6 and 24 hours post-ablation to assess laser-ablation induced apoptosis. Apoptosis induced luminescence (photons/sec/cm^2) was compared between ablation and sham groups and 6 and 24 hours post-ablation.
Results: Thermal stress induced differential, dose-, time- and cell-line dependent effects on cell death with induction of apoptosis at lower thermal doses (2.0–3.5 fold; 6 > 24 hours) and necrosis at higher thermal doses. Intentional sublethal thermal ablation of N1S1*luc2* tumors induced a significant increase in caspase 3/7 activity in the ablation v. sham group that was elevated at both 6 hours (8.2 fold, $1.4 \times 10^6 \pm 3.7 \times 10^5$ v. $1.7 \times 10^5 \pm 2.6 \times 10^4$ p/s/cm^2, respectively; $p < 0.03$) and 24 hours (11.7 fold, $4.8 \times 10^5 \pm 1.5 \times 10^5$ v. $4.1 \times 10^4 \pm 1.3 \times 10^4$ p/s/cm^2, respectively; $p < 0.03$).
Conclusion: These data support the hypothesis that thermal injury to HCC and hepatocytes differentially induces both programmed (apoptosis) and non-programmed (necrotic) cell death mechanisms depending on the degree of thermal injury. Upregulation of anti-apoptotic mechanisms in HCC may inhibit cell death following sublethal thermal injury.

#99

FEASIBILITY OF ULTRA-DEEP TREATMENTS WITH INTENSE THERAPY ULTRASOUND

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Background: ITU has been used successfully to produce focal heating and create thermal lesions, sparing the intervening tissue, at depths up to 4.5 mm[1]. Clinical effects of this treatment include improved lifting and tightening in the superficial musculoaponeurotic system (SMAS). The objective of this study is to establish the feasibility of three-dimensional deposition of focused ultrasound energy at depths ranging from 4.5 to 9.5 mm targeting the deeper regions of the SMAS, muscular tissue and tendons.
Study: Ulthera Device ® using focused ultrasound probes with depth of focus ranging from 4.5 to 9.5 mm and frequency of 4.5 MHz were used. Energy setting of 1.5 to 3.2J per lesion was applied to freshly excised porcine muscle. Porcine slices demonstrating lesion size and shape were micro-photographed; depth, pitch, and size (height and width) were measured at each energy setting.
Results: Lesion geometry was measured for energy setting range of 1.5 to 3.2J. Average lesion volume (approximated by a sphere) ranged from 0.028 (±0.018) to 0.226 (±0.062) varying with energy setting. Measured depth for the 4.5 mm probe was 4.41 ± 0.52 mm, 8.55 ± 0.19 mm for the 7.7 mm probe and 11.00 ± 0.91 mm for the 9.5 mm probe. Distance between the thermal zones (lesions) were within ± 15% of the probe parameters.
Conclusion: Thermal zones (lesions) of varying sizes (based on energy) can be deposited in porcine muscle in a predictable and precise manner at depths up to 11 mm. Results from pre-clinical work show that it is feasible to use ITU to treat deeper regions of the SMAS and musculature.

1. *Clinical Feasibility of 3-D Fractional Treatments with Focused Ultrasound,* R. Anderson, M. Slayton, R. Miller, A.Call. ASLMS 2010.

#100

HISTOPATHOLOGY OF A NOVEL 1440 nm DIODE SKIN REJUVENATION LASER

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Background: A new 1440 nm non-ablative fractionated diode laser device for the treatment of sun damage and extrinsic skin aging has recently been developed for consumer use. This study was conducted to determine the existence, physical extent, and wound healing response of the tissue changes produced by the device.

Study: This study was conducted in an AAALAC accredited testing facility under GLP conditions. Three hairless guinea pigs were subjected to laser treatment from the 1440 nm diode laser at energies ranging from 5–13 mJ/beam. Skin tissue samples were harvested immediately after treatment and on the 5^{th} and 14^{th} day post treatment. Histopathologic evaluation with H&E staining was performed for all samples.

Results: Immediately after treatment, a wounding pattern consistent with microthermal zones (MTZs) described after treatment with similar non-ablative fractional resurfacing devices was noted. The MTZs produced were between 160 and 530 μm deep and between 70 and 130 μm in diameter. No tissue ablation occurred. Slight dermal/epidermal junction delamination occurred immediately post-treatment, which fully resolved by 5 days post treatment. By the 5^{th} post-treatment day the epidermis appeared normal and neocollagenesis was noted in the dermis. By day 14 there was no evidence of residual thermal effect and the dermal and epidermal architecture were normal.

Conclusion: This novel laser produced histopathologic changes consistent with patterns created by established nonablative resurfacing devices. Post-treatment wound healing occurred rapidly. Histopathologic evaluation of the wounds created by this novel home-use device suggests that it may be safe for use on human skin.

#101

THE USE OF LASER INDUCED BREAKDOWN SPECTROMETRY (LIBS) FOR ASSESSMENT OF NAIL PSORIASIS OUTCOME AFTER TREATMENT WITH INTENSE PULSED LIGHT

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Background: Nail psoriasis is a major problem in dermatology since the only reliable diagnostic method is nail biopsy. Pulsed dye laser has been used successfully in treatment of nail psoriasis. Intense pulsed light has been used in treatment of plaque psoriasis by using 550 nm wavelength block filter. To use Laser Induced Breakdown Spectroscopy (LIBS) as an objective analytical technique to diagnose psoriasis and to assess changes after treatment with intense pulsed light.

Study: Twenty patients (3 females and 17 males) with bilateral finger and toe nail psoriasis and twenty healthy controls were recruited in the study. Patients were treated using intense pulsed light with 550 nm filter, 20 ms pulse duration and 25 J/cm^2 fluence. Sessions were performed bimonthly for a maximum of 6 months. Nail samples were collected from healthy control and patients before and after treatment. A typical LIBS experimental setup has been used. Q-switched Nd:YAG (1064 nm), was used with a pulse duration of 5 ns, 50 mJ energy. Nail Psoriasis Severity Index (NAPSI) was applied to assess the clinical outcome of before and after treatment.

Results: Clinical assessment revealed a significant reduction in overall NAPSI, nail matrix, and nail bed NAPSI from baseline (p?0.05). There is a pronounced increase of the spectral lines intensities of Mg, Fe, Ca and Na in case of pathological nails compared with the normal one. The CN and C_2 intensities are higher for normal nails than in psoriasis nails.

Conclusion: Using LIBS to diagnose psoriasis via nails elemental analysis has revealed pronounced increase in the elements in pathological cases compared to treated and normal. These findings coincide with the clinical improvement monitored by NPSI score.

#102

A NEW APPROACH TO IMPROVING SKIN SAFETY IN THERMAL INDUCED SKIN TIGHTENING: A METHOD OF COMBINING ACTIVE FEED BACK LOOP SUBCUTANEOUS PROBE RF INDUCED HEATING AND CAMERA IMAGED INFRARED SKIN SURFACE TEMPERATURES

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Background: A more exact endpoint of subsurface targeted energy, whether this be laser, ultrasound or radiofrequency (RF) and how to best monitor skin surface temperature for even delivery of energy and accuracy of skin temperature to avoid skin injury are current challenges.

Study: Radiofrequency heating of skin and subcutaneous tissue of the underchin in 30 patients was achieved by percutaneous placement of an 18 gauge probe for RF heating, with a subcutaneous temperature default loop set between 50 to 60R C. Skin surface temperatures, monitored by digital infrared thermometers, were replaced by concurrent monitoring with the FLIR E 40 thermal imaging camera which has a resolution of 160 × 120 (19,200) pixels versus most digital infrared thermometers, where at an 8:1 distance to target ratio, using a single pixel processed through a fixed focal lens, hot spots may be "averaged out", allowing skin hot spots to be missed.

Results: Skin temperature endpoints of up to 44R C were safely achieved using infrared high resolution camera monitoring with subcutaneous internal temperature radiofrequency probe defaults of between 50 to 60 R C. In one patient a delay less than one centimeter area of skin surface friability was noted after an isolated temperature peak of 49R C was seen with infrared camera use, but undetected by infrared thermometer monitoring.

Conclusion: Skin tightening gained with subsurface RF probe heating may be safely achieved with the concurrent use of both subsurface and skin surface temperature monitoring. Infrared camera imaging may provide a more accurate measurement of skin temperature than digital infrared thermometers.

#103

NON-INVASIVE 635 nm DIODE LASER SHOWS IMPROVED EFFICACY FOR BODY GIRTH CONTOURING

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Background: To improve treatment efficacy and patient satisfaction when reducing trunkal girth using a 635 nm diode laser for non-invasive body contouring.
Study: 29 patients were split into two study groups. Patient mix ranged in age from 17–75 years. Nine patients were treated with two 40-minute treatments weekly for 3 weeks. The remaining 20 patients were treated with one 40 minute treatment weekly for 6 weeks. Three trunkal sites including waistline, umbilicus, and inframammary were measured and summed prior to first treatment and two weeks after last treatment. Although all patients had active lifestyle, it was recommended to walk or cycle for 30 minutes four times weekly.
Results: A total of 27 of 29 subjects completed this trial. All nine who completed the three week regimen experienced a girth loss range of 5 1/8 inches to 11 1/8 inches, for a 7 1/8 inch loss average. The 18 others who completed the six week regimen experienced a 4-inch to 18 3/8 inch loss, with three losing more than 15 inches total. The average loss of the latter group was 13 3/8 inches. All but two of thos who completed the trial were very happy or happy with the results. Two others did not complete the trial due to poor results.
Conclusion: Both regimens resulted in 92% patient happiness (25 of 27) with an overall average of the summed inch loss exceeding 10 inches.

#104

INCREASING HAIR ABSORPTION OF LIGHT IN SITU BY LIGHT

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Background: Increasing hair follicle's absorption of light should increase efficacy for permanent hair removal. This study suggests hair shaft darkening can occur in response to appropriate light illumination.
Study: Hair temperatures were measured with a FLIR 4000 IR camera during exposure to an 800 nm laser emitting up to 80 W, 50 ms pulses followed by a 5 W 50 ms probe pulse. Hair samples were heated to temperatures between 100 and 220 C in 1 minute intervals. Control and 180 C heated samples were dissolved in Soluene and measured on an HP spectrophotometer. Hairy Yucatan grey skin was treated by 800 nm laser light and biopsied. Parameters included 35 J/cm^2, 25 ms (single and triple stacked pulses with long inter-pulse cooling time), a 65 J/cm^2, 100 ms pulse and a dual-pulse configuration of 8 J/cm^2, 5 ms followed 25 ms later by 57 J/cm^2, 170 ms. Biopsy punches were horizontally sectioned, stained with NBTC and photographed to assess peri-follicular injury. Results were compared to an opto-thermal computer simulation incorporating changes in hair properties deduced from the spectrophotometric measurements.
Results: Hair samples exhibited a threshold in temperature at laser powers dependent on hair color. Extinction coefficient at 800 nm wavelength of the heated hair was 30% higher than control. Complete and 50% thermal denaturation of the follicle's outer root sheath was observed in the stacked-pulse and single-pulse treatments, respectively. The dual pulse profile created similar peri-follicular denaturation areas as the 100 ms pulse treatment despite being half the average power. Finally, a nonlinear simulation predicts denaturation profiles observed in histology. Mechanisms for the hair darkening phenomenon will be described that include alterations in scatter and carbonization that lead to increase in light absorption by hair.
Conclusion: Hair darkening may be induced by appropriate laser parameters potentially increasing the efficacy of light-based hair removal treatments.

#105

MONITORING OF BOVINE TENDON STRUCTURAL CHANGES DURING ELECTROMECHANICAL RESHAPING USING OPTICAL COHERENCE TOMOGRAPHY

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Background: Tendons and ligaments are connective tissues that provide the human body with mechanical stability and joint movement. They routinely undergo massive stress and strain that can result in injury. In this study, the use of a recently developed technique, known as electromechanical reshaping (EMR) resulted in mechanical deformation in an ex vivo bovine tissue model.
Study: EMR utilizes milliamp DC currents in the form of platinum electrodes that produce an electrochemical reaction within the tendon. During EMR, redox chemistry driven changes in the structure of matrix molecules, as well as transient localized changes in tissue pH at the electrodes alter the tendon\'s mechanical behavior. A mechanical testing platform subjected the tissue to a load and EMR was applied at 6 V for 3 minutes via surface plate electrodes.
Results: Under elongation, EMR produces a decrease in the tendon's stiffness with no change in length. Under compression, EMR demonstrated no significant changes to the tissue's modulus, but causes a visible shortening of the tissue. In this study, optical coherence tomography (OCT) was utilized to provide real-time cross sectional images as a method of monitoring structural changes during the EMR process.
Conclusion: One possible application for EMR is to treat Dupuytren's contracture that causes connective tissues in the hand to stiffen and limit hand movement. The use of EMR to alter mechanical properties of tendon offers several advantages in non-invasive and non-destructive methods to alter mechanical behavior and shape of connective tissues.

#106

A CLINICAL PHOTOACOUSTIC MICROSCOPY SYSTEM FOR IMAGING THE MICROVASCULATURE OF HUMAN SKIN

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Background: Imaging the microvasculature of human skin is essential for optimized laser therapy of port-wine stain birthmarks. Currently, no three-dimensional microvasculature imaging device is available for clinical practice. The purpose of this study was to develop a photoacoustic microvasculature imaging system for hypervascular lesions in human skin.
Study: A light weight (36 g) optical resolution photoacoustic imaging probe was constructed. A ring transducer with 40 MHz central frequency was used to detect the photoacoustic signal. A commercially available kinematic mount allowed the alignment of the acoustic focus with the optical focus in both lateral and axial

directions. The imaging probe was connected to a pulsed laser (532 nm, 2 ns pulse duration, 5–100 kHz pulse repetition rate) with a standard FC/PC single mode fiber. A plastic water tank was used to couple the photoacoustic signal from the skin to the imaging probe. The lateral resolution of the system was calibrated by imaging a 1951 USAF resolution target with 2.5 nJ laser pulses. The signal-to-noise (SNR) ratio of the imaging system was calibrated by imaging a graphite sample with 40 nJ laser pulses. A microvasculature image of human skin was acquired from a healthy volunteer.
Results: The 6th element of group 7 of a 1951 USAF resolution target was clearly resolved, which indicated the lateral resolution of the imaging system was better than 2.2 μm. A 40-dB SNR PA signal was documented for a graphite sample. A real time B-scan imaging speed of 20 frames per second was achieved for clinical settings, and a three-dimensional microvasculature image with 511 slices was acquired from human skin.
Conclusion: A clinical photoacoustic microscopy system for imaging the microvasculature of normal human skin was successfully developed, calibrated, and tested.

#107

IMAGING GINGIVITIS RESPONSE TO A NOVEL DENTIFRICE

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Background: In order to prevent permanent damage to the tooth-supporting structures from gingival inflammation, new, improved approaches to oral biofilm removal and control are needed. Existing methodologies for evaluating efficacy are laborious and subjective. Goal of this pilot study was to determine whether Optical Coherence Tomography (OCT) imaging can be used as a convenient alternative to clinical indices to track the reponse of inflamed gingiva to a novel toothpaste.
Study: 10 subjects with gingivitis were recruited. 5 subjects received a novel dentifrice, Livionex Dental Gel, and the other 5 received Colgate Total toothpaste. In this randomized, controlled, double-blind pilot study (UCI IRB 2002-2805), plaque, gingival, periodontal indices, and full pocket charting were documented by a clinician. After OCT and intra-oral images, volunteers received standardized oral hygiene instructions. Patient oral hygiene and indices listed above were documented at weekly intervals for 6 weeks. Periodontal index was determined at beginning and end of the study. From OCT images, changes in soft and hard supporting tissues of the teeth were measured using a software-based point-to-point measurement capability. The changes in gingival health over time based on clinical measurements were used as the standard for evaluating images of the gingiva.
Results: A reduction of 10–30% in gingival soft tissue swelling was apparent in OCT images after 1 week, and continued progressively to end of the study; rate and amount of change varied considerably between subjects and dentifrice used. Pocket depths as measured from the OCT images also reduced progressively, and soft tissue pocket width decreased also. Plaque and gingival index were the earliest clinical indicators of changes in gingival inflammation.
Conclusion: Improved gingival health resulting from better oral hygiene can be mapped efficiently using OCT.

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#108

POLARIZATION-ENHANCED MULTISPECTRAL IMAGING FOR EVALUATING DERMAL STRUCTURAL CHANGES CAUSED BY NON-ABLATIVE FRACTIONAL TREATMENT WITH A HOME-USE DEVICE

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Background: Recently, laser non-ablative fractional treatment (NAFT) has become available in home-use setting due to advent of self-application NAFT devices. In this mode of treatment, in contrast to a typical in-office scenario, fractional coverage is gradually accumulated over a period of time through frequent (e.g., daily) applications. Even though clinical efficacy of this regimen has been demonstrated in several studies, exact dynamics of changes in skin structure effected by the treatment is not fully understood. In this work, we applied polarization-enhanced multi-spectral imaging to observe and monitor effects of the home-administered NAFT on collagen-elastin dermal network.
Study: 6 subjects with peri-orbital wrinkles used a commercially available OTC NAFT device (PaloVia® Skin Renewing Laser, Palomar Medical Technologies Inc., Burlington, MA) according to recommended daily treatment regimen. Evaluations included subject questionnaires, digital photography, and monitoring with an experimental PERFIS device (UMass, Lowell, MA). Wild-field reflectance images of both co-polarization and cross-polarization were acquired between 390 and 750 nm. The images were analyzed with proprietary software. Collagen density, full width at half maximum of image histograms (FWHM IH) and normalized averaged pixel values were chosen to characterize dermal structure.
Results: Dynamics of treatment results was typical of the previously published device profile. Treatments were well-tolerated with minimal side effects. The PERFIS images showed detailed dermal structures such as collagen-elastin network, blood vessel system, and hair follicles. Different collagen network patterns were observed for patients of different age groups. FWHM IH and collagen density data were summarized and used to quantify collagen content. Data analysis at two-week timepoint revealed increase in collagen content and ordering of the collagen-elastin network as a result of the treatments.
Conclusion: Polarization-enhanced multi-spectral imaging is a convenient, easy to use, non-invasive evaluation tool, allowing to monitor changes in dermal structure caused by non-ablative fractional treatments at early stages when clinical results are not yet apparent.

#109

ULTRAVIOLET FLUORESCENCE IMAGING OF THE SKIN RESPONSE TO IRRITANT CONTACT DERMATITIS AND TAPE STRIPPING

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Background: Tape-stripping and irritant contact dermatitis (ICD) are mechanical and chemical methods to induce epidermal cellular proliferation, respectively. Tape-stripping and ICD elicit a fluorescence response characterized by a broad excitation band around 295 nm with an emission peak at 340 nm when measured with fluorescence excitation spectroscopy (FES). The excitation band at 295 nm is assigned to tryptophan moieties. This endogenous marker of cellular proliferation is normally found in the skin at higher levels in cells that are proliferating rapidly. Our practical goal is to validate a wide-field functional imaging system for the assessment of cellular proliferation in skin from its endogenous fluorescence response to UV light.

Study: The system consists of a xenon arc lamp with a 300 nm narrow band filter and a UV-sensitive camera with a 340 nm filter. We imaged the skin fluorescence response to ICD exposure and tape-stripping of the arm daily. ICD was induced by household dishwasher detergent. In addition, we imaged unaffected control sites and acquired FES spectra at the center of every study site for validation.

Results: The time-evolution of the fluorescence intensity response as measured by FES correlated with that of the imaging system at the same site location. Additionally, the imaging system provided measurements of the surface distribution of the fluorescence intensity. Tape stripping elicited a cellular proliferation response with uniform skin surface distribution. The response to ICD was not as uniform with higher fluorescence at the center of the exposed site relative to the boundaries.

Conclusion: Preliminary validation studies demonstrate that our imaging system could be a valuable non-invasive diagnostic and monitoring tool to quantitatively study the kinetics of imaging proliferative process, such as ICD.

#110

WINDOWS TO THE BRAIN: NOVEL CONCEPT FOR PROVIDING NON-INVASIVE, CHRONIC ACCESS TO BRAIN FOR OPTICAL DIAGNOSTICS AND THERAPEUTICS

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Background: Every year in the U.S., two million Traumatic Brain Injury (TBI) cases lead to 56,000 death and 18,000 survivors suffering from neurological impairment; and, 66,000 cases of brain tumors are diagnosed. Patients with TBI, brain tumors, congenital deformities, or decompressive craniectomies require adequate reconstruction which provides chronic optical access to brain. Optical access is essential for precise postoperative laser-based diagnosis and treatment without future highly-invasive procedures. Our goal is to develop an optically transparent polycrystalline Yttria-Stabilized-Zirconia (YSZ) cranial implant ("window") that enables chronic, non-invasive delivery and/or collection of laser light into/from affected areas within the brain. This goal will be achieved through replacement of the skull with the optically-transparent cranial implant and use optical clearing agents (OCAs) to temporarily render the overlying scalp transparent on demand.

Study: The YSZ cranial implant is fabricated using current-activated pressure-assisted densification technique. Optical and biomechanical properties of YSZ implants were characterized. In vivo, a part of mouse skull is replaced with the implant during craniectomy. The window was permanently covered with native scalp that was rendered temporarily transparent using minimally-invasive percutaneous drug delivery (PDD) of OCA. Microneedling, increasing the temperature of OCA and vacuum and pressure chambers were used to improve the PDD rate of OCA.

Results: The biocompatibility of YSZ implant is confirmed in vitro by cytotoxicity assays of mouse embryonic fibroblast cells grown on the implant surface. Optical coherence tomography (OCT) images of murine brain confirms improved signal strength through exposed YSZ implants relative to exposed native cranium. An optimal combination of microneedling, OCA temperature, vacuum and positive pressure has resulted in a 70% change in relative reflectance of ex-vivo porcine skin.

Conclusion: The results of this study suggest that transparent YSZ implant provides biomechanical stability, cerebral protection, and chronic optical access to brain and OCA can be used to render the scalp temporarily transparent.

#111

TARGETED PHOTODESTRUCTION OF OVARIAN CANCER CELLS USING ANTI-HER2 CONJUGATED ICG-LOADED POLYMERIC NANOPARTICLES

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Background: Optical nano-materials present a promising platform for targeted molecular imaging of cancer biomarkers and its photodestruction. Our group is investigating the use of polymeric nanoparticles, loaded with indocyanine green, an FDA-approved chromophore, as a theranostic agent for targeted intraoperative optical imaging and laser-mediated destruction of ovarian cancer. Here, we investigate the effectiveness of ICG loaded nanoparticles (ICG-NCs) functionalized with anti-HER2 for targeted laser-mediated photodestruction of ovarian cancer cells in vitro.

Study: The polymeric nano-constructs are formed by self-assembly involving green chemistry methods, and subsequently, loaded with ICG. The surface of ICG-NCs is coated with single and double aldehyde terminated polyethylene glycol (PEG), before functionalization with antibody. Monoclonal anti-HER2 is covalently coupled to the PEGylated ICG-NCs using reductive amination. We incubate ovarian cancer cells (SKOV-3) with the functionalized ICG-NCs for various time intervals, and use fluorescence microscopy to confirm cell targeting. We use an 808 nm laser with varying irradiance (1–6 W/cm^2) and exposure times (4–10 minutes) to irradiate the SKOV-3 cells. At the end of each laser irradiation experiment, we assess cellular injury in response to laser irradiation using live/dead viability assay.

Results: Based on the results of this study, we identify threshold irradiation parameters that result in photodestruction of ovarian cancer cells.

Conclusion: The anti-HER2 functionalized ICG-NCs present a promising theranostic agent for optical molecular imaging and photodestruction of ovarian cancer cells.

Acknowledgements: This study was supported in part by an ASLMS student grant, and National Science Foundation (CBET-1144237).

#113

LASER PHOTOCOAGULATION OF PORT-WINE STAIN BLOOD VESSELS: THREE-DIMENSIONAL MONTE CARLO/FINITE ELEMENT SIMULATION WITH REALISTIC VESSEL GEOMETRY

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Background: Pulsed laser photocoagulation is commonly used in dermatologic laser surgical procedures to treat port-wine stains (PWS). Therapeutic outcome of the treatment is highly dependent on the selection of laser dosimetry, including wavelength, fluence, spot size and pulse duration. Although numerical modeling is an effective approach to predict the outcome of laser photocoagulation of subsurface blood vessels, a reliable and flexible model that includes realistic blood vessel networks and incorporates light-tissue interaction, heat transfer and thermal damage is not available.

Study: We present a three-dimensional computational model of laser photocoagulation of realistic subsurface blood vessel networks. Three-dimensional networks of normal and PWS blood vessels are generated with a novel algorithm. A Monte Carlo optical model with tissue absorption, scattering and surface scattering is constructed in Zemax optical design software to simulate the distribution of light flux in tissue. A finite element model is applied to simulate heat transport in tissue under flexible space- and time-dependent boundary conditions. Space- and time-dependent probability of photocoagulation in blood vessels and skin is computed with an Arrhenius thermal damage model. We compared the probability of photocoagulation of subsurface PWS blood vessels on: 1) laser wavelength (532 nm and 595 nm), and 2) placement of an index matching window on skin.

Results: A flexible algorithm is successfully demonstrated to automatically generate both normal and PWS blood vessels with controllable network geometry. Model results suggest that 532 nm light provides more complete intraluminal photocoagulation and more extensive damage to the blood vessel wall compared with 595 nm light. Placement of an index matching window on the skin reduces optical fluence in the epidermis, reduces non-specific heating of melanin and can improve photocoagulation of subsurface PWS vessels.

Conclusion: The novel three-dimensional model of laser photocoagulation of subsurface blood vessels is a valuable tool to select the optimal laser dosimetry for PWS treatment. With realistic three-dimensional blood vessel networks in the model, PWS therapeutic outcomes for various blood vessel geometries can be investigated.

#114

A MULTI-MODAL SPECTROSCOPY INSTRUMENT FOR REAL-TIME EARLY DETECTION OF SKIN CANCER

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Background: Current skin cancer screening procedures are subjective, invasive and time-consuming; approximately $2B per year is spent on unnecessary biopsies. Spectroscopic-based technologies offer a real-time, non-invasive and more accurate solution for early skin cancer detection; the combination of multiple spectroscopic techniques has proven to be very successful. Here we describe the design and performance of a fully-integrated "single click" multi-modal spectroscopy (MMS) system, which incorporates a novel fiber-optic probe, for the early detection of skin cancer.

Study: Our multi-modal system combines fluorescence (337 nm excitation), Raman (830 nm excitation) and reflectance (visible excitation) spectroscopies. An effective multi-modal probe design must cater to the specifics of each technique such as high Raman collection efficiency and appropriate source-detector geometry for the calculation of physiological parameters from reflectance spectra. Our solution involves an innovative gradient-index (GRIN) lens configuration to focus and collect light from the same area.

Results: Using tissue simulating phantoms, we verified that our probe's geometry is capable of accurately measuring reduced scattering and absorption coefficients across physiologically-relevant ranges (error <8%). Our probe's Raman collection efficiency (4%) is comparable to previously developed probes; however, our fabrication method is considerably cheaper. On human skin, our probe is capable of detecting spectral features such as the Raman Amide I, III and CH_2 bands and the hemoglobin Q and Soret absorption features that are important for skin cancer diagnosis. For all 3 modalities, our MMS system is capable of acquiring high-quality spectra with data acquisition times of less than 5 seconds.

Conclusion: We have verified that the design of our fiber-optic probe meets the individual requirements of each spectroscopic modality. Data is collected using a fully-integrated system that combines the requisite hardware and software for MMS acquisition in a portable functional format necessary for the clinical environment.

#115

A MINIMALLY-INVASIVE APPROACH TO THE CHALLENGE OF ORAL NEOPLASIA

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Background: Despite significant advancements in the treatment of oral cancer, it still results in 10,000 U.S. deaths annually. Squamous cell carcinomas (SCC) account for 96% of oral cancers and are usually preceded by dysplasia. Current techniques require surgical biopsy of oral lesions, which are often benign and detect malignant changes too late for optimal treatment. A non-invasive capability for early detection of oral dysplasia is required for patient survival. In this study we aim to develop a fiber coupled miniature probe suitable for examination of oral cavity. The probe includes coherent Raman scattering (CRS) along with two-photon excited florescence (TPEF) imaging capabilities.

Study: The probe design includes optimized objective lens, efficient light delivery and collection through optical fiber, real time fiber scanning capabilities and home build photodetector. Each of these parts is individually optimized for improved performance. For preliminary experiments we imaged SCC excised tissue.

Results: We have designed and constructed a miniature lens assembly with achromatic performance, numerical aperture of 0.5 and lateral resolution of 1 μm. We incorporated a fiber tip scanner, including a piezo-electric actuator and fiber cantilever. The fiber

tip spiral scans at the rate of 20 Hz, resulting in faster imaging of field of view of 100 × 100 μm^2. All components are enclosed in a compact probe of 10.5 mm diameter and length of 38 mm, suitable for imaging of oral cavity. A SCC sample imaged with TPEF/CRS clearly separates the nuclei from the cytosolic cell content and shows similarities to hemotoxylin/eosin (H&E) stained images in the epidermal layers.
Conclusion: Advances made in this work enables discrimination of the cell cytoplasm and nucleus similar to conventional H&E staining contrast, using CRS imaging. The improved imaging resolution of TPEF/CRS probe makes it possible to visualize cell nuclei and cell boundaries, without the need of histopathology of biopsy, crucial for diagnostic of oral cancer.
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#116

IN VIVO MULTIPHOTON TOMOGRAPHY: POTENTIAL FOR NON-INVASIVE EARLY DIAGNOSIS OF PIGMENTED LESIONS

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Background: Recently, non-invasive optical imaging technologies based on laser-scanning microscopy have emerged as promising tools for real-time, *in-vivo* imaging of skin lesions. Among these, multiphoton microscopy (MPM) distinguishes itself as a laser-scanning microscopy technique that relies on nonlinear light-matter interactions such as two-photon excited fluorescence (TPEF) and second harmonic generation (SHG) to achieve sub-micron resolution 3D images of tissues. In skin imaging using MPM, the main sources of TPEF are reduced nicotinamide adenine dinucleotide (NADH), keratin, melanin and elastin fibers while SHG is used to visualize the collagen fibers in the dermis. This presentation will focus on *in-vivo* non-invasive microscopic images of benign melanocytic nevi, atypical nevi and melanoma. Our long-term goal is to develop a non-invasive method for diagnosing these lesions and minimize the need for invasive biopsies for diagnosis.
Study: Imaging was performed with a clinical laser-scanning MPM-based tomograph (MPTflex, JenLab GmbH, Germany). Melanocytic nevi, atypical nevi and melanoma were imaged in 15 patients (5 patients in each group). The MPM images of lesions were compared to histopathology to determine if imaging and histology results demonstrate correlations in terms of tissue constituents and also, to evaluate if the traditional histopathology criteria can be identified in the MPM images.
Results: MPM images of benign melanocytic nevi were characterized by the presence of nevus cell nests at the epidermal-dermal junction. In atypical nevi, features such as cytological atypia, lentiginous hyperplasia and nests of nuclear pleomorphic cells were observed. In the melanoma cases, migration of melanocytes and pagetoid spread of large pleomorphic cells in the upper layers of the epidermis were typically observed.
Conclusion: The good correlation between the features identified by MPM and those corresponding to histological images, suggests that multiphoton microscopy could be a promising tool for non-invasive pigmented lesions diagnosis.

#117

BILIRUBIN: AN ADDITIONAL ENDOGENOUS FLUOROPHORE IN HEPATOLOGY FOR LIVER FUNCTIONALITY MONITORING

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Background: Autofluorescence based optical biopsy under UV-visible excitation is a promising approach for the real time diagnosis of liver metabolic conditions. Since bile production and composition are increasingly considered to monitor liver functionality in surgery and transplantation, bilirubin potential as endogenous fluorophore acting as additional biomarker has been investigated. Bile and liver tissue autofluorescence properties have been monitored following warm ischemia and reperfusion, as experimental functional alteration.
Study: Fluorescence analysis was performed through a fiber optic probe (366 nm excitation) on bile collected from rat livers submitted to partial portal vein and hepatic artery clamping before reperfusion (60 + 60 min; n = 4 vs n = 4 sham operated rats), in parallel with liver tissue autofluorescence monitoring.
Results: Preliminary results on bilirubin in aqueous solution with solubilizing agents (BSA, CTAB, biliary salts) showed that 336 nm excitation strongly favors the intramolecular interchromophore energy transfer efficiency, because of the molecule bichromophore nature. As a consequence, bilirubin fluorescence spectra are the convolution of two bands 515–523 nm, 570 nm their relative contribution reflecting the intramolecular interchromophore phenomenon efficiency, depending on structural conformation and microenvironment. In comparison with sham operated rats, changes in the main band spectral profiles of bile from ischemic liver are detected under 366 nm excitation, but not under 465 nm excitation, although theoretically preferential for bilirubin. Excitation at 366 nm is thus able to highlight spectral alterations likely reflecting differences in bilirubin microenvironment, that is in bile composition. This evidence can be related to marked changes in liver energetic metabolic engagement during the ischemic/reperfusion phases, as indicated by the decrease of NAD(P)H contribution to the whole tissue autofluorescence emission, followed by an increase indicating an attempt to recover the pre-ischemic condition.
Conclusion: Data on both bile and liver tissue confirm the possibility to improve the comprehensive metabolic information provided by AF excitation in the near UV region.

#118

CHARACTERIZING *IN VIVO* OPTICAL SIGNATURES ASSOCIATED WITH NEURON DEATH IN A PRECLINICAL MODEL OF ALZHEIMER'S DISEASE

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Background: There is currently no cost-effective, quantitative screening technique for detecting Alzheimer's disease (AD). Previous work has shown spatial frequency domain imaging (SFDI) which uses nonionizing near-infrared light, can detect early brain perfusion deficits in an AD mouse model. The objective

of this study was to use SFDI to see if the light scattering signal is sensitive to the inflammation and neuron death found in AD.
Study: We used SFDI to image three month old male transgenic mice expressing progressive diphtheria toxin-induced neuronal injury when taken off a doxycycline diet (Cam/Tet-DTa). Five Cam/Tet-DTa mice were imaged chronically from no lesioning to after 23 days of lesioning and compared to controls ($n = 5$) for scattering and absorption (30 wavelengths, 650–970 nm). An additional five Cam/Tet-DTa and nine controls were imaged only after 23 days of lesioning to test the reliability of chronic imaging.
Results: Baseline scattering and absorption showed no significant difference between Cam/Tet-DTa mice and controls. After 23 days of lesioning, including both naïve and chronically imaged mice, brain cortical scattering was 10–12% higher in the Cam/Tet-DTa mice compared to controls ($p < 0.005$). Chronic imaging, which involved exposing the skull and suturing the scalp together after the first day of imaging, showed no significant difference in scattering between the first and 23rd day of imaging in controls. Removing doxycycline from the diet caused a significant decrease in oxy-hemoglobin ($100 \pm 6\,\mu M$ vs. $79 \pm 7\,\mu M$), deoxy-hemoglobin ($57 \pm 3\,\mu M$ vs. $48 \pm 4\,\mu M$), and total hemoglobin concentrations ($157 \pm 9\,\mu M$ vs. $127 \pm 9\,\mu M$) ($p < 0.05$) in controls, but not in Cam/Tet-DTa mice.
Conclusion: SFDI scattering signal is sensitive to neuronal death and brain inflammation and this optical biomarker may be used to screen or chronically monitor disease progression in AD patients.

#119

EVALUATION OF RAMAN-SHIFTED ALEXANDRITE LASER FENESTRATION OF OPTIC NERVE SHEATHS

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Background: Optic nerve sheath (ONS) fenestration was previously performed with a cost-prohibitive infrared free electron laser. We sought to determine the optimal conditions (wavelength, pulse energy, and number of pulses) for ONS incision without damaging underlying nerve tissue using mid-IR pulses from a tabletop Raman-shifted Alexandrite (RSA) laser.
Study: Porcine cadaver optic nerves were used within 24 hours. Ablation thresholds, ablation rates, and collateral damage of porcine ONS from RSA laser pulses (both free-space- and waveguide-delivery at 6.1 μm, 6.3 μm, and 6.45 μm) were measured. In addition, ONS fenestration windows were incised with 1–3 passes of laser energy delivered through a handheld waveguide probe (spot size 200 μm), and evaluated. Ablation thresholds were determined via PROBIT analysis. Ablation rates were calculated from OCT depth measurements immediately following computer-controlled delivery of a predetermined number of laser pulses (10 Hz) to single spots on the ONS. OCT and histology were performed to evaluate the quality of the ONS fenestrations and the degree of collateral damage.
Results: Ablation thresholds of porcine cadaver ONS were in free space delivery (300 μm diameter spot): $0.13 \pm .02$ mJ at 6.1 μm, $0.24 \pm .03$ mJ at 6.3 μm, and >0.24 mJ at 6.45 μm; and through the waveguide: $0.26 \pm .03$ mJ at 6.1 μm, $0.48 \pm .03$ mJ at 6.3 μm, and >0.5 mJ at 6.45 μm. Insufficient laser energy was available at 6.45 μm for accurate measurement. Some ablation rate variability was observed. At 6.1 μm, the ablation rates in free space were: 2–3 μm/pulse near 0.7 mJ, 3–6 μm/pulse near 1.3 mJ, and ONS perforation within 1–2 s. at >1.5 mJ; and through the waveguide: 2 μm/pulse near 0.6 mJ, 3 μm/pulse near 0.8 mJ, and 4–6 μm/pulse near 1.0 mJ. The latter usually with ONS perforation within 1–2 s. Histologically, we typically found some thickening but no increased H&E staining around the ablation crater. No damage was found in the underlying nerve if exposure did not continue after sheath perforation. OCT imaging and histology demonstrated successful ONS window fenestrations.
Conclusion: The lowest ablation threshold measured was for the wavelength of 6.1 μm. Ablation rates increased with increasing energies at 6.1 μm and 6.3 μm. Insufficient energy was available at 6.45 μm to measure ablation rates. Porcine cadaver ONS fenestration was successfully performed by the RSA laser at 6.1 μm and 6.3 μm.

#121

BLUE LIGHT ELIMINATES COMMUNITY-ACQUIRED METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS IN INFECTED MOUSE SKIN ABRASIONS

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Background: Bacterial skin and soft tissue infections (SSTI) are a common problem encountered in clinical practice and affect millions of individuals annually in the United States. Treatment of SSTI has been significantly complicated by the increasing emergence of community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA) strains. The objective of this study was to demonstrate the efficacy of blue light (415 ± 10nm) therapy for eliminating CA-MRSA infections in skin abrasions of mice.
Study: The susceptibilities of a CA-MRSA strain (USA 300 LAC) and human keratinocytes (HaCaT) to blue light inactivation were compared by in vitro culture studies. A mouse model of skin abrasion infection was developed by using a bioluminescent strain USA300 LAC: lux and immunocompromised mice. Blue light was delivered to the infected mouse skin abrasions at 30 min and 24 h after the bacterial inoculation, respectively. Bioluminesence imaging was used to monitor in real time the extent of infection in mice.
Results: In vitro cell culture studies demonstrated that USA 300 LAC was much more susceptible to blue light inactivation than HaCaT cells ($P = 0.038$). Transmission electron microscopy imaging of USA 300 LAC cells exposed to blue light exhibited disruption of the cytoplasmic content, disruption and breakage of cell wall, and cell debris. In vivo studies using mice showed that blue light rapidly reduced the bacterial burden in both early and established CA-MRSA infections in mouse skin abrasions, as demonstrated by the bacterial luminescence intensity. More than 2-$\log_{10}$ reduction of bacterial luminescence in the mouse skin abrasions was achieved when 41.4 and 108 J/cm^2 blue light had been delivered respectively for the therapy at 30 min and 24 h after the bacterial inoculation.
Conclusion: There exists a therapeutic window of blue light for bacterial infections where bacteria are selectively inactivated by blue light while host tissue cells are preserved. Blue light therapy has the potential to rapidly reduce the bacterial load in SSTI.

#122

PRECLINICAL *IN-VIVO* EVAULATION OF PDT/PDL THERAPY ON NORMAL VASCULATURE

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Background: Pulsed-dye laser (PDL) therapy is the gold standard for treatment of port wine stain (PWS), but complete removal is infrequently achieved. Photodynamic therapy (PDT) is under study as an alternate protocol. Our previous data suggest that a protocol with PDT and PDL irradiation at reduced radiant exposures can achieve persistent vascular shutdown. Our study objective is to evaluate this PDT/PDL protocol with use of two photosensitizers: NPe6 and Benzoporphyrin derivative (BPD).

Study: For PDT, we used either NPe6 activated with LED irradiation (wavelength = 664 ± 20 nm) or BPD with laser irradiation (576 nm or 690 nm excitation). PDT was followed immediately by PDL irradiation (7 mm, 8 J/cm^2, 585 nm). Experiments were performed with the mouse window chamber model and laser speckle imaging to monitor blood-flow dynamics. In this study, we defined a successful treatment outcome as achieving persistent vascular shutdown within the window, seven days following PDT/PDL treatment.

Results: Dose-response analysis enabled us to identify characteristic radiant exposures for the PDT achieves persistent vascular shutdown. We determined the NPe6 characteristic radiant exposure to be 85 J/cm^2. For BPD, we determined the following characteristic radiant exposures: 153 J/cm^2 and 63 J/cm^2 for 576 nm and 690 nm wavelengths, respectively. PDL irradiation at 7 mm, 8 J/cm^2 was identified as a radiant energy that did not induce persistent vascular shutdown. We identified specific classes of responses in the combined PDT/PDL treatments: no vascular shutdown, acute vascular shutdown followed by gradual restoration of blood flow, and acute vascular shutdown that persisted over the seven-day monitoring period.

Conclusion: Our preliminary data suggest that the PDT/PDL therapy is a viable treatment option for PWS vasculature.

#123

BONE GROWTH BIOMARKERS IN FRACTURES AFTER LOW-LEVEL LASER THERAPY

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Background: To investigate the effect of low-level laser therapy (LLLT) on bone repair after femur fractures.

Study: 60 adult Wistar rats underwent an ostectomy and were randomly assigned to two groups: Group A (n = 30; ostectomy + LLLT); Group B (n = 30; ostectomy + sham laser). Each group was divided into three subgroups (1, 2 and 3) according to the day of death (8th, 13th, and 18th day after surgery, respectively). An experimental model of complete fracture was surgically created by removal of a 2 mm fragment from the middle third of the femoral shaft in the right hind limb, previously stabilized with a straight titanium plate and four screws. Cell cultures were produced from the excised bone fragments. Animals and cell cultures of Group A were exposed to eight sessions of LLLT (GaAlAs, power density = 200 mW/cm^2, ? = 808 nm, dose = 2J, exposure time = 5 seconds per point) by contact method, once a day, from day 1 to day 8 after surgeries. Group B was treated with sham laser. Osteocalcin, osteopontin and osteonectin were assessed by immunohistochemical analysis.

Results: The cut edges showed higher and early expression of osteocalcin and osteopontin and increase of osteonectin on the first two studied periods in Group A. Cell cultures showed increased expression of osteocalcin on the 13th and 18th days and an increase in osteonectin in group A compared to group B. Cut edges and cell cultures revealed a new facet of bone formation. As in cell culture there is no inflammatory phase, the tissue must adapt itself to a restricted environment (no external calcium and other minerals supply and no mechanical stimulation). In spite of that, two out of the three bone matrix proteins investigated by immunohistochemistry (osteocalcin and osteonectin) presented similar patterns.

Conclusion: LLLT played an important role in bone tissue formation, in vivo and in vitro, and is relevant to fracture healing.

INTERNATIONAL EXPERIENCE IN LASERS IN DERMATOLOGY

#125

TREATMENT OF DERMATOSIS PAPULOSA NIGRA WITH 1064 nm Nd:YAG LASER IN PATIENTS WITH FITZPATRICK IV-VI SKIN TYPES WITH ONE YEAR FOLLOW UP

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Background: Dermatosis papulosa nigra is a benign cutaneous condition. It is typically distinguished by multiple, small, hyperpigmented, asymptomatic papules on the face and neck of black adults. The condition may be cosmetically unpleasant to some patients. Aggressive therapeutic modalities have been complicated by postoperative hyperpigmentation, hypopigmentation or scarring. Keloid formation is another potential complication. To evaluate the safety and long term efficacy of the 1064 nm Nd:YAG laser in treatment of DPN through retrospective photographic analysis.

Study: A retrospective analysis was conducted for all patients ($n = 60$) who received 2 sessions of 1064 nm Nd:YAG laser treatments 3 weeks apart. The parameters used for treatment were; 1064 nm wavelength, 100–120 J/cm^2 Fluence, 3 mm spot size and 2 stacking pulses were fired on each lesion. Patients were requested to return for evaluation 3 months and 12 months after the second and last session to assess any side effects and the recurrence rate as well as to complete an improvement scale questionnaire. Blinded photographic assessments were performed by three independent dermatologists using unlabeled photos for before and after and arranged in non-chronological order. Reviewers were asked to determine before and after photos and the degree of improvement in the lesions. Degree of improvement was graded using a four point scale: −1 = Adverse effects, 0 = No improvement, 1 = Mild improvement, 2 = Marked improvement.

Results: Based on blinded photo assessments by three independent Dermatologists, all the three reviewers had correctly identified the before and after photos. Clinically significant improvements were reported by all the reviewers. No long term adverse effects were observed neither clinically during the follow up visits nor during the photo evaluation of the photographs.
Conclusion: DPN can be treated in type IV-VI Fitzpatrick skin patients using the 1064 nm laser with long term efficacy and safety.

#126

TREATMENT OF FACIAL MELASMA IN LATIN AMERICAN WOMEN USING LOW-FLUENCE QS-Nd:YAG LASER

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Background: Melasma is a frequent skin disorder and usually a distressing condition to the patients. Treatment options are limited and show unsatisfactory results.
Study: To access the safety and efficacy of 1064 nm low-fluence Qs-Nd:YAG laser in the treatment of melasma in Latin American women. Sixteen female patient (Fitzpatrick skin type III to V) were treated with 1064 nm QS-Nd:YAG laser with ten sessions at 1-week interval. The parameters used were: 8 mm spot size, 0,8 to 1,6 J/cm^2 of fluence and pulse repetition rate of 10Hz. Two investigators evaluated the modified Melasma Area and Severity Index score (m MASI) before the laser sessions, one week after and at day 30 after the last treatment session by digital photographs. Safety, efficacy, and recurrence were accessed. The patients were instructed to apply sunscreen protection factor of 30 and avoid sun exposure. No other treatment was allowed during the study.
Results: Mean mMASI scores decreased 45%, from 7,9 ($\pm$ 4,2) at baseline to 4,3 $\pm$ 2,9 after the treatment; 69% of patients had a mMASI value decrease up to 50%; 31% had a decrease up to 75%. At day 30 follow-up mMASI scores decreased 17%, from 7,9 $\pm$ 4,2 at baseline to 6,4 $\pm$ 4,5; 25% of patients showed recurrence and 12%, mild decrease of mMASI values (up to 25%), 44% had a decrease up to 50% and 6% had a decrease up to 75. Minimal adverse effects were observed like mild erythema, lasting up to 2 hours. Two patients (13%) presented with post-inflammatory hyperpigmentation at day 30.
Conclusion: The 1064 nm QS-Nd:YAG is a safe treatment for melasma, with satisfactory efficacy rates. However, other treatments may be combined to laser toning due to the early recurrence rates and post-inflammatory hyperpigmentation observed in this study.

#127

A RETROSPECTIVE REVIEW OF A SINGLE TREATMENT SESSION OF PIGMENTARY DARK CIRCLES USING 2790 nm PEARL FUSION AND QS-ALEXANDRITE COMBINATION LASERS

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Background: Pigmentary dark circles are a common problem that is difficult to treat. Sun protection and lasers are used successfully in reducing pigmentation. Bleaching creams, when tolerated, are a useful treatment adjunct.
Study: Fourteen patients (12 females, 2 males, skin types II-V) with photographic documentation were selected for this study. Patients were photographed and LMX cream, oral Lorazepam and Lysine Clonixinate were used for pain control. Pearl Fractional (Cutera) 60–120 mJ, density 3 was used first, QSwitched Alexandrite (Candela) 5–5.5 J/cm^2 was used second, followed by a single pass of Pearl (Cutera) 3–3.5 J/cm^2.
Results: Healing time was 5–7 days. Transient post-inflammatory hyperpigmentation occurred in all patients. All patients had significant clearing, particularly those with lighter skin types.
Conclusion: Combination 2790 nm Pearl Fusion (Fractional and non-fractional ablation) and QS-Alexandrite laser in a single session is very effective in reducing pigmentary dark circles in patients skin types II-V, with short healing times.

#128

SKIN BARRIER FUNCTION ASSESSMENT BY *IN VIVO* CONFOCAL MICROSCOPY AND OTHER NON-INVASIVE OPTICAL MEASUREMENTS ON PATIENTS SUFFERING FROM ROSACEA TO EVALUATE THE EFFICACY OF A POST-LASER SERUM

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Background: Pulsed Dye Laser (PDL) has been since many years the Gold Standard for the treatment of Rosacea Subtype I. However, the role of the post-laser topical treatment used after the procedure to speed up the recovery of the normal skin barrier function remains neglected. Different skincare solutions have been used to sooth and protect the skin as a post-laser treatment. A comparative evaluation of a new post-laser serum versus placebo was performed in order to assess its immediate soothing effect and its efficacy to recover the innate immunity linked to a normal skin barrier function.
Study: Thirty-one subjects with phototype I–IV presenting a rosacea subtype I condition on both sides of the face received a single PDL treatment (9–12 J/cm^2, 7 mm spot). The evaluated serum was applied on a randomized side of the face and a placebo was used in the other. The immediate soothing effect was measured through thermography imaging. On the baseline, 1, 9, 21 and 30 days after the treatment IVCM captures were performed to evaluate the skin condition and to measure the stratum corneum thickness. Skin barrier function was also assessed through closed-chamber TEWL. Redness was evaluated through spectroscopy and photographs scoring. Oedema and dermal density were measured with ultrasound imaging.
Results: IVCM showed a significant earlier improvement of the skin condition treated with the serum. The stratum corneum thickness presented a high correlation with both the TEWL and the ultrasound data. At day 9 after treatment all the evaluated parameters indicated a statistically significant improvement on the product side. At day 30, both sides had equally recovered.
Conclusion: The serum has a faster skin recovery than placebo. The assessment techniques used in the study provide accurate, objective and non-invasive measurements allowing a better assessment of the treatment efficacy and improve our understanding of the skin condition.

#129

OVER TIME HISTOLOGICAL TISSUE CHANGES AFTER NON-INVASIVE TREATMENT WITH A 1210 nm LASER

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Background: The objectives of this investigation are to evaluate the histological changes over time of non-invasive treatment with a 1210 nm laser, chosen to target a mid-infrared lipid absorption band.

Study: Non-invasive abdominal treatments with a 1210 nm laser with surface cooling were performed patients prior to abdominoplasty. Histological samples was obtained from post-abdominoplasty tissue at 2 days, 1 week, 1, 3 and 6 months post laser and fixed in formalin or frozen for processing. Doses ranged from 120 to 200 J/cm^2 and from 220 to 480 J/cm^2 for 40s and 160s pulses, respectively. Samples were collected from Tissue sections were stained with H&E, nitroblue tetrazolium chloride (NBTC), cleaved caspace-3, and perilipin. Photographs and ultrasound were performed pre-treatment and throughout the study. Safety was evaluated by blood monitoring and skin evaluations.

Results: Eight patients completed the study. Deep dermal and septal perivascular infiltrate was seen 2 days post laser. At 1 week, hyalinized and homogenous collagen bundles were noted at the dermal-hypodermal junction. Decreased NBTC staining showed damage zones predominantly in the hypodermis approaching 6 mm in thicknesses. Decreased perilipin staining was also seen which represents the first time laser damage to this lipid barrier membrane was measured. Caspase staining showed apoptotic adipocytes at the periphery of necrotic tissue. Histiocytes were initially observed at the junction between apoptotic and necrotic adipocytes. Histiocytes, giant cells and fibrotic tissue still present at 6-months. The incidence of damage to the lower dermis is higher for 40s compared to 160s exposures.

Conclusion: We observe histological changes occurring over a 6 month period, showing acute and long term changes. We were able to include or avoid damage to the lower dermis depending on the desired damage profile, showing significant fat reduction zones of hypodermal necrosis. Clearance of damaged adipocytes is slow with residual damage present at 6-months.

#130

LASER-ASSISTED LIPOSUCTION - FOUR YEARS FOLLOW-UP

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Background: The aim of laser treatment in lipodistrophy was to facilitate lipoaspiration by means of previous lipolysis; to diminish postoperative hematomas by the coagulative action of laser and to tighten the skin by stimulation of dermal collagen. The objective is to evaluate the patients treated from 2008 to 2012.

Study: 258 patients presenting with lipodistrophy, and skin laxity received laser assisted lipolysis (LAL). 194 patients received Smartlipo MPX (1320 and 1064 nm Nd-YAG) while 64 subjects were treated using Smartlipo Triplex (1440, 1320 and 1064 nm Nd-YAG). The procedures were performed under local or general anesthesia. Tumescent technique was used in all cases. Energy was first delivered into a deep layer in those areas with thick subcutaneous fatty pad and then a shallow plane was treated to induce skin tightening. In those areas with a thin subcutaneous adipose layer energy was only delivered into a shallow plane. The adipose tissue was aspirated.

Results: The subjects received treatment in 11 anatomical sites (mean 2.5 sites per patient). The average aspirated volume was 1,421.5 ml per patient. During the first two years the most frequently treated sites were abdomen, flanks and trochanteric regions. In the last two years, submental region, inner thighs, knees and arms were the most frequently treated areas. In those areas where removal of fat was the main aim of the procedure, the laser significantly facilitated fat aspiration using thin cannulas (2 mm) resulting in an almost atraumatic procedure. The most efficient results were achieved in those areas where skin tightening was the primary aim: submental region, arms, and inner thighs. In those sites, skin retraction obtained by dermal heating resulted in significant tightening. No lasting adverse effects were recorded and outcomes increased to 12 months.

Conclusion: LAL is a viable procedure for patients with lipodistrophy and in those presenting with skin laxity.

#131

EVALUATION OF SIDE-EFFECTS FROM AN IPL HOME-USE DEVICE: IMPORTANCE OF CONSTITUTIVE AND SUN INDUCED SKIN PIGMENTATION

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Background: Numerous low-dose optical home-use devices are available for hair removal. These are considered unsuitable for darker skin-types due to the risk of nonspecific epidermal damage and potential side-effects. At home, people may perform IPL treatments on sun-exposed areas, which may increase the risk of side-effects. The aim was to evaluate the importance of constitutive and UV-acquired pigmentation for the risk of side-effects after IPL.

Study: Twenty-one subjects with different skin complexions were enrolled (SPT II-IV). Two buttock test areas (4 × 6 cm) were randomized to 0 or 8 solar simulated (sun) irradiations in consecutively increasing Standard Erythema Doses (2–4 SED's). Subsequently each area was subdivided into four test-sites that were randomized to receive 3 IPL treatments of 0, 7, 8, or 10 J/cm^2. Biopsies were taken at 16–24 hours after first IPL treatment and subjects were seen for 1- and 4-week follow-up. Outcome measures were: i) clinically evaluated skin reactions, ii) self-assessment of pain (0–10), iii) RNA expression of pro-opiomelanocortin (POMC) and microphthalmia-associated transcription factor (MITF) pigment-markers.

Results: Skin pigmentation measured by skin remittance increased significantly after UV-irradiations ($P < 0.0001$). Mild, transient skin reactions appeared after IPL on sun-exposed and non-irradiated skin. No subjects responded with blisters, crusting, pigment- or textural changes. Sun-exposed skin responded more frequently with transient erythema than non-irradiated skin

($P = 0.001$). Pain level increased with increasing IPL-dose ($P = 0.008$), with darker skin complexion (range: 0–8, R = 0.39, $P = 0.002$) and with sun-tanning (range: 0–10, $P = 0.01$). Preliminary quantitative real-time polymerase chain reaction data (qPCR) ($n = 20$) for POMC and MITF expression demonstrated trends towards an increase of both pigment-markers after IPL and sun-exposure.
Conclusion: Mild and short-term skin reactions were seen which were influenced by constitutive as well as sun-induced skin pigmentation.

#132

INTERNATIONAL PROGRESS IN STANDARDS AND REGULATION FOR LIGHT-BASED HOME-USE DEVICES

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Background: The recent development of light-based laser and intense light devices for consumer use with or without physician direction has raised new challenges in safety standards and regulatory requirements for these appliances. If international standards committees do not collaborate in the development of these standards, chaos will result, with standards being developed by competing manufacturers. In addition, some countries regulate such products as medical devices because they produce physiological changes in the skin.
Study: Home-use laser products have emission levels from "embedded" lasers that would ordinarily result in their having laser hazard classifications of 3B or 4, but because of design features and interlocks, cannot emit hazardous radiation when the product is not in contact with the skin. With no outside emission, control measures in current horizontal standards do not make much sense. The International Electrotechnical Commission (IEC) has therefore defined a new laser class, 1C in its draft revisions to IEC standard 60825-1 and has made progress on vertical standards for the laser and intense light products that are being marketed for skin treatments in the home (such as hair removal and skin rejuvenation).
Results: In Europe, the German Ministry has objected to lasers being sold "OTC" to end consumers, requesting the European Commission in Brussels to change draft wording of the General Product Safety Directive allowing the new Class 1C. The German proposal is that lasers be restricted to use by medical doctors only. Whilst no equivalent ocular hazard generally arises with home-use IPL, higher Risk Group 'embedded' IPL sources could conceivably be employed in home-use devices for certain applications (e.g. acne therapy).
Conclusion: If this new classification is approved, the vertical standards will specify the appropriate design, engineering, reliability, test methods, labeling and instructional controls required for safe consumer use.

#133

FRACTIONAL CO_2 TREATMENT OF ATROPHIC AND MIXED SCARS IN CHILDREN AFTER HEMANGIOMAS OR TRAUMA

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Background: Fractional resurfacing has been applied to the treatment of hypertrophic scars with some success. Scars that are atrophic or mixed are more challenging. These types of scars are unfortunately relatively prevalent in children, particularly after involution of hemangiomas.
Study: Twenty-four children, aged 2–16 years (mean 4.2) were treated from 2008–2011, for involuted hemangiomas (12 burns, 6 trauma, 3 cutaneous, leishmaniasis 2, and pyoderma gangrenosum 1). Treatment was performed under general anesthesia in 20 patients, and under local 1% lidocaine in 4 cases. Treatments were performed with a CO_2 laser onto which a beam-splitting handpiece was fitted, to generate a 7×7 (49-dot) matrix operating at 25 W/200msec (102 mJ/pulse). Two passes were performed. Follow-up examinations were performed at 3, 7, 30, and 60 days post-treatment to monitor recovery, improvement and any subsequent sequelae. Photographs taken prior to initiation of treatment and 60 days following the end of treatment were independently evaluated and compared by two physicians and graded on a 5-point scale: excellent: 75–100% lesion clearance and textural improvement; good: 50–75% improvement; fair: 25–50% improvement; poor: <25% improvement; or worse: final results were worse than the pre-treatment findings. Eighteen of the 21 were evaluated at 6–9 months as well.
Results: In all patients, treatment caused erythema edema lasting 7–18 days (mean 9.2 ± 2.2 days). No permanent adverse effects were reported. At the 60-day clinical assessment, outcome was rated excellent in 14 patients (58%), good in 7 (30%), and fair in 3 (12%). No cases were graded as poor or worse. The improvement was maintained at 6 and 9 months.
Conclusion: Fractional CO_2 provides a useful therapy for the treatment of children with atrophic or mixed scars due to involuted hemangiomas or other causes. The treatment is well-tolerated and provides long-lasting benefit.

#134

CLINICAL AND HISTOLOGICAL STUDY FOR THE TREATMENT OF ACNE SCARS BY FRACTIONAL RF

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Background: Fractional radiofrequency (RF) is a RF (high frequency) version of a fractional type. Since RF has a biological action that is different from light, a distinctive clinical effect is expected to result from fractionally generating an electrical field on the skin surface through fine bipolar electrodes. The eMatrix fractional RF system (Syneron, USA) is an apparatus that was developed with the aim of enabling subablative rejuvenation, and it is useful in improving the deep layers of the skin. It is also particularly highly effective clinically in the treatment of atrophic acne scars that are associated with collagen fiber degeneration in the dermis.
Study: We conducted a clinical study in which we treated 20 patients once a month with eMatrix RF in order to characterize its efficacy as a treatment for atrophic acne scars. Skin punch biopsies, taken from each subject before therapy, after the second treatment session and 1 month after the third treatment session, were routinely prepared for transmission electron

microscopy (TEM) and were examined using an electron microscope.
Results: The results confirmed clinical improvement in all 20 cases. No marked histological changes were observed in the epidermis, but increases in collagen fibers and elastic fibers were seen in the dermis.
Conclusion: Fractional RF system is useful in improving atrophic acne scars.

#135

COMBINATION OF Nd:YAG AND FRACTIONAL CO_2 LASER IN THE TREATMENT OF HYPERTROPHIC AND KELOIDS BURN SCARS: PRELIMINARY RESULTS

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Background: It is well known that the use of laser in the treatment of hypertrophic scars and keloids has shown acceptable outcomes, however there is a lack of information about the combination of Nd:YAG and fractional CO_2 laser in the management of this type of scars. The objective of this study is to analyze the efficacy and safety of this combination therapy in the treatment of burn scars.
Study: A prospective single-site study was conducted with Patients who underwent 4 sessions of 1064 nm Nd:YAG laser every 2 weeks followed by fractional CO_2 laser in the treatment of burn scars. Blinded independent investigators evaluated the scars using the Vancouver Scare Scale (VSS) at baseline and 1 month after last treatment. Subjective assessment by the patient was recorded using the patient component of the Patient and Observer Scar Assessment Scale (POSAS).
Results: Thirteen Patients (phototype III–VI) with 19 burns scars were enrolled. The mean age was 20 years (range 1–60), 53% male. Out of nineteen scars, eight (42%) were hypertrophic and eleven (58%) keloids. The mean time since trauma was 8 months (range 3–36). VSS average at baseline was 9 pts in hypertrophic scars and 10 pts in keloids, with a final improvement of 43% and 35% respectively after treatment with greater relevance in vascular 47% and pliability 44%. Regard to POSAS, there was a rating of 54 pts before treatment in hypertrophic, and 62 pts in keloids. After treatment was noted an improvement of 39 and 36% respectively. Amelioration was remarkable on pruritus 59%, pain 54% and stiffness 37% of the total population.
Conclusion: The combination of 1064 nm Nd:YAG and CO_2 Fractional is a safe and effective therapeutic alternative in the management of hypertrophic and keloid scarring post burn, with a greater impact in terms of associated symptoms.

#136

TRANSEPIDERMAL ELIMINATION BY ABLATIVE FRACTIONAL CO_2 LASER IS AN EFFICIENT SATISFACTORY THERAPEUTIC MODALITY OF XANTHELASMA PALPEBRUM

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Background: Xanthelasma palpebrum is one of the most common types of xanthomas. More than 50% of patients presenting with xanthelasma are hyperlipedaemic. Management of xanthelasma is challenging to all physicians, carrying the risk of incomplete removal leading to recurrence, or scar formation. The aim of the study is to compare between super pulsed and fractional CO_2 in treatment of xanthelasma palpebrum.
Study: An intrapatient comparative prospective study on a total of 20 adult patients with bilateral, nearly symmetrical 48 xanthelasmas. Lesions on the right side were completely removed by ablative super pulsed CO_2 laser (0.5–1.5 Watts) in one session and the left side received 3–5 sessions of fractional CO_2 laser (power: 20 watts, spacing: 500 μm and dwell time 500–700 μsec with 1–2 stackings and 1–3 passes) at 4–6 weeks interval. Documentation of results was done usisng photography.
Results: As regards lesions treated with ablative super pulsed CO_2 laser, there was a significant change in thickness ($p = 0.045$) and size of lesion ($p = 0.008$) before and after therapy. While, lesions treated with fractional CO_2 laser showed significant change in thickness ($p = 0.001$) and size of lesion (0.001) before and after treatment. A significant difference was detected ($p = 0.004$) on comparing the score of color improvement after super pulsed CO_2 laser treatment and fractional CO_2 laser. Patients satisfaction showed a more statistical difference in lesions treated with fractional CO_2 than those treated with super pulsed CO_2 laser ($p = 0.001$).
Conclusion: Compared to super pulsed CO_2 laser, fractional CO_2 laser is an equally effective therapeutic modality of xanthelasma palpebrum offering no down time or scaring. Adjusting the used parameters to minimize the number of sessions is recommended.

#137

FRACTIONAL CO_2 LASER ASSOCIATED WITH Q-SWITCHED YAG LASER FOR THE REMOVAL OF TREATMENT-RESISTANT TATTOOS

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Background: Tattoo removal treatments have been a challenge even with the best technologies currently available. We are frequently faced with patients who are resistant to the treatment with Q-switched laser commonly used in the market, which demotivates many of them, who end up not following the treatment. The association of fractional CO_2 laser, prior to the Q-switched laser has been a frequently used option in our clinics with outstanding results.
Study: This study was conducted to show the results, safety and effectiveness of associating fractional CO_2 laser simultaneously with the YAG laser, in a prospective study in more than 300 patients who looked for our services at the Leger clinics in Porto Alegre and São Paulo, Brazil. The procedure is performed in patients who have presented resistance to the isolated use of YAG laser. We used to apply the fractional CO_2 laser to improve the skin quality or in case of color changes in patients who had managed to have their tattoos totally removed. And in the last years we have been associating the CO_2 laser concomitantly with the Yag laser in those patients that have showed more resistance to the removal of the pigment with the sole use of the YAG laser.
Results: The TMZ (thermal micro-zones) created by the fractional CO_2 laser improve the action of the YAG laser when subsequently applied, making the laser beam act directly on the pigment particles that are found on the dermis, which contributes to a

higher effectiveness in the photo-acoustic effect of the Q-switched laser.
Conclusion: The results in the patients treated with the association of the two lasers have been photographically registered and it has been observed both by the medical staff and the patients themselves an improvement, not only in the absorption of the pigment particles, but also in the skin quality, and with a more harmonious skin coloring.

#138

NON-ABLATIVE FRACTIONAL Q-SWITCHED Nd:YAG 1064 nm FOR REPAIR OF PHOTOAGING SKIN

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Background: Q-switched 1064 nm laser is associated with rapid vaporization and thermal expansion stresses leading to skin mechanical damage and typically used for correction of exogenous and endogenous deep pigmentation. Giving the common place of fractional, infrared-domain milliseconds non-ablative lasers in aesthetic dermatology, a novel non-ablative fractional Q-switched 1064 nm laser was studied for photo-aging skin correction.
Study: Ten healthy female subjects (Age ranging 35–53 years, mean 44.3) and skin types I-IV) were diagnosed with mild-to-moderate facial photo-damage, hyper-pigmentation, telangiectasia, laxity, skin roughness and actinic keratosis. Patients were treated with non-ablative fractional Q-Switched 1064 nm Nd:YAG laser (Harmony XL, Alma Lasers Ltd.). Treatments consisted of 4 sessions at 2–4 week intervals. Follow-up (FU) visits were 1 and 3 months following the final treatment.
Results: Utilizing the Glogau scale, 6 Subjects were graded Type II (means wrinkles in motion), and 4 Subjects were graded Type III (means wrinkles at rest) at Baseline. At the FU2, 3 month post final treatment, 60% of the subjects were graded with at least a one point improvement in the overall Glogau global assessment. Between baseline and FU2, Investigator assessments showed the following improvements: Hyperpigmentation 70%, Telangeiectasis 80%, Laxity 80%, Tactile Roughness 60%, and AKs 60%. Pain assessment was reported between 0 to 2 in all treatments (scale 0–10). Of expected side effects, erythema was most common, – occasionally being reported as high as a 2 (scale 0–10). No unexpected adverse effects were reported.
Conclusion: The non-ablative fractional Q-Switched 1064 nm Nd:YAG laser is safe and effective in improving signs of mild-to-moderate photodamage skin irregularities with no downtime, no-to-minimal pain, and without any adverse side effects.

#139

A PILOT STUDY ON THE EFFECTS OF HIGH INTENSITY FOCUSED ULTRASOUND ON UPPER LID PTOSIS IN ASIAN PATIENTS

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Background: Lid ptosis refers to drooping of an upper eyelid of one or both eyes. Ptosis can affect both children and adults, but usually occurs because of aging, this prompts patients to seek doctors consult. High intensity focused ultrasound (HIFU) is an energy modality that can propagate through tissues resulting into thermal coagulative change within the focal region of the beam while the remaining regions are unaffected.
Study: We evaluated the efficacy of high intensity focused ultrasound in upper lid ptosis, using margin reflex distance, margin fold distance and margin crease distance as parameters and to statistically evaluate its significance. 15 Patients males and females was selected, aged 30–55 years old. All subjects had 1 session of High intensity focused ultrasound (Ulthera).
Results: Results reveal Ultrasound appears to be a safe and effective modality for facial skin tightening. A single ultrasound treatment of the forehead and around the eye area yielded an average increase in MDR1 of 0.95 mm mean difference for the Right eye and 1.15 mm mean difference in the left eye after 3 months of 10 patients. Marginal Crease Difference mean average for the right eye is 0.85 mm increase and 0.75 increase after 3 months.
Conclusion: All patients manifested both increase in MDR1 and MCD. The study is statistically significant and has proven that HIFU is effective in addressing Lid ptosis.

#140

SPECIFIC MICROPORE DIMENSIONS FROM VARYING SETTINGS WITH A PORTABLE FRACTIONAL ERBIUM LASER- HISTOLOGICAL DATA FROM *EX VIVO* PORCINE SKIN

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Background: Ablative fractional laser (AFxL) is increasingly used for a variety of skin conditions, which emphasizes the need for knowledge about specific laser-tissue interactions. The aim of this study was to investigate the relation between micropore dimensions and varying laser parameters by analyzing a wide range of shoot profiles.
Study: Ex vivo pig skin was exposed to fractional Er:YAG laser at 2940 nm, spot size 225 μm and 5% density. Four different settings were used in combinations of 50–225 μs pulse durations, 1.15–2.22 W and 2–50 stacks, delivering total energy levels from 4.6 to 640 mJ per individual laser channel. Histological endpoints were ablation depth (AD), ablation width (AW) and coagulation zone (CZ) ($n = 136$ sections analyzed). Histological endpoints were evaluated by comparing laser settings with multiple linear regression analyses. Logarithmic transformations were applied to obtain linear curve fits.
Results: Data expressed a wide range of micropore dimensions from epidermal pits (median 66 μm, range: 16–106) to deep cone-shaped micropores, reaching mid-dermis (median 926 μm, range 460–1348). Within specific laser settings used, the AD increased with increasing amount of total energy delivered. Micropores of identical AD's were therefore, created from different amounts of total energy delivered, which however, affected dimensions of the CZ and AW. CZ varied from 17–122 μm and depended linearly on the total energy delivered (r^2:0.54–0.85, $p < 0.0001$). AW varied from 131–422 μm and depended on number of stacks used (Log_{10} (stacks), r^2:0.53–0.61, $p = 0.0001$).
Conclusion: These data enables the design of unique micropores of specific AD and varying dimensions of CZ and AW. It is the clinical perspective that optimal combinations of AD, AW and CZ

allow physicians to meet individual requirements for different clinical treatments.

NURSING/ALLIED HEALTH

#145

LASER THERAPY: AN ADJUVANT TREATMENT IN ACUTE AND CHRONIC WOUNDS REPAIRING

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Background: Acute are related to surgery procedures and chronic wounds are related to patients that remain immobile on bed. Nursing assistance is needed in order to prevent the high risk of complications. It's the most common in such situation to find wound ulcer, vascular sore and diabetic neuropathies lesions. Low Level Laser Therapy (LLLT) has being applied to assist the chronics wound repairing process that aid the cellular and tissue resolution through the anti-inflammatory, cicatricial and analgesic effects. The aim of this study was to evaluate the contribution of laser therapy in different acute and chronic wounds repairing, as an important adjuvant treatment associate to the hygiene and antisepsis cares in the accomplishment of the lesion dressings.
Study: After 10 years of practice in our clinic, against the morbidity prevention, using LLLT for repairing acute wound surgeries and chronic wounds, such as: wound pressure, vascular lesion and diabetic neuropathies wound, have been carried out. The basic parameters taking in consideration were: the patient general conditions, age, corporal surface and SAEF (Spatial average energy fluency). Diode Lasers with different wavelengths, varies from (630 nm to 655 nm and Power = 25 mW–30 mW) and (808 nm, Power = 250 mW), surrounding the lesions area were applied.
Results: For all treatments there were reductions in sore exudates, the presence of viable granulated tissue with improvement of vascular perfusion, foreseen the edges retraction as same as to control bacterial proliferation, thus preventing skin infection and other complications.
Conclusion: The laser therapy is the main ally for assisting all types of lesions, which contribute for repairing different acute and chronic wounds with effectiveness, therefore improving the quality of life for all patients treated with LLLT.

#146

FRACTIONAL LASERS AND ITS DIFFERENT APPLICATIONS

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Background: Fractional technology is based on the concept of treating columns of skin called microthermal treatment zones (MTZ) while leaving some of the skin in between intact. The energy used and the penetration can be greater without the risk of scarring or causing adverse events. Additionally, the healing time is less because only part of the skin is affected with the laser. There are two parameters that can vary on these types of laser: density of the MTZs and the energy applied per MTZs, this latter one confers the depth of penetration. Also, these lasers can be ablative and not ablative and each one of these modalities has different wavelengths. Many types of fractional lasers are available today and they can treat a broad range of skin conditions that go from many types of scarring, stretch marks and pigmentation disorders to photoaging.
Study: The high volume of laser procedures in our center gives us an extensive experience. We offer all the current available modalities of fractionated lasers and tailor each treatment for the patient and condition that needs to get treated. Depending on the type of laser used, a different pre-operative evaluation and post operative care is required. Also it is important to be aware of the possible complications that each of the laser procedures can originate.
Results: We present an extensive review of the types of fractionated lasers along with the different indications for each one of them, the room set and precautions that needed to be taken in the procedure and the post-care the patient is required to take.
Conclusion: This comprehensive review offers an approach to the different fractional lasers that are available as well as the details that each one of the procedures entails.

#147

ADVANCES IN TATTOO REMOVAL

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Background: The incidence of tattoo placement is growing with years and the need for removal is equally increasing. Even though there are many lasers available for their removal, the current standard of care is far from being ideal. The challenge of complete removal is still there, especially in colors like blue and green where the response is still very modest. Also, more often than not, the sessions required to achieve good results are many, reaching more than 10 or 20 times. Frustration both from the side of the clinician and the side of the patient is very common.
Study: In our center, we have achieved success with new technologies that have given some answers to these problems. The new pico second laser has proven to give good results for both recalcitrant tattoos as well as blue and green ink.
Results: We also developed a new technique for reducing the treatment sessions with a substance called perfluorodecalin (PFD). It is an innocuous compound already used in the ophthalmology, pulmonology and cardiovascular fields with no side effects. The principle is based on oxygen diffusion produced upon laser treatment with PFD. We have achieved excellent results with no complications.
Conclusion: We will provide an extensive review on these new procedures, their differences with actual standard of care, including the measures that needed to be taken upon the procedure and post care.

#148

TOPICAL ANESTHESIA IN A LASER PRACTICE

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Background: The majority of laser treatments require pain management. There are many options available in the topical field, each one of these with different profile of side effects, onset of action and duration of effect. In order to efficiently and safely use each one of the options it is important to have knowledge of what they entail.

Study: In our practice, the usual anesthetics used are BLT (Benzocaine 20%/lidocaine 6%/tetracaine 5%), lidocaine 7%/tetracaine 7%, lidocaine 2%/tetracaine 2%, lidocaine 30% and EMLA (lidocaine 2.5%/prilocaine 2.5%. For the topical anesthetics that have lidocaine as a component, precaution needs to be taken with patients that have a compromised liver function since they may develop some of the side effects as well as the patients with cardiovascular arrhythmias.

Results: For the benzocaine compound the risk of methemoglobinemia needs to be closely monitored and their signs need to be well known. Allergies in general to any of the compounds need to be closely documented and separate attention should be taken to sulfa allergy since benzocaine can cross react with it. Also, the common reactions need to be well known to know what to expect when applying each one of the topical anesthetics. Other important elements to take into account is the surface of application, the depth of the laser and the time the procedure will take because depending on them, decision will be made on which of the options should be used.

Conclusion: In order to use topical anesthesia during laser procedures the risks, side effects profile and a good medical history of the patient needs to be done.

#149

MECHANICAL OR CHEMICAL RESURFACING? COMBINE FOR OPTIMAL TRANSFORMATION

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Background: Mechanical resurfacing and chemical resurfacing techniques have been around for thousands of years. Both methods of skin resurfacing can produce results for patients with pigmentary disorders, fine rhytides, acne scarring, oily/sebaceous skin and overall tone and texture. Both methods have evolved into popular non-invasive cosmetic procedures for photo-aging and other common cosmetic concerns. Which method of resurfacing is better, mechanical or chemical? The objective is to show that optimal results are obtained when the two procedures are combined during a single treatment.

Study: Mechanical resurfacing (aka microdermabrasion, mechanical exfoliation or micro-resurfacing) employs the use of a medium, such as crystals, a diamond tip or a bristle tip. The medium is combined with vacuum for exfoliation of the stratum corneum as well as circulation, which supports the inflammatory response in the dermis. An increase in collagen remodeling is shown as well as the stratum corneum normalizing and achieving a healthy 'basket weave' appearance, according to studies in the Journal for Dermatology Surgery. Also increases hydration by improving the barrier function of the skin. Chemical resurfacing (aka chemical peels or chemical exfoliation) uses a chemical, such as glycolic, Jessner's or Trichloracetic Acid (TCA), to exfoliate the stratum corneum. There are different levels of chemical resurfacing, from superficial to deep peels. The stronger the peel, the better the results but along with deeper peels come risks and complications. Some of the most popular agents used for chemical resurfacing are glycolic, lactic, salicylic, Jessner's and TCA. When the stratum corneum is removed from the mechanical resurfacing immediately prior to chemical resurfacing, the peeling agent will have increased penetration into the skin. This will also decrease downtime since peeling agents usually go after the keratin.

Results: Both methods show an improvement in the skin, but the combination of mechanical resurfacing and chemical resurfacing delivers a synergistic result. Not only are results vastly improved but downtime is also decreased.

Conclusion: Patients want results with little to no downtime, and the combination of mechanical with chemical resurfacing during a single treatment capitalizes on these demands.

PHOTOBIOMODULATION

#151

LIGHT THERAPY AT 808 nm INDUCES A DOSE-DEPENDENT ALTERATION IN MICROGLIAL POLARIZATION

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Background: Despite success using light therapy (LT) in promoting recovery after central nervous system (CNS) injury, the effect of LT on microglia, the primary mediators of immune and inflammatory response in the CNS, remains unclear. Microglia exhibit a spectrum of responses to injury, including polarization into pro- or anti-inflammatory phenotypes. Pro-inflammatory (M1 or classically activated) microglia contribute to chronic inflammation and neuronal toxicity, while anti-inflammatory (M2 or alternatively activated) microglia play a role in wound healing and tissue repair.

Study: The effect of LT on microglial polarization was therefore investigated using colormetric assays, immunocytochemistry, proteomic profiling and RT-PCR *in vitro* after exposure of primary microglia or the BV2 microglial cell line to LT of differing energy densities: 0.2, 4, 10 and 30J/cm^2 (28, 565, 1413, and 4239 seconds of exposure, 50 mW power laser, 808 nm wavelength, 7.14 mW/cm^2 output power on 7 cm^2 area at 9cm distance).

Results: We now show that LT has a dose dependent effect on M1 and M2 polarization of microglia. Specifically, LT with energy densities between 10 and 30 J/cm^2 could induce an M1 phenotype in microglia, with dose-dependent induction of reactive oxygen species (ROS) and nitric oxide (NO) as well as expression of the classical M1 cell marker CD86. Markers of the M2 phenotype, including CD206 and TIMP1, were observed at lower energy densities of 4 to 10 J/cm^2.

Conclusion: These data suggest that the typical Arndt-Schulz law of activation after LT does not hold true in cells with a spectrum of responses, and that LT can alter microglial phenotype in a dose dependent manner. These data are therefore of

important relevance to not only therapies in the CNS but also to understanding of LT effects and mechanisms.

#152

TWO-PHOTON LUMINESCENCE PROPERTIES OF GOLD NANORODS FOR MACROPHAGE TARGETING

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Background: Gold nanorods can be internalized by macrophages (an important early cellular marker involved in atherosclerosis and cancer) and used as a contrast agent for a variety of imaging techniques for macrophage targeting. The objective of this study is to compare two-photon luminescence (TPL) properties of four sizes of gold nanorods with surface plasmon resonance at 700, 756, 844 and 1060 nm respectively.

Study: TPL from single nanorods and rhodamin 6G particles was measured using a laser-scanning TPL microscope. TPL emission spectrum from nanorods was recorded by a spectrometer with a photon multiplying CCD.

Results: All four sizes of nanorods produced strong TPL intensities with dependence on the excitation wavelength, indicating a plasmon-enhanced two-photon action cross section (TPACS). Quadratic dependence of luminescence intensity on excitation power (confirming a TPL process) was observed at low power levels, followed by an intensity saturation or decrease at high power levels due to a photobleaching effect. Largest TPACS of a single nanorod was measured to be 11642 GM compared to 23 GM of a single rhodamin 6G particle at 760 nm excitation. Characteristics of nanorod's TPL emission spectrum can be explained by the recombination of electrons near the Fermi level with holes near the *X* and *L* symmetry points in the Brillouin zone.

Conclusion: Comparison results of TPL brightness, TPACS and emission spectra of nanorods can be used to guide selection of brightest imaging contrast agent and design of imaging systems with fiber-based detection.

#153

ORGANIC LIGHT EMITTING DIODE AND LASER ARE COMPARABLE FOR IMPROVING DIABETIC CUTANEOUS WOUND HEALING IN RATS

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Background: A major complication for diabetic patients is chronic wounds due to impaired wound healing. Zucker Diabetic Fatty (ZDF) rats can be induced into type II diabetes and exhibit impaired wound healing as seen in human. The organic light emitting diode (OLED) promotes ATP expression, metabolic activity and cell proliferation in a hyperglycemic diabetic *in vitro* model. In this study, the effectiveness of OLED and LASER was compared for treating diabetic cutaneous wound healing using ZDF rats.

Study: An 8 mm diameter cutaneous wound was made on the right (treatment side) and left (control side) flank of ZDF rats. Wounds on the right side were treated with the OLED (630 nm wavelength) or LASER (635 nm wavelength). Light irradiation was performed immediately following surgery and once daily for 7 days. The power density for both light sources was 10 mW/cm^2 and the energy density was 5 J/cm^2. Spot size was 1.5 cm diameter. Animals were euthanized at 36 hours for immunohistochemistry using antibodies to Fibroblastic Growth Factor 2 (FGF2) and to label macrophages (CD 68) or day 13 for histological scoring. Wound closure was digitally photographed daily and measured using ImageJ.

Results: There was no significant difference between LASER and OLED groups on wound closure rate. Both LASER and OLED had significantly higher histological scores than the control side; no statistical difference was found between two treatments. A significantly higher expression level of FGF2 was found in the OLED group compared to control. OLED also significantly enhanced the macrophage activation during initial stages of wound healing. This enhancement may contribute to shorter inflammatory phase and better healing rate.

Conclusion: OLED and laser have comparative effects on wound closure in diabetic cutaneous wound healing. Accelerating initial inflammatory responses and FGF2 expression may contribute to the effectiveness of the OLED treatment.

#154

TRANSCRANIAL LOW-LEVEL LASER (LIGHT) THERAPY IN MICE: TRAMAUTIC BRAIN INJURY AND BEYOND

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Background: Traumatic brain injury (TBI) has no good treatment at present. Transcranial low-level laser (light) therapy at near-infrared wavelengths (810 nm) penetrates the scalp and skull and provides many beneficial effects to the brain. These include neuroprotection, anti-apoptosis, anti-inflammation, angiogenesis, neurogenesis and synaptogenesis. These effects could also be beneficial in numerous brain disorders.

Study: Mice were subjected to two different types of TBI (closed head and controlled cortical impact (CCI)) and treated with LLLT to the head starting at 4 hour post-injury. The wavelength, fluence, power density, pulse structure and treatment repetition were varied. Mice were followed with neurological severity score, wire grip test, forced swim test, tail suspension test, Morris water maze, and numerous immunofluorescence studies on brain sections removed at sacrifice.

Results: In the closed head model a single treatment 4-hours post-TBI with CW lasers at 660 nm and 810 nm were effective, while 730 nm and 980 nm were not. In the CCI model 810-nm laser pulsed at 10 Hz was superior to 810 nm laser at CW or pulsed at 100 Hz. In another study we compared a single treatment 4 hours post TBI with three daily treatments and with fourteen daily treatments. Three daily treatments gave best results while 14 treatments gave no benefit. This result was explained by the lack of neurogenesis after 14 treatments that was apparent after 3 treatments. Upregulation of a neurotrophin (BDNF) and markers for synaptogenesis was also seen.

Conclusion: The beneficial effects in stimulating neurogenesis, synaptogenesis and BDNF after transcranial LLLT suggest it may have wider applications beyond TBI to neurodegenerative

diseases such as Alzheimer's and psychiatric diseases such as major depression.

#155

PAIN THRESHOLD INCREASING ACHIEVED BY LOW-LEVEL LASER THERAPY IN RATS

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Background: A dorsal root ganglion (DRG) is a nodule that contains bodies of neuron cells; they lie along the vertebral column by the spine and play a role in nociception. Laser irradiation can induce varicosity formation and blocks fast axonal flow in small and medium diameter rat DRG neurons in vitro.

Study: We illuminated transcutaneously with low-level laser the L4 dorsal root ganglion of healthy rats (***Rattus Novergicus)***. The animals received a single treatment with continuous-wave 660 nm lasers (120 J/cm^2, delivered at 1 W/cm^2). The limiar pain threshold of right hind paw was measured with Von Frey hair before and 1/2, 1, 2, 3, 6 and 24 hours after the illumination.

Results: There is a increase in limiar pain threshold that starts just after illumination, has a maximum in 3 hours, and remains during 6 hours. 24 hours after the irradiation the limiar pain threshold returns to the baseline. During the period of lower sensitivity the animal can afford the double of pressure stimulus that they afford before the laser irradiation.

Conclusion: The effectiveness of 660 nm light agrees with previous publications, it can be explained by the absorption spectrum of cytochrome oxidase and the blockage of the conduction of nociceptive signals in primary afferent neurons. This work intends to be a piece in the puzzle to understand the mechanisms of pain relief effect by laser irradiation.

#156

980 nm WAVELENGTH LIGHT DECREASES MECHANICAL ALLODYNIA IN A RAT NEUROPATHIC PAIN MODEL

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Background: Peripheral neuropathy is a common debilitating disorder. We hypothesized that 980 nm wavelength light would improve neuropathic sensory alterations in a spared nerve injury rat model.

Study: A 5 mm segment of the common peroneal and tibial nerves was removed and their proximal ends were ligated. The sural nerve was left intact. Seven days post-surgery, rats were randomized into light treated group (LT) and control group (CTRL). For the LT, a 980 nm wavelength laser was used to transcutaneously irradiate the dorsal root ganglia (DRG) and spinal cord segments related to the injured nerves (output power 1.25 W, 19 s, 10 mW/cm^2 at depth of the DRG) and the lateral skin of the involved hind paw (1W output power, 20s, power density 10 or 60 mW/cm^2 at sub-dermal level). Von Frey filaments were used to measure mechanical allodynia. Testing was done seven days after surgery (baseline) and days following two light treatments (3, 7, 11 and 15). On day 15, the rats were euthanized. Skin samples were collected for immunohistochemistry. Protein gene product 9.5 (PGP9.5) anti-body was used to label intra-epidermal nerve fibers and Langerhan cells (LC).

Results: The CTRL exhibited increased mechanical allodynia. LT significantly decreased the mechanical allodynia compared to the CTRL on days 7 (60 mW/cm^2), 11, and 15 (both power densities). In the CTRL, there was distal degeneration of intra-epidermal Ad and C nerve fibers and denervation of the LC accompanied by increased expression of PGP9.5. In the LT group, there was regeneration of the intra-epidermal nerve fibers, re-innervation of the LC and a decrease in expression of PGP9.5.

Conclusion: LT significantly decreased mechanical allodynia. Cutaneous changes involving distal nerve degeneration, and LC have been implicated in development of chronic pain and sensory aberration in peripheral neuropathy. These results indicate that transcutaneous irradiation can alter these neuropathic changes.

#157

LOW LEVEL LASER THERAPY EFFECTS IN EXPRESSION OF THE METALLOPROTEINASE MMP2 AND MMP9 AND PERCENTAGE OF COLLAGEN TYPE I AND III IN PAPAIN CARTILAGE INJURY MODEL

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Background: Cartilage injury and its destruction are common in osteoarthritis (OA) and are associated with increased levels of several matrix metalloproteinases (MMPs), that are considered an important class of proteinase in terms of cartilage degradation, because they can degrade all components of complex extracellular matrix (ECM), including type II collagen. Investigate histologically as well as protein expression of metalloproteinases 2 and 9 the effect of therapy with low-power laser operating at 50 mW and 100 mW power on joint damage in rats induced by papain.

Study: Sixty male Wistar rats were randomly distributed into 4 groups of 15 animals each: G1, was control negative group, G2 control positive group, G3 was submitted to lesion and treated with LLLT at 50 mW, and G4 were treated with LLLT at 100 mW. The animals were submitted to OA induction with a mixture of 4% papain solution. At the euthanasia day, it was performed a procedure for obtaining the articular lavage. Which was immediately centrifuged and the supernatant stored at -80°C for protein expression analysis by Western Blot. The material was stained with Hematoxylin and Eosin for the histopathological description and Picrosirius Red, was used to estimate the percentual of collagen fibers. As normal distribution was determined, ANOVA with Tukey's post hoc test was used for comparisons between periods 7, 14 and 21 days were compared within each group as well as between. All data are expressed as mean and standard deviation values, with the null hypothesis considered $p < 0.05$.

Results: The both laser groups were efficient on tissue repair and decreasing the inflammatory process however the ge group was better regarding to reduction of metalloproteinase 2 and the increased collagen type III.

Conclusion: 50 mW laser was more efficient in the modulation of matrix metalloproteinases and tissue repair.

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#158

LASER THERAPY IN COLLAGENASE-INDUCED ACHILLES TENDINITIS IN RATS: BIOCHEMICAL AND BIOMECHANICAL ASPECTS

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Background: Tendinopathy is a common and debilitating degenerative disease that takes time to heal and where the tendon rarely recovers its original mechanical strength and elasticity. The corresponding inflammatory process can promote a degradation of collagen type I and II found in tendon tissue, with a concomitant production of matrix metalloproteinases (MMPs). Since three decades, low level laser therapy (LLLT) is used on the base of results from clinical studies of mixed tendinitis and other tendinopathies, but the biological mechanisms involved remain not completely understood. In this paper, the effects of LLLT on the short-term biochemical and biomechanical properties are examined and compared with widely used diclofenac sodium in the case of the rat Achilles tendinitis.
Study: Wistar rats are inoculated with collagenase (1 mg/ml; Sigma) and treated with diclofenac sodium or laser therapy (1 or 3 Joules). The tensile behavior of tissues is characterized through successive loading – unloading sequences providing several mechanical parameters (forces, stretches, stiffnesses).
Results: It is shown that during the acute inflammatory process of the tendon the high levels of MMP-3, MMP-9 and MMP-13 (measured by RT-PCR) are significantly correlated to the measured mechanical properties. The treatment by non-steroidal anti-inflammatory drugs (NSAIDs) such as diclofenac sodium, presents a low protector effect and can affect the short-term biochemical and biomechanical properties. Furthermore, LLLT with 1 J exhibits the best results both in MMP reduction and mechanical properties.
Conclusion: We propose in particular to examine the mechanical behavior of this tissue when subjected to stresses including successive sequences of loading - unloading. During acute inflammatory process of the tendon the high levels of MMPs such as MMP-3, MMP-9 and MMP-13 have significantly modified the mechanical properties of tendon. In other hand, the reduction these matrix metalloproteinase would have a protective action translating to an improvement in mechanical properties. The treatment by non-steroidal anti-inflammatory drugs such as diclofenac sodium perhaps despite being known for analgesic effect presented low protector effect and can affect the short-term biochemical and biomechanical properties in the case of the rat Achilles tendon. Low laser therapy 1 J and 100 mW showed to best results both in the MMP reduction and some mechanical properties.

#159

HEMODYNAMIC CHANGES POST LOW LEVEL LASER THERAPY IN ELDERLY OBESE RATS: AN EXPERIMENTAL STUDY

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Background: Systemic Arterial hypertension is a multifactorial disease that affects 600 million people worldwide and 25% of the Brazilian inhabitants. Several studies have evidenced an important role in the hypertension pathogenesis related to inflammatory processes. Low Level Laser Therapy (LLLT) is applied in diverse conditions, including reduction of inflammatory process. Some biophysical experiments have been conducted by our group to assess the laser light distribution and the rheological properties of the blood so that the best parameters could be determined. The present work purpose was to evaluate the response of LLLT in systemic blood pressure and heart rate.
Study: In Wistar rats a cannula was inserted into carotid artery to measure blood pressure (AP) and heart rate (HR) prior to laser irradiation in the caudal area with following parameters: Diode CW Laser (DMC, Brazil) with ? = 685 nm, Power = 20 mW and Time = 130 s. The measures of the systolic pressure and heart rate were recorded in three different stages: prior (baseline), during and after 4 times Laser application.
Results: Low doses of LLLT did not alter the hemodynamic parameters when separately applied compared to baseline; however, the sum of all 3 LLLT applications led to a significant drop in the systemic blood pressure and heart rate values. Likewise, a substantial decrease of the underlying parameters was noted when a high dose was applied.
Conclusion: LLLT application onto rat's caudal area had a synergetic effect in elderly obese rats with potential impact in hemodynamic and autonomic parameters. Based on our current experimental data, it is possible to infer that the sum of low doses or just one high fluence of LLLT irradiation could alter the response of hemorheological properties.

#160

THE EFFECT OF LOW LEVEL LASER THERAPY ON ACUTE KIDNEY INJURY INDUCED BY ISCHAEMIA AND REPERFUSION IN RATS

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Background: Acute Kidney injury (AKI) is associated with a high degree of morbidity and mortality. Ischaemia-reperfusion injury (IRI) is one of the major causes of AKI. Currently, inflammatory cytokines specially TNF-, seems to be involved in the injury and no pharmacological agents have proven to prevent AKI after IRI. In the last decade we demonstrated that LLLT is able to inhibit inflammatory markers including cytokines (TNF- and IL-1 for example). Aims. Here we investigate the effect of LLLT on inflammatory cytokines in Rat kidney after IRI.
Study: After approval of the Ethical Committee for Animal Use, Male Wistar rats were taken to the experiment table and sedated with ketamine plus xilazyne. The anterior abdominal wall was incised on the median line. The left renal pedicle was found and blood circulation stopped via an atraumatic vascular clamp. After 45 min of ischaemia the clamps were released and blood circulation was allowed. After recirculation a colour change was observed in the kidney for 2 min. After 2 hours of reperfusion, the kidney was removed for histological and biochemical analysis. In the laser treated group, an energy dose of 3 Joules was delivered in two points centrally and bilaterally, 5 min after reperfusion.

Results: Biochemical analysis revealed a significant decrease in IL-1ß (75% ± 6) and IL-10 (28% ± 4) after LLLT. TNF-a was not altered by the treatment. Morphological evaluation demonstrated a better cell organization in the laser-treated group and a decrease of inflammatory cells infiltration.
Conclusion: Our results suggest that LLLT may reduce or ameliorate the AKI induced by ischaemia and reperfusion of the kidney.

#161

EFFICACY OF LOW-LEVEL LASER THERAPY COMBINED WITH LYMPHATIC STIMULATION FOR CIRCUMFERENCE REDUCTION OF THE WAIST

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Background: Low-level laser therapy (LLLT) at 635 nm has emerged as a viable non-invasive body contouring solution - validated by numerous peer-reviewed publications. LLLT induces the formation of a transitory pore within adipocyte membranes releasing accumulated intracellular lipid material. The lymphatic system is responsible for removing the released lipid material. Accordingly, we evaluated the clinical utility of combining LLLT at 635 nm and lymphatic stimulation for non-invasive body contouring of the waist.
Study: Thirty-eight subjects were treated with a monochromatic (635nm), multi-head scanner laser. Subjects were treated every-other-day for two weeks for six treatments. Subjects were treated for a total of 40 minutes. Following each LLLT treatment, subjects received lymphatic stimulation with pressotherapy for 20 minutes. Waist circumference was evaluated across three separate evaluation points: baseline and weeks 2 and 3.
Results: Subjects demonstrated a statistically significant circumference loss of −2.8 cm (1.1 inches) in two weeks ($p < 0.0001$). In a previous study, assessing the efficacy of LLLT the reduction observed across the waist was 0.98 inches. With the addition of lymphatic stimulation, increased circumference reduction of 0.12 inches or 0.30 cm was reported.
Conclusion: These data show that the introduction of lymphatic stimulation improved waist circumference reduction following treatment with LLLT at 635nm. Additionally, this reinforces the notion of providing patients with a multifaceted non-invasive body contouring therapy.

#162

REDUNDANT PATHWAY MEDIATED PHOTOBIOMODULATION ENHANCEMENT ON A MYOBLAST PROLIFERATION IN ITS PROLIFERATION-SPECIFIC HOMEOSTASIS

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Background: A proliferation-specific homeostasis (PlSH) is a negative feedback response maintaining a proliferation at its optimum level. Photobiomodulation has been found to enhance a normal proliferation in its PlSH in many laboratories, but its mechanism was left unsolved. The photobiomodulation of red light at 640 nm from light emitting diode array (RLED) on a normal myoblast proliferation was studied in this paper.
Study: The C2C12 myoblasts were cultivated in 10% fetal bovine serum and 4.5, 22.5 (normal glucose, nG), 45.0, 67.5 and 90 (high glucose, hG) mmol/L glucose, respectively. The hG and nG groups were irradiated with RLED at 0.035 mW/cm^2 for 15 min once a day for 3 and 6 days, respectively. All the parameters were routinely assessed.
Results: The PlSH in nG (nPlSH) was established. At day 3, hG decreased the proliferation rate, but increased the mRNA expression of insulin-like growth factor (IGF) 1 and forkhead transcription factor (FOXO) 3a, and RLED completely recovered the proliferation rate and the FOXO3a mRNA expression, but further increased IGF-1 mRNA expression so that the PlSH in hG (hPlSH) was established. RLED promoted the normal proliferation from day 4 on so that the enhanced PlSH (ePlSH) was established. RLED at day 3 increased IGF-1 mRNA expression, but decreased FOXO3a mRNA expression.
Conclusion: The photobiomodulation enhanced normal myoblast proliferation in ePlSH may be maintained by the simultaneous full activation of both nG induced redundant pathways in nPlSH and hG induced redundant pathways in hPlSH.
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#163

LASER THERAPY OF TRAUMATIC CENTRAL NERVOUS SYSTEM INJURIES

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Background: Nobel prize R. Levi-Montalcini demonstrated the regenerative properties of neurons, and may other Authors confirmed this discover. E. Mester and sons, Chekurov, V. Iniushin demonstrated anti-inflammatory effects of laser beams on human tissues. Many other Authors confirmed it. For these reasons we experimented the use of Non Surgical Laser Theraoy (NSLT) in the treatment of Traumatic Central Nervous System Injuries (TCNSI), since 2003 year. The goal of our study is the research of data useful for all patients with TCNSI, with the possibility of prediction of obtainable results.
Study: We compare the results obtained in different patients with similar lesions, treated with same procedure. We started our experimentation 9 years ago. 130 Patients enrolled have TCNSI occurred at least one year before laser treatment and documented by EEG, NMR, ESSP, and ESMP. All patients have total and/or subtotal sensory and motor paralysis under lesion level. Lasers used were 808 nm and 10600 nm and applied with a first cycle of 20 sessions, four a day. A therapy protocol was used according to the clinical conditions of each patient. We repeated in average half cycle for month.
Results: On Central Nervous System injuries, after first cycle the majority of patients had improvement sensory, motor and voluntary command and of EEG, RMN and ESSP and ESMP features. Further improvement added after each cycle. No side effect appeared, except rare burns of first degree, in correspondence of some bone prominence and metallic prothesis. Follow-up is positive after 4 year, for somebody for nine years.
Conclusion: Laser therapy procedures are really useful in the management of TCNSI. Follow up is extremely positive. Limit of this treatment is the need to perform a large number of irradiations for to obtain positive results.

#164

LOW LEVEL LASER THERAPY TO REDUCE COMORBIDITY IN SPINE SURGERY: PILOT STUDY

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Background: Over 300 thousand laminectomies are estimated to be carried out in the United States, with a failure rate higher than 40%. Postlaminectomy epidural adhesion is implicated as a main cause of "failed back surgery syndrome" and associated with increased risk of complications during revision surgery. The postoperative epidural scar can cause extradural compression or dural tethering, which results in recurrent radicular pain and physical impairment. Low-Level-Laser-Therapy (LLLT) is proven effective to aid in inflammation and wound healing. The authors present a pilot study to delineate and analyze the effects of LLLT in surgery of the spine.

Study: A prospective randomize placebo-controlled study conducted over this year. In this study, 20 patients undergoing laminectomy were randomly divided into 2 groups. In the first group, 10 patients received LLLT during surgery over dura mater, over subcutaneous and over the skin, 24h and 72h after surgery. In the second group, 10 patients were induced to think they were getting the same treatment. Were evaluated as markers ESR, C reative protein in the second and fifth days after surgery, temperature and visual analogue scale before and after application and drainage output in the first three days following surgery in both groups.

Results: Wilcoxon test was performed for independent samples, with a significance level of 95%. LASER group showed a drop in temperature of at least 33.8 oF, a smaller increase in inflammatory markers, a lower drainage output and a reduction of at least 3 points on the visual analogue scale before and after application of LLLT.

Conclusion: Our data indicate that the application of LLLT should be done during and after surgery. The use of LLLT in patients undergoing spine surgery with laminectomy showed a decrease in postoperative pain, inflammatory activity and better healing, assisting in the recovery and early return of patients to their daily activities.

#165

LOW LEVEL LASER/LIGHT THERAPY DIRECT AND INDIRECT TARGETS

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Background: The common method for applying LLLT is to aim light at an injury or lesion to promote healing, reduce inflammation or induce analgesia. However there is more to LLLT then just treating stressed cells around a pathology. Nerves, lymph, trigger points and blood are also influenced by light and not just by treating at the site of injury. Many laboratory and clinical research studies have shown that treatments remote from the site of injury produce statistical and clinically meaningful improvements to a range of pathologies. Analgesia can be induced anywhere proximal or distal to an injury as long as it is on the same nerve pathway. Myofascial trigger points distant from a pathology cause muscle tightness and shortening; they contribute to pain and dysfunction in arthritic joints and tendinopathies (as well as being a pathology in their own right), these can be deactivated with light. Lymph flow can be improved by treating nodes and lymph vessels proximal to an injury. There is sufficient evidence that blood irradiation improves flow, reduces oxidative stress and influences a variety of blood related products (platelets, red blood cells and lymphocytes). All of these will have power density, time, energy and fluence dependent effects. This presentation will be a brief overview of evidence; the wavelengths, power density, treatment time, treatment intervals and where to treat will be presented.

#166

ANALYSIS OF OPTICAL DOSIMETRY IN RAT-TAIL MAY CORROBORATE TRANSCUTANEOUS LOW-LEVEL LASER THERAPY IN BLOOD RESPONSE

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Background: Due to the great number of transcutaneous Low-Level-Laser-Therapy (LLLT) application in blood circulation, the study of light penetration through skin and its distribution inside the body becomes extremely important. A promising way of illumination, in animal model research, is the transcutaneous LLLT on the tail, tested in this work. The aims are to analyze the possibility of precise illumination through regions of the rat caudal area, to measure the penetration and distribution of red (? = 660 nm) and near infrared (NIR) (? = 808 nm) diode laser light, and compare optical properties of tail structures.

Study: The rat's tail (*Rattus norvergicus*) was separated from the body and a tail section was illuminated with red and NIR lasers in three points (0.5, 1.0, 1.5 cm) away from the cut. A high resolution camera, perpendicularly positioned, was used to obtain the images of the tail structures. Profiles of scattered and transmitted light intensities, parallel and perpendicular to the laser beam direction were obtained from the images.

Results: There is a peak in the scattered light profile corresponding to the skin layer. Due to the distinct optical properties, of veins, tendons, muscles and nerves, several peaks of scattered light are observed. The bone layer gives rise to a valley in the profile indicating low scattering coefficient or frontal scattering. NIR light was better transmitted into the tail with deeper penetration. The tail geometry as well as the tissue composition and optical properties give rise to an interesting wave guide effect.

Conclusion: The present work evaluated the light penetration and distribution inside biological tissues and seems to be a cost-effectiveness method to corroborate transcutaneous LLLT study in blood response.

#167

ANALYSIS OF THE LINEAR DEPENDENCE BETWEEN WEIGHT AND CIRCUMFERENCE CHANGE FOR LOW-LEVEL LASER THERAPY AT 635nm

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Background: As the non-invasive body contouring segment continues to grow, evaluating the clinical utility of emerging technologies under more stringent study parameters is becoming important. The circumference change generated by these technologies is often subtle compared to more invasive surgical procedures, and as a result, trials should properly evaluate the role confounding variables may have played in the reported results. For instance, the mean weight change is often reported in body contouring studies but weight change is never directly correlated to the reported circumference change. Herein, we evaluated the role weight plays in the reported circumference reduction for low-level laser therapy at 635 nm.
Study: Sixty-seven subjects presenting with voluminous subcutaneous fat along the truncal region were qualified and enrolled. Subjects received concurrent treatment of the waist, hips, and thighs from a monochromatic, multi-head laser scanner. Subjects were treated every-other-day for two weeks for a total six treatments. Subjects were evaluated at four separate evaluation points: baseline, weeks 2 and 3, and 2 weeks post-procedure.
Results: Subjects demonstrated an average circumference loss of −3.521 inches, which was reported by Jackson et al. (2009). The mean weight loss reported for test subjects was −1.11 lbs. compared with −0.31 lbs. for control subjects. A week linear dependence was reported for test subjects at weeks 1 and 2 with reported correlation coefficients of −0.026 and 0.63, respectively. Conversely, a correlation coefficient of 0.63 for control subjects was reported at week 2, which indicates a strong linear dependence between weight and circumference change. ANCOVA analysis across all evaluation points did not demonstrate a statistically significant dependence between body weight and body circumference change.
Conclusion: These results demonstrate the circumference reduction reported was not attributed to subject weight change.

#168

LOW LEVEL LASER THERAPY IN THE ACUTE WOUNDS POST CARDIAC SURGERY AND ITS RELATION WITH HEMOSTATICS MECHANISMS

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Background: Mediastinitis is a serious complication in the postoperative of cardiac surgery (CS). The prevalence of mediastinitis and osteomyelitis infections can reach up to 5.0% when utilize the transesternal access. The mediastinitis risks increase with the presence of preexisting conditions and/or surgical procedures associates, such as hemostatics alterations. The morbidities appear with different anomalies in the blood aggregation or factors that influence in erythrocytes/platelets interactions. During the corporal extra circulation (CEC) in CS, the anti-coagulation is regularly employed and later on an antagonistic is administrated to diminish the bleed risk. The fragility of the physiological mechanisms in regulating forward the acute inflammatory process can alter the blood hemostatics aggregation, resulting in complications of surgical incision repairing. The work\'s purpose was evaluated whether applying LLLT could prevent the sternotomy complications as same as improve the inflammatory response, then seek the regulation for the blood hemostatics aggregation.
Study: Prospective, quantitative and control study with 28 patients submitted to the cardiac surgery were divided into: Group I (just conventional treatment) - 14 patients (50.0%) had received anticoagulant and from these, 10 (35.7%) were under blood transfusion; Group II (conventional therapy plus LLLT on the immediate post operative (PO), 3° and 6° PO day) - 14 patients (50.0%) had received anticoagulant and from these, 7 (25.0%) had blood transfusion. Diode laser-CW ($\lambda = 655$nm, Fluence $= 8 J/cm^2$, SAEF $= 0{,}9 J/cm^2$, Power $= 25$ mW) surrounding the lesion were applied. The Mann-Whitney test for statistic analysis (p-value $<0{,}05$) were employed.
Results: In Group I: 5 patients (17.8%) had main complications in the surgical wound repair; Group II: no patient presented morbidity (p-value-0,077).
Conclusion: The coagulation cascade directly involves factors related to the hemostatics and aggregation in replying to the acute inflammatory process. Our study signalize that LLLT aid to develop microcirculation around sternotomy incision, also alter the blood viscosity/aggregation, as we encountered in previous study, that facilitate the acute wounds repairing post a major surgery.

#169

STUDY OF THE EFFECTS OF LOW-LEVEL LASER THERAPY ON THE MAXIMUM VOLUNTARY VENTILATON IN HEALTHY INDIVIDUALS

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Background: Low-level laser therapy (LLLT) has been widely used directly on biological tissue in order to regeneration function, pain relief, acceleration of metabolism, increased synthesis of collagen and improvement of peripheral oxygenation and lung ventilation. The purpose this study was to evaluate the effects of low intensity laser on the respiratory muscles before and after maximal voluntary ventilation.
Study: This was a cross-sectional study with 28 healthy students. They were assessed in two moments: the first (M1) in which the student was instructed to perform the maneuver of maximum voluntary ventilation (MVV), shortly after the pen of LBI was placed on the respiratory muscles, but off (placebo effect) and, after 30 minutes, was performed again MVV maneuver; the second moment (M2), 24 hours later than M1, the student was instructed to perform MVV maneuver followed by LLLT application immediately on the respiratory muscles and to repeat the MVV after 30 minutes. Laser therapy was performed with and infrared laser (904nm, 80Hz frequency) punctually at each motor point, 4 and 6 in the diaphragm rectus abdominal, in a total of ten points, totaling $3 J/cm^2$ for each point and $30 J/cm^2$ per session.
Results: MVV values were expressed as mean and standard deviation. For placebo group the mean MVV value was 120.87 ± 28.18 and 128.46 ± 27.46, before and after LLLT-sham application, respectively. Whereas the mean VVM for laser group was 127.29 ± 28.53 and 136.05 ± 29.38, before and after LLLT application, respectively.
Conclusion: There was an increase of MVV after LLLT application, especially under maximal effort. It is believed that the increase obtained in MVV for placebo group represents an effect related to learning the maneuver.

#170

LOW LEVEL LASER THERAPY IN SKIN REACTIONS POST RADIOTHERAPY

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Background: Radiotherapy (RT) in the head and neck region has significant side effects, both acute and long term. Specific reactions depend on the treatment site, dose, and patient's response. Acute side effects include mucositis, xerostomia, taste changes, skin reactions (burning) and pain in the irradiated area. The aim of this study was to evaluate Low Level Laser Therapy (LLLT) in skin reactions post radiotherapy.

Study: 40 patients were divided: Prevention Group (GI) - Burning prevention w/Laser therapy after RT, patients underwent to LLLT w/? = 660 nm, P = 25 mW, Time = 10 s, Dose = 6,25 J/cm^2/ point, in head and neck area, daily according w/RT schedule were applied. Control Group (GII) kt- 20 patients just underwent to RT without LLLT.

Results: All patients from prevention group (G.I) didn't discontinue the RT treatment as well as skin reactions complications reduction in all patients. In G.II over 85% had burning skin.

Conclusion: These findings support that the preventive treatment w/LLLT on skin presented significant results. Burning lower incidence provides to the patient a better quality of life, besides better condition for the completion of cancer treatment. Laser therapy against RT clinical sequelae has shown to be effective, safe and valuable tool with cost-effectiveness.

#171

INDUCTION OF AUTOLOGOUS MESENCHYMAL STEM CELLS AT THE BONE MARROW BY LOW LEVEL LASER THERAPY HAS BENEFICIAL EFFECTS ON THE ISCHEMIC HEART AND KIDNEY

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Background: Multiple clinical trials were performed recently on the use of various stem cells to the ischemic heart. The aim of the present study was to demonstrate that low level laser therapy (LLLT) application to stem cells at the bone marrow (BM) may have beneficial effects on the infracted rat heart post myocardial infarction as well as ischemic kidney.

Study: Rat model for myocardial infarction and ischemic injury to the kidney was used. Laser was applied to the bone marrow.

Results: LLLT applied to the infracted area in the heart caused a significant reduction of 39% in the infarct size compared to control infracted, non-laser treated rats. LLLT applied directly to stem cells in the BM caused significant ($p < 0.001$) reduction of 79% in the infract size compared to control. In the group of rats in which LLLT was applied to the BM a significant ($p = 0.05$) elevation of 27-fold in the density of c-kit immunopositive cells (a marker of MSCs) in the infracted area as compared to control was noticed. Electron microscopy indicated newly formed cardiomyocytes on the edge of the infracted area in the hearts of the laser treated rats. In the experiments with kidneys post ischemic reperfusion injury quantitative histomorphometric analysis of the histological sections revealed that dilatation of the renal tubules had been reduced, structural integrity of the renal tubules restored and reduced necrosis in the laser-treated rats as compared to the control non-laser-irradiated group.

Conclusion: The present study demonstrates a novel approach of applying LLLT to autologous BM of rats with ischemic heart or kidney in order to induce stem cells that are consequently recruited to the ischemic organs, leading to a marked beneficial effect to the heart post-myocardial infraction. This approach can also be applied to other ischemic organs with consequent beneficial effects.

PHOTODYNAMIC THERAPY

#173

NON-SELECTIVE UP-REGULATION OF THE CUTANEOUS RESPONSE WITH AMINOLEVULINIC ACID AND HEXYL-AMINOLEVULINIC ACID, PHOTODYNAMIC THERAPY BY TOPICAL RETINOIDS

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Background: There is literature that demonstrates an enhancement of the generation of porphyrin products with vitamin A derivatives, vitamin D derivatives, Methotrexate (MTX) and topical 5-fluoruricil (5-FU). For MTX and 5-FU, a preferential enhancement is seen in cancerous and precancerous cell. Our center has a large group of patients on topical retinoids for the treatment of photo-damaged skin. We have recently seen a number of cases that demonstrate a dramatic enhanced cutaneous phototoxic response to aminolevulinic acid (ALA) photodynamic therapy (PDT) and 0.5%hexyl-aminolevulinic acid (HAL) PDT.

Study: This is a retrospective review of four patients who received PDT treatment after having been treated with Tazarotene 0.1% cream or Tretinoin 0.05% emollient cream for 3 months or longer. One patient was treated with ALA and incubated for 3 hours and then treated with 10J Blue light. Three patients were treated with HAL and incubated for 1 hour and then treated with either 10J of Blue light or 37J of Red light.

Results: Clinical responses consisted of dramatic erythema with significant swelling and one case of full thickness epidermal sloughing of the skin in treated areas. Responses were clearly dramatically enhanced over those patients who had not received topical retinoids. In the one patient who was treating actinic keratoses with ALA PDT, there was no differential response between pre-cancerous lesions and normal skin. All healed over a two to three-week period without scarring.

Conclusion: Our experience suggests that caution should be exercised when performing ALA or HAL PDT on patients receiving topical retinoids. There appears to be nonselective up-regulation of the cutaneous response seen to this therapy. Since topical retinoids are used commonly to treat photo-damaged skin and acne, we would suggest caution until a controlled study could be performed to demonstrate safety and appropriate treatment parameters.

#174

THE EFFECT OF MULTIPLE SEQUENTIAL LIGHT SOURCES TO ACTIVATE AMINOLEVULINIC ACID IN THE TREATMENT OF ACNE VULGARIS

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Background: Photodynamic therapy (PDT) with topical aminolevulinic acid (ALA) is a safe and effective therapy for acne. Reports of the sequential use of multiple light sources for ALA activation in the treatment of acne are lacking; primarily individual light sources have been evaluated. The aim of this study was to compare the safety and efficacy of ALA-PDT for acne using blue light combined with red light, pulsed dye laser (PDL), and/or intense pulsed light (IPL).

Study: 78 patients (106 treatments) treated with field-directed ALA-PDT between 2001–2010 for facial or upper trunk were enrolled in this retrospective, single-center study. Treatments were performed with blue light only, blue light + PDL, blue light + IPL, blue light + PDL + IPL, or blue light + red light + PDL + IPL. Patient-reported outcome measures, graded on a 4-point scale (0 = none, 1-mild, 2 = moderate, 3 = severe) and collected via a prescripted telephone questionnaire, included incidence of adverse events (peeling, acne, erythema, and pain), degree of improvement, and improvement in overall skin quality.

Results: There were no statistically significant differences between patient groups in degree of acne improvement or improvement in overall skin quality, despite a trend toward greater improvement with blue light + IPL + PDL than with blue light only, blue light + IPL, or blue light + PDL. Patients with blue light + IPL reported a significantly lower rate of acne flares than those treated with blue light + IPL + PDL ($p = 0.019$) and blue light + red light + IPL + PDL ($p = 0.028$). No statistically significant differences in post-procedure peeling, erythema, or pain were observed.

Conclusion: Results showed a trend toward greater efficacy with comparable tolerability using multiple, sequential light sources in ALA-PDT of acne. The study was significantly limited by small, disparate numbers of patients between treatment groups, warranting a larger, prospective study.

#175

THE EFFECT OF MULTIPLE SEQUENTIAL LIGHT SOURCES TO ACTIVATE AMINOLEVULINIC ACID IN THE TREATMENT OF ACTINIC KERATOSES

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Background: Photodynamic therapy (PDT) with topical aminolevulinic acid (ALA) is a safe and effective treatment of actinic keratoses (AKs). Although various individual light sources have been evaluated for ALA activation, reports of the sequential use of multiple light sources are lacking. The aim of this study was to compare the safety and efficacy of ALA-PDT for AKs using blue light combined with red light, pulsed dye laser (PDL), and/or intense pulsed light (IPL).

Study: 65 patients (93 treatments) with nonhyperkeratotic AKs on multiple body sites treated with field-directed ALA-PDT between 2001–2010 were enrolled in this retrospective, single-center study. Treatments were performed with either blue light only, blue light + PDL, blue light + IPL, blue light + PDL + IPL, or blue light + red light + PDL + IPL. Patient responses were collected via a prescripted telephone questionnaire. Patient-reported outcome measures included incidence of adverse events (peeling, acne, erythema, and pain), degree of improvement, and improvement in overall skin quality, graded on a 4-point scale (0 = none, 1 = mild, 2 = moderate, 3 = severe).

Results: Patients treated with blue light + IPL + PDL reported greater improvement in extent of AKs ($p = 0.008$) and overall skin quality ($p = 0.045$) than those treated with blue light + IPL, with less post-procedure erythema than those treated with blue light + PDL ($p = 0.033$) or blue light + IPL ($p = 0.002$). Patients treated with blue light + red light + IPL + PDL reported less post-procedure pain than blue light + PDL ($p = 0.035$), less erythema ($p = 0.023$) and peeling ($p = 0.032$) than blue light + IPL, yet greater acne flares than blue light + IPL ($p = 0.022$).

Conclusion: Results showed a trend toward greater efficacy with improved tolerability using multiple, sequential light sources in ALA-PDT of AKs. The study was limited by small, disparate numbers of patients between treatment groups. A larger, prospective study is needed.

#176

THE EFFECT OF MULTIPLE SEQUENTIAL LIGHT SOURCES TO ACTIVATE AMINOLEVULINIC ACID IN THE TREATMENT OF PHOTODAMAGE

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Background: Photodynamic therapy (PDT) with topical aminolevulinic acid (ALA) is safe and effective for cutaneous photorejuvenation. However, the sequential use of multiple light sources for ALA activation and treatment of photodamage has only rarely been discussed in the literature. The aim of this study was to compare the safety and efficacy of ALA-PDT for photodamage using blue light sequentially with red light, pulsed dye laser (PDL), and/or intense pulsed light (IPL).

Study: 98 patients (125 treatments) with photodamage on multiple body sites treated with field-directed ALA-PDT between 2001–2010 were enrolled in this retrospective, single-center study. Treatment groups included blue light only, blue light + PDL, blue light + IPL, blue light + PDL + IPL, or blue light + red light + PDL + IPL. Patient-reported outcome measures obtained via a prescripted telephone questionnaire were graded on a 4-point scale (0 = none, 1 = mild, 2 = moderate, 3 = severe) and included incidence of adverse events (peeling, acne, erythema, and pain), degree of improvement, and improvement in overall skin quality.

Results: Patients treated with blue light only reported a significantly lower average degree of improvement in photodamage than those treated with blue light + PDL ($p = 0.022$), blue light + IPL ($p = 0.049$), and blue light + IPL + PDL ($p = 0.024$). Patients treated with blue light + PDL reported a significantly greater degree of improvement in overall skin quality than those treated with blue light only ($p = 0.029$). Apart from decreased peeling in patients treated with blue light only compared to blue light + PDL ($p = 0.047$), there were no other statistically significant differences in post-procedure adverse events.

Conclusion: Results showed a trend toward greater efficacy with similar tolerability using multiple, sequential light sources with ALA-PDT for photorejuvenation. This retrospective study was limited by small, disparate patient numbers between treatment groups.

#177

THE EFFECT OF MULTIPLE SEQUENTIAL LIGHT SOURCES TO ACTIVATE AMINOLEVULINIC ACID IN THE TREATMENT OF ROSACEA

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Background: Photodynamic therapy (PDT) with topical aminolevulinic acid (ALA) is safe and effective for treating rosacea. However, reports of multiple, sequential light sources being used for ALA activation in the treatment of rosacea are largely absent from the literature. The aim of this study was to compare the safety and efficacy of ALA-PDT for rosacea using blue light sequentially with red light, pulsed dye laser (PDL), and/or intense pulsed light (IPL).

Study: 31 patients (40 treatments) with rosacea treated with ALA-PDT (2001 through 2010) were enrolled in this retrospective, single-center study. Treatment groups included blue light only, blue light + PDL, blue light + IPL, blue light + PDL + IPL, or blue light + red light + PDL + IPL. Patient-reported outcome measures obtained via a prescripted telephone questionnaire were graded on a 4-point scale (0 = none, 1 = mild, 2 = moderate, 3 = severe) and included incidence of adverse events (peeling, acne, erythema, and pain), degree of improvement, and improvement in overall skin quality.

Results: There was no statistically significant difference in degree of improvement of rosacea or improvement in overall skin quality. Apart from decreased peeling in patients treated with blue light + IPL compared to blue light + PDL ($p = 0.041$) and blue light + IPL + PDL ($p = 0.005$), there were no other statistically significant differences in post-procedure adverse events.

Conclusion: The use of multiple, sequential light sources with ALA-PDT for rosacea, although well-tolerated, did not lead to statistically significant improvements in efficacy based on this retrospective study limited by a small sample size with disparate patient numbers between treatment groups.

#178

CONVENTIONAL vs FRACTIONAL LASER-MEDIATED PHOTODYNAMIC THERAPY OF DIFFICULT TO TREAT BASAL CELL CARCINOMAS - A RANDOMIZED CLINICAL TRIAL

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Background: Photodynamic therapy (PDT) is in some countries approved for selected cases of nodular basal cell carcinomas (nBCC) but efficacy is reduced for thicker tumors. Ablative fractional lasers (AFXL) facilitate uptake of methyl aminolevulinate (MAL) by creating micro-channels in the skin and may thus improve PDT outcome. This study evaluates efficacy and safety of AFXL-mediated PDT (AFXL-PDT) compared to conventional PDT (PDT) of facial difficult to treat nBCC.

Study: The study included 32 patients with histologically verified facial nBCC categorized as difficult to treat tumors (diameter > 15 mm, located in high risk zones or on severely sun-damaged skin). After tumor debulking, patients were randomized to receive two treatments with either PDT or AFXL-PDT. AFXL was applied using a fractional CO_2-laser, delivering two stacked pulses of 40 mJ/pulse, 5% density. MAL was applied under occlusion for 3 hours and illuminated with red diode light of 37 J/cm^2. Clinical assessments were performed at 3, 6, 9, 12 months postoperatively and biopsies were taken at 12 months for histological evaluations.

Results: At inclusion, median tumor diameter was 7 mm with no difference between groups (FX-PDT vs. PDT; $p = 0.146$). Clinically, recurrences were diagnosed later and in lower numbers after AFXL-PDT (0, 6, 19, 19% recurrence at 1, 3, 6, 12 months) than PDT (13, 25, 38, 44%), which suggests superior efficacy rates, but not reaching significance ($p = 0.114$). Histology at 12 months revealed similar recurrence rates (AFXL-PDT: 38% versus PDT: 44%). Median pain scores during illumination were similar for the two treatment regimens (VAS 0–10; $p > 0.519$) and cosmetic results equally satisfying (scale 0–3; $p > 0.090$).

Conclusion: This small sample study documents a trend for favorable treatment results after AFXL-PDT, but larger clinical and histological studies are needed.

#179

MODELING OF PHOTODYNAMIC THERAPY FOR THE TREATMENT OF ACTINIC KERATOSIS

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Background: Photodynamic therapy (PDT) using 5-aminolevulinic acid is an effective method to treat actinic keratosis (AK). Different light sources and doses are used. This study aims to define a mathematical model to evaluate and to compare their efficiencies.

Study: The PDT process for AK treatment is modeled using a 4×4 light point sources array placed at 5cm parallel to a skin sample model resulted from the inclusion, in epidermis, of an ellipsoid-modeled AK with homogeneous protoporphyrin IX (PpIX) accumulation. Interactions between the light beams and the skin sample model are described by an equation involving attenuation coefficients and transmittances and taking account of the biological and PDT-induced PpIX removals. Integration of the resulted transmitted intensity over exposure time and wavelength followed by a spatial differentiation leads to the absorbed light dose at a given location. Three light doses are considered (red light dose, 632 nm, 37 J/cm^2, 75 mW/cm^2; blue light dose, 417 nm, 10 J/cm^2, 10 mW/cm^2; daylight dose, 30 J/cm^2, 2 mW/cm^2). The Minimum of the 3 Absorbed Light Doses at the Deepest Point of the AK (MALDDP) is determined. Then two dichotomic searches are performed to compute the exposure times required with the two other light sources to achieve MALDDP.

Results: Through computations performed using Matlab™, MALDDP is determined to be 0.32 J/cm^2. This value obtained with the blue light dose is achieved by the red light with a fluence rate

of 75 mW/cm^2 (respectively, the daylight dose with a fluence rate of 2 mW/cm^2) using an exposure time of 399 seconds (respectively, ~235 minutes).
Conclusion: The results are consistent with the literature and the clinical light doses (deviations less than 20%). The model, although based on a number of assumptions, is realistic and provides a good approximation of the underlying physical and biological processes.

#180

TARGETED CANCER GENE THERAPY BY STIMULI-RESPONSIVE AND PHOTOCHEMICALLY TRIGGERED INTRACELLULAR RELEASE OF PLASMID DNA

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Background: Photochemical internalization (PCI), a modified form of photodynamic therapy (PDT), is a highly efficient technology for inducing transfection of genes into cells in a time- and site-specific manner. PCI employs photosensitizers (PS) that incorporate themselves into the cell and endosome membrane. We have developed a core-shell nanoparticles (NP) consisting of a gene-carrying polyamine/DNA polyplex core shielded by an acid degradable shell. The shell, which protects the gene-carrying core during circulation and cellular internalization, mimics a viral vector.
Study: NP is taken up and transported into the cell by endocytosis, the shell hydrolyzes and releases its contents in the mildly acidic endosome. The application of light disrupts the PS containing endosome membrane releasing the plasmid into the cell cytoplasm. We have evaluated the ability of PCI, in combination with gene carrying stimuli responsive NPs, to enhance the nonviral insertion of functioning suppressor genes into glioma cells. Glioma cell monolayers were incubated with NPs with a GFP-PTEN polyplex core together with the photosensitizer $AlPcS_{2a}$. Transfection efficiency, for the 2 genes was assayed by cell growth inhibition and fluorescence microscopy with and without laser light treatment (PCI).
Results: Inhibition of cell growth was significantly increased by the NPs compared to that seen with PTEN core polyplexes alone. PCI mediated transfection of the suppressor and GFP gene was greatly enhanced for both core polyplexes alone and NP encapsulated cores indicating endosomal escape of the plasmid.
Conclusion: The combination of stimuli-responsive NPs and PCI is a viable alternative to viral vectors for gene transfection, can match its transfection efficacy without its biosafety concerns, and enables temporal and spatial selectivity of gene expression.

#181

ADVANCED THERMO-FRACTIONAL PDT FOR NON-MELANOMA SKIN CANCER

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Background: PDT can treat AK and thin NMSC. Laser-assisted fractional and full surface epidermal ablation has been proposed to enhance 5-ALA penetration. Pre- and post-PDT 1064 nm Nd:YAG laser volumetric heating increases tumour cell necrosis. This study aimed to assess the safety and efficacy of a combination of pre- 5-ALA 2940 nm fractional and full surface Er:YAG laser and super-long PIANO (1.5 sec) 1064 nm Nd:YAG heating after PpIX activation for thick NMSC.
Study: Twelve Fitzpatrick 2–3 patients (38–91 yrs, mean 63) affected by thick NMSC (1 extramammary Paget disease, 8 SCC, 3 BCC) were treated after shave biopsy. Each subject received a standardized preparation 12–14 h before PDT: 2940 nm fractional (350 micron - 0.25 mm spot, 0.6 ms, 100 J/cm^2, 50% coverage), and full surface (50 micron) epidermal-dermal vaporization (4 mm spot, 0.6 ms, 6 J/cm^2), followed by 20 mm spot 1064 nm super-long PIANO pulse (1.5 sec) thermal-priming with Dynamis SP laser (Fotona, Ljubljana, Slovenia) before 20% 5-ALA liposome-encapsulated application. PDT consisted of three LED (one 420 nm and two 633 nm) exposures spaced 20 min apart. Superficial fluorescence was measured before and after each steps. Digital photographs, and clinical F/U were scheduled every 7 days (first 2 weeks post-op) and every 30 days for 4 months. PDT was repeated in case of clinical persistence of NMSC. Subjective assessment of treatment outcome and willingness to repeat PDT was obtained.
Results: All subjects completed their post-op clinical evaluation. All NMSC showed a progressive reduction leading to a cosmetically acceptable second-intention healing (20–60, average 30 days). No complications were observed. No NMSC recurrence was observed 4 months after an average of 1.6 PDT sessions. All patients (100%) confirmed to accept further PDT procedures preferring them to surgery.
Conclusion: Advanced PDT can be considered an alternative treatment for thick NMSC. More studies are needed to understand the contribution of each of the subsequent steps involved in this complex procedure.

#186

EFFICACY AND SAFETY OF CONTINUOUS LOW IRRADIANCE PHOTODYNAMIC THERAPY (CLIPT) IN THE TREATMENT OF CUTANEOUS RECURRENCE OF BREAST AND DERMAL MALIGNANCIES

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Background: Photodynamic therapy (PDT) is an important treatment for patients with both pre-malignant and malignant conditions. CLIPT is a novel modification of PDT that enhances tumor specific cytotoxicity while minimizing necrosis to adjacent healthy tissue. This phase I clinical trial was designed to determine the maximum tolerated dose (MTD) and tumor response using CLIPT for cutaneous recurrence of both breast and dermal malignancies.
Study: The study design planned for sequential cohorts of 6 patients to be treated at increasing laser intensity, starting at 100 j/cm^2. Dose limiting toxicity (DLT) was defined as full thickness necrosis. The MTD was defined as the highest dose level at which $\leq$ 33% of patients experienced the DLT. Patients were injected with Photofrin and then underwent 24 hours of continuous photodynamic therapy. Also assessed were clinical and pathologic response rates and quality of life measures.
Results: Eleven patients were enrolled: 9 with recurrent breast cancer and 2 with recurrent dermal cancers. Two patients were treated at 100 j/cm^2 and suffered full thickness skin necrosis. The next cohort of patients was therefore dose reduced and treated at

50 j/cm^2. One of the subsequent 9 patients suffered full thickness necrosis, thus establishing the MTD at 50 j/cm^2. Eight of 11 patients (73%) demonstrated either a complete or partial clinical response. Interestingly, two patients had significant regression of tumor nodules distant from the treatment field. Quality of life measures were generally improved following treatment - particularly bleeding and pain from the tumor nodules. Of the 8 patients whose TUNEL assay results were available, 8 (100%) demonstrated a pathologic response to treatment as evidenced by either tumor apoptosis or regression.
Conclusion: The MTD of CLIPT was established at 50 j/cm2. CLIPT is a highly effective therapeutic modality in the treatment of dermal recurrence of both breast and cutaneous malignancies.

NORTH AMERICAN ASSOCIATES FOR LASER THERAPY (NAALT)

#191

PHOTOBIOMODULATION: MOLECULAR MECHANISMS AND MODELS FOR CLINICAL EFFICACY

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Background: This presentation will describe our current knowledge of the biological mechanisms for photobiomodulation specifically outlining the exciting new advances in our understanding of the key molecular players. Our contribution to this field involving activation of a latent growth factor complex will be described and its clinical applications will be described including stem cell differentiation, wound healing and immunomodulation. A modular, hierarchical model developed to describe the rationale for efficacious clinical dosing regimens for photobiomodulation will be elaborated. Finally, the spectrum of clinical applications and the underlying biological responses targeted by photobiomodulation will be discussed.

PANAMERICAN PHOTODYNAMIC ASSOCIATION (PAPDT)

#196

EVALUATION BY SCANNING ELECTRONIC AND OPTICAL MICROSCOPY OF CHEMICALLY INDUCED BREAST CANCER IN RATS SUBJECTED TO PHOTODYNAMIC THERAPY

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Background: Breast cancer is a malignant epithelial being first cause of death between women by cancer in Brazil, for 2012 estimates show approximately 518.510 new cancer cases in Brazil and that 53.000 breast cancer cases. Current cancer treatments are extremely painful, aggressive and debilitating to the patient. Photodynamic therapy (PDT) is a alternative therapy to cancer treatment and have been widely studying. Studies realized with different photosensitizer agents show that PDT is a efficient therapy against several cancer types including breast cancer. The aim of the present study was to evaluate by scanning electron microscopy and by optical microscopy morphological alterations from breast tumor.
Study: The tumors were induced by gavage with 7, 12-dimethylbenz (a) anthracene. To the PDT application the animal were sedated with Ketamin (Syntec) to Xilazine (Syntec). Then the PDZ were administrated by intraperitoneal way (8 mg/Kg) and irradiated after 24 hours (Laser Habilita Quantum Tech, 670nm). To Scanning electron microscopy (SEM) the tumor samples were washed in Phosphate buffer and fixed in Glutaraldehyde (2,5%) and Paraformaldehyde (4%) solution. Tumor samples were also processed to histology and stained with hematoxylin and eosin (HE).
Results: Was possible identified malignancy criteria in the samples stained with HE and analyzed with the optical microscope such as glandular and nuclear atypical, prominent nucleoli and cytoplasmic vacuoles. Some cells present chromatin migrating to the periphery of the cell cytoplasm, pyknotic nucleus or nuclei without chromatin and intense neutrophilic infiltrate. Also was observed viable blood vessels in the necrosis tissue. Electron scanning microscopy show that the tumors not treated with PDT show large malignant cells multiplication, membrane projections, little blood vessels and several apical shape cells.
Conclusion: The finds in this study are significant and correlated with others papers, but is needed more research with more samples, to determine all alterations that are triggered by PDT.

#198

NON-INVASIVE QUANTIFICATION OF PPIX CONCENTRATION DISTRIBUTION IN A BASAL CELL CARCINOMA MODEL USING FLUORESCENCE IMAGING

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Background: ALA-mediated PDT has been an alternative treatment option for basal cell carcinomas (BCC). ALA-PDT efficacy depends on the PDT dose, which is related to PpIX distribution in the lesion. Thus it is highly desirable to quantify PpIX concentration distribution, preferably noninvasively.
Study: We imaged tumors located on tails of Gli mice, which over express the downstream Gli2 transcription factor and develop spontaneous BCCs in skin. ALA was administered in two different ways: topical and intra-tumor (it). Solvable extractions were also performed to quantify absolute concentration in vitro.
Results: We observed significant variations in PpIX concentrations in vivo for both topical and it administration. Our

results correlated well with the in vitro solvable extraction method (r-sqr = 0.87). Local concentrations for it and topical administrations were similar. However, the tumor contrasts compared to skin were higher for it administration.
Conclusion: We demonstrate the feasibility of absolute PpIX quantification in vivo by quantitative fluorescence imaging in a novel basal cell carcinoma model. The method will be applied in our ongoing clinical trials of PDT for dosimetry as well as response monitoring.

#201

NON-INVASIVE BLOOD FLOW CHANGES CORRELATE WITH STAT3 CROSSLINKING

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Background: Non-invasive optical spectroscopy can provide near real-time parameters related to therapy efficacy. Herein we aim to test whether early blood flow changes will be indicative of PDT response for high and low fluence rates.
Study: C3H mice with subcutaneous SCCVII tumors were treated with 0.47 μmol/kg HPPH at two fluence rates: 14 mW/cm^2 and 75 mW/cm^2 with 100 J total doses. Tumor blood flow (rBF) was measured continuously during PDT using diffuse correlation spectroscopy (DCS). After treatment, the tumors were removed to determine the percent crosslinking of Signal Transducer and Activator of Transcription 3 (STAT3), a molecular biomarker for photoreaction.
Results: We observed significant differences in blood flow changes between the two fluence groups. These non-invasive blood flow changes correlated well with STAT3 crosslinking. Mice in the low fluence group showed higher average STAT3 crosslinking than those in the high fluence group (19.2 ± 6.1% vs. 7.0 ± 2.8% respectively).
Conclusion: Continuous monitoring of hemodynamics can provide in vivo markers indicative of PDT efficacy. This may lead to more effective therapy monitoring with real-time feedback during treatment.

#202

PRECLINICAL DEVELOPMENT OF TWO-PHOTON PDT AGENTS FOR THE TREATMENT OF HEAD AND NECK CANCERS

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Background: An on-going problem in photodynamic therapy is the lack of depth efficacy in tumor treatment in the tissue transparency window (750–900 nm). We have developed new porphyrins that can be activated at 800–840 nm, and have demonstrated significant tumor regression in mouse models using two-photon treatment. While total cures have been achieved in ca. 30–40% of treatment cohorts, tumor re-growth is observed in the remainder. Continuing studies of HNSCC xenograft models are now focused on developing image-guidance of the two-photon PDT process (TPPDT).
Study: A triad have been developed that incorporate: (1) a porphyrin with large two-photon absorption with activation at 800–840 nm, (2) Near-infrared imaging agents operating at 700 or 800 nm, (3) small peptides that direct the triad to over-expressed tumor receptors. The triad can be delivered by IV or local infiltration, and reaches a maximum concentration in 4–24 h. The treatment laser beam is then rastered throughout the tumor volume in 20–30 minutes.
Results: Toxicity studies for the triad (1–10 mg/Kg) were carried out, with no observable toxicity over 1–2 weeks. Maximum efficacy was achieved at 900 mW and with a dose of 10 mg/Kg for HNSCC xenograft tumors implanted in SCID mice. All treated mice demonstrated rapid tumor regression, with complete cures observed for ca. 30% of mice in 15–20 days. Excellent healing post-PDT is observed including rapid hair re-growth, and no scarring.
Conclusion: TPPDT is an excellent alternative choice for treating subcutaneous tumors. At the current timer, tumors can be killed at depths of at least 2 cm without any toxic effects observed in healthy tissue post-PDT. One ongoing question in PDT tumor treatment is the question of 'safe' margins. We are currently addressing this problem by designing a treatment protocol that will allow the TPPDT process to be carried out under image guidance, with safe "optical margins".

#206

CLINICAL RESPONSE OF VULVAR INTRAEPITHELIAL NEOPLASIA TO PHOTODYNAMIC THERAPY USING METHYLENE BLUE AND RL50® LIGHT SOURCE

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Background: The incidence of VIN (vulvar intraepithelial neoplasia) showed an increase of 1.2 to 2.1:100000 women due to the HPV (Human papillomavirus)h infection. The proposed treatment demonstrates recurrence rates of around 30% for ablative surgery and remission rates between 50% to 80% for local immunological response modifiers. The development of inexpensive therapeutic, minimally invasive, is the aim of this study.
Study: 15 patients diagnosed with VIN were enrolled in the study, the average age was 48.1 years and 4/15 (26.7%) patients were smokers. Photodynamic therapy was applied every two weeks, and all patients received intralesional injection of an aqueous solution of 2% Methylene blue with 2% Lidocaine and subsequent exposure to RL50 ®, red halogen lamp, wavelength between 600 to 750 nm, the dose of light was 100 J/cm^2, time of exposition of 25 to 40 minutes for 4 to 8 sessions.
Results: 11/15 (73.3%) patients had lesion regression and 4/15 (26.7%) underwent excisional approach due to treatment failure after 8 applications. Local effects such as erythema and edema were observed for 4 to 7 days after PDT. No patient had ulceration or necrosis at the site of application. Follow up for 18 months no recurrence was observed.
Conclusion: VIN recurrence and the risk of malignant disease progression proposed several therapeutic approaches resulting in vulvar pain and deformitis, besides increasing the cost of treatment. Photodynamic terapy using no porphyrins chemical agents and no laser lights proposes the destruction of infected keratinocytes with HPV, viral load reduction and alteration of local immune response and seems to be a highly effective and inexpensive therapeutic for public health in developing countries.

#213

REAL-TIME ANTIFUNGAL PHOTODYNAMIC THERAPY IN ENDODONTIC INFECTION: A LIGHT PROPAGATION STUDY

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Background: Photodynamic therapy (PDT) can be an interesting and innovative antifungal approach. Several studies have demonstrated positive antifungal activities of PDT, but some discrepancies can still be found in the literature and PDT parameters certainly lack consistency. In this work we developed a model of *Candida albicans* biofilm infection inside dental root canal to evaluate microbial reduction and light distribution into the root canal system using different light delivery methods to perform the irradiation.

Study: After conventional endodontic treatment ten teeth were sterilized and the canals were contaminated with genetic engineered bioluminescent *C. albicans* to form a 3 days biofilm. The samples were divided into two groups one using laser tip in contact with the root canal entrance and the second using a diffuse fiber to perform irradiation. Images of the irradiated area were obtained during irradiation and microbial reduction was monitored via bioluminescence.

Results: Our findings demonstrate that the bioluminescent biofilm shows good reproducibility, the images can be easily accessed and allow several repetitions in the same sample.

Conclusion: Light distribution in dental tissue was markedly dependent on the irradiation device and this parameter is directly related with microbial destruction.

#216

UPTAKE OF METHYENE BLUE PHOTOSENSITIZER IN LEISHMANIA AMAZONENSIS

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Background: *Leishmania spp.* is an important parasite that causes several neglected diseases such as cutaneous leishmaniasis. There are few studies that have demonstrated a significant effect of some photosensitizer during photodynamic therapy (PDT). Phenothiazines like methylene blue (MB) have an important photosensitizing activity against microorganisms. However, the literature is scarse about uptake of photosensitizer molecules into parasites. In this study we evaluate the influence of contact time and photosensitizer concentration using MB and investigate the *L. amazonensis* promastigotes interaction with the dye via MB uptake evaluation.

Study: Tubes with 1.10^7 *L. amazonensis* promastigotas were incubated with 50 μM, 100 μM, 250 μM and 500 μM of MB, tested in three different times (10, 30 and 60 min) of incubation. Afterwards, tubes were washed once with PBS 0.1 M followed by incubation with lise solution (1:1 - NaOH 2 M and SDS 2%) overnight. The MB fluorescence was measured at $l = 690$ nm with excitation at $l = 532$ nm using a spectrophotometer. Statistical analysis of the data was performed using Student's *t* test and $p < 0.01$ was considered significant.

Results: Our results showed no statistically significant differences among the tested groups regarding contact time. However increasing dye concentration promotes further enhancement on uptake values.

Conclusion: These findings suggest that high methylene blue concentration at short incubation times could be used to test photodynamic activity against *L. amazonensis*.

#217

EVALUATION OF VARIABLES INVOLVED IN ANTIFUNGAL PHOTODYNAMIC THERAPY

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Background: In vitro studies have demonstrated positive antifungal activity of photodynamic therapy (PDT), but employment of this treatment in vivo requires optimization of the variables involved. In this work we investigate the fungus and photosensitizer (PS) distribution as well as light propagation in a mice model of vaginal candidiasis (VC).

Study: Twenty female Balb-c mice were treated subcutaneously with estrogen 72 h before intravaginal inoculation of Candida albicans to establish a persistent infection. Vaginitis was verified by histological and microbiological evaluation after 5 days. With the infection induced we investigated fungal localization by bioluminescence and photosensitizer distribution by fluorescence. Light propagation into vaginal canal was also analyzed. To test PDT, methylene blue (500 μM) was topically applied intravaginally for 10 min. before irradiation. The vaginal area was illuminated using a 660 nm-red laser ($P = 100$ mW, $E = 3$J) during 6 min. Samples were collected from vaginal content for microbiological counting.

Results: Our findings show that the fungal colonization was localized mainly into the vaginal canal. PS was observed on the vaginal canal mucosa and on biofilm surface. The use of an optical fiber allowed a better light distribution inside the vaginal canal. A decrease of fungal burden of 1 log after PDT was observed.

Conclusion: Therefore, although the dye and light distribution covered the whole infection site other parameters have to be taken into account to improve microbial reduction.

#218

CLINICAL RESPONSE OF HIDRADENITIS SUPPURATIVA TO PHOTODYNAMIC THERAPY USING TETRACYCLINE AND RL50® LIGHT SOURCE

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Background: The Hidradenitis suppurativa is a chronic, inflammatory, debilitating and recurrent follicular skin disorder due to inflamed lesions in the apocrine gland bearing skin of body and most commonly the axillary, inguinal and anogenital regions that needs a great number of approaches to reduce the extent and progression of the disease. The aim of this study is the application of PDT, a not debilitating therapy, allowing spacing of the outbreaks and functional maintenance of the affected region.

Study: 5 women were diagnosed at Hurley's stage II of Hidradenitis suppurativa and submitted to photodynamic therapy. Photosensitizer: Tetracycline 500 mg orally. The light source: Red Light (RL50®) wavelength of 600 nm. Dose of light: 100 J/cm^2. Time of exposition: 30 minutes.
Results: 3/5 (60%) patients showed inflammation and drainage decrease after five applications. 2/5 (40%) patient had partial reduction of inflammation and drenage. Local effects such as erythema and edema were observed and regressed after 5 days.
Conclusion: The goals Hidradenitis Suppurativa's treatment is try to revert it to a milder stage, and photodynamic therapy seems promising low cost option on chronic vulvar disease that requires numerous approaches.

#219

PRIMING TUMORS FOR PDT

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Background and Objectives: The functional status of tumor blood vessels during and after photodynamic therapy (PDT) is predictive of treatment outcome. Maintenance of vascular patency during illumination, followed by post-illumination ischemia, leads to better long-term response. In an extension of this work, we seek to develop methods of priming tumor vasculature to insult by PDT, which will require accumulation of vascular damage after illumination without compromising perfusion during light delivery. Herein, we focus on studies of two pharmaceutical-mediated and clinically-relevant approaches for sensitization of tumor blood vessels to PDT.
Study Design: Studies were conducted in mice that bore murine fibrosarcoma (RIF) or one of several human tumor models (e.g., H460 non-small cell lung carcinoma). To prime tumor vasculature to PDT, animals were administered either an antibody to vascular endothelial growth factor (VEGF) or a small molecule inhibitor of epidermal growth factor receptor (EGFR) for two days prior to light delivery for PDT. Measured outcomes included monitoring of long-term therapeutic effectiveness as well as short-term assays of vascular function and cellular damage.
Results: Mice treated with anti-VEGF antibody developed an altered vascular composition characterized by better association of tumor vessels with basement membrane matrix. Increases in the deposition of vessel-associated collagen IV produced a more PDT-responsive vascular phenotype, confirmed by greater decreases in tumor perfusion after PDT of "primed" tumors and better long-term outcomes (cure rates of ~50% vs. ~10% in "primed" vs. non-"primed" tumors). Similarly increased cure rates, accompanied by a stronger vascular response, also resulted from pre-treatment with the EGFR inhibitor Erlotinib.
Conclusions: Altering the structural composition of the tumor vasculature and/or survival signaling by its endothelium can augment vascular response to PDT. These data suggest that pre-PDT priming of tumor vasculature can be used to improve responsiveness to therapy.

SURGICAL APPLICATIONS

#220

INTERSTITIAL LASER DEVICES IN MEDICAL APPLICATIONS: REGULATORY PERSPECTIVE

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Background: Laser medicine is a rapidly developing area providing novel diagnostic information or therapeutic benefits. In contrast to the non-contact mode laser, interstitial laser delivery to target tissue provides treatment effects directly to internal tissues. The thermal necrosis therapy by interstitial laser has been driven by invasiveness-reducing technologies, and could be a good alternative to traditional surgical procedures. Along with other minimally-invasive energy delivery methods (e.g., radiofrequency, ultrasound), implantable laser fibers are being studied for thermal destruction of a variety of tissues.
Study: In the past, the FDA has cleared a number of interstitial laser surgical devices through the Premarket Notification process. From the regulatory review perspective, there are challenges in the following areas.
Results: (1) Disease-specific treatments including oncological applications. Interstitial laser devices have been granted clearances for general soft tissue coagulation indications and a limited number of specific treatments, but data on specific disease treatments, especially malignant tumor necrosis, are still lacking; (2) Image guidance for probe positioning. The laser probe needs to be precisely located and multiple imaging technologies have been proposed to be used for guidance; (3) Monitoring the biological effects; Thermal sensing for real-time temperature monitoring as well as methods for monitoring mechanical disruption of tissue structure, play important roles for ensuring complete ablation of the target tissue while sparing the non-target tissue from treatment, i.e. effectiveness and safety of the treatment; (4) Treatment assessment. Depending on the indications, tissue destruction monitoring and post-procedure evaluation by radiological imaging could provide a valuable assessment method for long term success of the treatment. The imaging method may involve multi-imaging modalities and potential use of pharmaceutical contrast agents.
Conclusion: In this presentation, we review the interstitial laser surgery literature, compare its application to other minimally invasive energy delivery methods, summarize the regulatory status, and discuss challenges moving academic research into viable products.

#221

PERCUTANEOUS LASER ABLATION OF HEPATIC METASTASES WITH REALTIME MAGNETIC RESONANCE THERMOMETRY MONITORING

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Background: To develop and evaluate an alternative technique to standard CT/US guided thermal ablations of liver metastases, aiming at avoiding hepatic resections in the subset of patients with CT/US invisible lesions, subcentimeter lesions, and/or lesions at challenging locations.

Study: MRI-guided laser ablations were performed in 22 patients (13M, 9F, age = 45–84y) with 43 liver metastases (20 colon, 2 gastric, 3 melanoma, 17 pancreatic neuroendocrine, 1 pancreatic adenocarcinoma). Procedures were performed within an interventional MRI suite equipped with 1.5T wide bore scanner. Interventions were performed under general anesthesia within the scanner bore while viewing real-time image updates on an in-room monitor. A laser fiber with 15 mm diffusing tip encased in 5.5 F cooling catheter (Visualase, TX) was inserted in the target lesion under interactive visualization on a tri-orthogonal plane FLASH sequence. A test dose of diode laser energy (980 nm, 30 sec, 4.5 W) was applied to verify the location of ablation nidus on real-time temperature and cumulative damage estimate mapping. Subsequently, ablative energy dose was delivered utilizing an average of 27 watts with treatment endpoint based on on-line thermal monitoring of growing ablation. Fiber repositioning for additional ablation was conducted as needed. Final ablation was evaluated on TSE T2 and enhanced TSE T1 in 3 planes.

Results: Accurate targeting was achieved in all tumors regardless of size and location. This was facilitated by reliable breathholds under general anesthesia. Target tumor sizes were 0.9–4.0 cm. Locations included all liver segments but the caudate lobe. Complete ablation was achieved in 1 session for each lesion. Applied laser energy was 1080-36720J per lesion. Post procedure pain ratings were 0–7. No complications were encountered on follow-up durations of up to 51.6 weeks. Laser ablation zones demonstrated central iso-to-hypointense signal surrounded by hyperintense/enhancing rim on T2&T1, respectively. Follow-up scans showed involution of ablation zones. One patient with 2 ablated gastric sarcoma metastases underwent subsequent resection of ablated zones during partial hepatectomy performed for additional lesions. Pathology demonstrated complete necrosis of resected ablations.

Conclusion: Percutaneous focal laser ablation of subtle liver metastases under real-time MR-guided fiber placement and temperature mapping is feasible, well tolerated, and effective on short and intermediate term follow-up. The technique maintains a minimally invasive option for treating liver metastases that cannot otherwise be approached under CT or ultrasound guidance.

#222

MRI-GUIDED AND MONITORED FOCAL LASER ABLATION FOR PROSTATE CANCER

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Background: Current options for patients with prostate cancer include whole gland treatment, hormonal therapy, or active surveillance. These options represent a dilemma for younger patients with localized low-grade cancer who are offered a choice of either observation or disproportionately aggressive therapy resulting in significant complications including urinary incontinence and erectile dysfunction. We describe a technique for a minimally-invasive focal treatment using laser ablation to target the cancer area while preserving the rest of the prostate gland.

Study: A 51-year-old patient presented with high PSA level (6.73 ng/ml). Transrectal ultrasound guided biopsy (TRUS) showed low-grade (Gleason 3 + 3 = 6) prostate cancer. Multiparametric MRI confirmed the presence of a 1.7 cm left central gland confined cancer. Laser ablation was performed within an interventional MRI suite utilizing a 3T-MRI system (Magnetom-Trio, Siemens, Germany) under conscious sedation. The rectal piece of an MR-compatible prostate biopsy system (DynaTRIM®, In-Vivo, USA) was inserted into the rectum. A 1.0-cm-active-tip diode laser fiber (Visualase, TX, USA) was introduced within an internally cooled catheter through a 14-gauge introducing sheath. The catheter tip location was confirmed on TSE-T2WIs. A laser test dose of 5 watts was applied for 20 s. Definitive ablation was then conducted utilizing 12 watts for 191 s. These resulted in the delivery of 2392J of energy to tumor site. Simultaneous temperature maps and cumulative damage maps were obtained, co-registered and overlaid on anatomical imaging to obtain real-time monitoring of extent of ablation. The procedure was concluded when the cumulative damage map was noted to encompass the entire tumor.

Results: The patient tolerated the procedure well and was discharged 4 hours after procedure. Complete tumor necrosis was achieved in a single session as shown on intraprocedural Gadolinium-enhanced MRI. A follow-up MRI after 3 weeks showed no residual tumor. The patient has been under follow-up for 6 months without evidence for early or late complications. PSA level dropped to 2.9 ng/ml. Laser ablation zone demonstrated central iso-to-hypointense signal surrounded by hyperintense/enhancing rim on T2&T1, respectively.

Conclusion: This report describes a technique for MRI-guided and monitored transrectal focal laser ablation for minimally-invasive targeting of localized low-grade prostate cancer. The technique appeared to be feasible, tolerated and efficacious in this case report. Prospective assessment of safety and efficacy awaits further evaluation on a larger cohort of subjects.

#223

CAN HIGH POWER LASER ON SWINE MITRAL VALVE CHORDAE TENDINEAE IMPROVE MITRAL REGURGITATION? INSIGHTS FOR A NEW SURGICAL ERY TECHNIQUE

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Background: Rheumatic fever remains a significant worldwide cause of mitral regurgitation, responsible for approximately 90% of early childhood valvular surgery in Brazil. Elongated/flail chordate are frequently responsible for this condition, that must be surgically corrected. Despite recent progress in mitral valve reconstruction techniques, there are no published reports shortening the chordate tendineae applying Surgical Laser. The aim of this study was to analyze and compare the histological

tissue mitral valve chordae and its mechanical resistance with and without High Power Laser (HPL) application. The present work being, therefore, the first attempt to obtain some information.
Study: A total of 20 porcine mitral valve chordae from three healthy hearts were measured and divided in 2 groups: Control Group (GI): chordae without HPL. Laser Group (GII): chordae submitted to HPL procedure. Diode CW (TheraLase Surgery-DMC, Brazil) Laser application, through 400 μm fiber thickness, under controlled conditions with following parameters: ? = 980 nm, P = 3 W, T = 15–25s, E = 30–60J was performed. The chordae temperature was controlled in real time by ultra sensible thermography equipment (Flir Systems ThermaCAM SC3000). A testing machine (Emic DL 200 MF, Linha DL) was used to measure the chordae tensile properties and histological analysis was carried out.
Results: Histological analysis showed in GI the presence of collagen bundles organized arrangement, while in GII, after the temperature has been reached (raised above) 43°C, collagen bundles were organized differently however with chordae tendineae reduction. We found changes in the resistance of chordae tendineae in GII.
Conclusion: It is clear that the temperature were critical in this work in order to alter the chordae tendineae size and avoid the valve insufficient problem although keeping the regular strength of valve's function. More studies are needed to verify this method usefulness, especially in human pathological valves, avoiding each decade artificial replacement or anticoagulant administration continuously.

#224

LASER ASSISTED MINIMALLY INVASIVE SURGERY FOR PRIMARY HYPERHIDROSIS

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Background: Primary axillary hyperhidrosis is a frequent disease affecting all aspects of the lives of patients suffering this problem. Up to these days, no permanent solution existed but the excision of the axillary skin with its undesirable consequences. Today the use of 924/975 nm diode laser subdermally, via a 1.5 mm diameter flexible fiber, destroys selectively and permanently the axillary sweat glands as confirmed clinically and histologically.
Study: We present 19 patients (12 males-7 females, ages 19–41) operated from January to April 2012 (to comply with the mínimum 6 months follow up required) with primary axillary hiperhidrosis. All but one were grade 4 in HDSS, the other was grade 3. No exclusión criteria were used and no starch iodine test performed (sweat can be seen with the naked eye). Klein modified solution was used and the laser fiber inserted subdermally delivering the energy as superficially as possible. We use only the 924 nm wavelength at 20 watts (the selective one for melting the adipose tissue) and our end point is to reach 38–39 degrees Celsius in the skin. The total energy delivered is not an end point per se because, lasering is finished when the temperature is reached. Aspiration and curettage with a special cannula ends the procedure.
Results: 18 patients reported grade 1 in HDSS after the procedure and 1 patient reported grade 2 in HDSS. Most of the patients referred a slight soreness in the axillas for 2–3 days after the procedure and the sweating disappeared almost immediately. All of them are fully satisfied with results.
Conclusion: This procedure offers a safe and permanent solution for more than 90% of patients with P.A.H. (2 m mp4 video available).

#225

EVALUATION OF UNIQUE SIDE FIRING 1440 nm FIBERLASER FOR JOWL REDUCTION AND SELECTIVE SMAS TIGHTENING

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Background: Recent technological improvements in fiberlaser design have resulted in the development of a unique sidefiring laser which was initially introduced for the treatment of cellulite. The device's novel 1440 nm Nd:YAG laser with a Sidelight 3D™ optical fiber transmits energy bi-directionally under the skin to thermally smooth out fat cells and heat dermal tissue to promote skin thickening and tightening; resulting in tighter and smoother skin and jowl reduction. The benefits possible with a multidirectional laser include the ability to focus the fiber deep to jowl fat superficially for skin tightening and also side wise for selective SMAS tightening. Use of a real time temperature sensor can also permit selective SMAS heating to be monitored as it reaches a predetermined temperature to maximize tissue contraction due to thermal injury and wound remodeling including neocollagenesis and dermal contraction.
Study: Patients interested in minimally invasive facial rejuvenation were evaluated for lower face and jaw line signs of aging including loss of defined mandibular contour, the development of jowls and facial and skin laxity. Patients with mild signs of facial aging were selected for sidelase facial rejuvenation which utilized the multidirectional sidelight 3D™ optical fiber to selectively target fat of the jowl, dermis for collagen stimulation and dermal tightening and the SMAS for deep layer myofascial tightening. Procedures were completed under local anesthesia and jowl treatment included aspiration of most patients.
Results: Patients were evaluated by side by side photo comparison by the author and graded for improvement based on the improvement of mandibular definition, jowl reduction and facial and skin laxity improvements. All patients undergoing treatment experienced improvements in the study parameters.
Conclusion: A new Sidelight 3D™ optical fiber transmits 1440 nm optical energy bi-directionally under the skin to thermally smooth out fat cells and heat dermal tissue to promote skin thickening and tightening; results in tighter and smoother skin and jowl reduction with added definition to the mandibular contour. The 3D options for the first time allows fat dermis and SMAS to be targeted resulting in enhanced improvements for laser facial sculpting and contouring.

#226

EVALUATION OF THE 1064 nm Nd:YAG LASER FOR THE TREATMENT OF CERVICOFACIAL ADIPOSTY

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Background: To evaluate the safety and efficacy of the 1064 nm Nd:YAG laser for the treatment of neck and jowl adiposity.

Study: 56 patients with localized adiposity of the neck and jowels were treated with the 1064 nm Nd:YAG laser. Volume of tumescent infiltration, energy imparted, patient comfort, and patient demographics were recorded at the time of the procedure. Subjective and objective improvement was assessed at 1, 3, 6, and 12 months. Any adverse events were recorded.
Results: All procedures were performed under local anesthetic (median anesthetic volume = 41ccs) with or without oral anxiolysis. Two dermal burns and two hematomas occurred. 15 patients who did not undergo concomitant head and neck procedures completed the full one year study. No significant complaints of intraoperative or postoperative discomfort were noted. No long term adverse events occurred. Improvement in neck volume and contour was first noted primarily between months one and three but was most evident between three and 6 months. Interval improvement continued for the full year of the study. All subjects expressed satisfaction with the procedure and results at one year.
Conclusion: 1064 nm Nd:YAG laser lipolysis is a safe and effective modality for the treatment of localized adiposity of the neck and jowl.

#227

FUNCTIONAL AND ESTHETIC SATISFACTION IN PATIENTS TREATED WITH DIODE LASER BY HYPERTROPHIC LABIA MINOR

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Background: The labia minor hypertrophy has been associated with congenital and acquired abnormalities. Most patients consult for esthetics or shame related to this anomaly, but a good portion of these patients reported a series of functional limitations. The number of patients who undergo labioplasty increases 20% annually. A diode laser method for this surgical correction is proposed.
Study: This was a prospective - descriptive study. It included patients with hypertrophy and/or asymmetry of the labia minora, who consulted for surgical correction (edge excision technique) between 2008 and 2011. The size of the labia (ranked by Franco), age, reasons for consultation, postoperative evolution, complaints, complications, esthetics and functional satisfaction were evaluated. We use in surgery a diode contact laser (30 W, 980nm, optic fiber 600 μ, continuous mode). Polyglactin 910 suture was used (4 -0) if necessary.
Results: 302 women assist for laser labia minor surgical reduction. Were evaluated: after 24 h 100%, 7 days 83.44%, and 30 days 45.69%: 138 patients. The statistics reported in this study are referred to the latter group. Age was 19–56 years. All women consulted by cosmetic reasons, 2/3 by discomfort wearing clothes or sports; and 1/3 consulted by discomfort during sexual intercourse or genital discharge. Hypertrophic labia was moderate (class II – III of Franco, more than 75%, asymmetry of labia more than 1/4). After 30 days, almost 90% women were very satisfied or satisfied with esthetic concerns (122/138). Only 10% of women were unsatisfied by functional results (discomfort with clothes or vaginal discharge persistence). Were only 15 patients (10.8%) requiring suture of labia, and 1 case of deshicence of suture.
Conclusion: The diode laser labioplasty is a safe procedure, with satisfactory esthetics and functional results.

#228

APPLICATION OF HOLMIUM LASER IN THE TREATMENT OF POST-PROSTATECTOMY URETHRAL STRICTURES

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Background: The purpose of the study was to compare the efficacy of holmium laser and cold knife urethrotomy in treatment of post-prostatectomy urethral strictures.
Study: We studied 64 patients with vesicourethral strictures following prostatectomy during a three years period. The mean ± SD age was 67.4 ± 13.9 years. Twenty-one patients underwent cystoscopic-guided transurethral incision of the bladder neck by holmium:YAG laser and 43 by cold knife. The patients visited one and three months after surgery and if there was any voiding complaint, cystoscopy was performed.
Results: Re-laser therapy was unavoidable for other 6 (39%) patients in this group. Thirty-two (80%) patients in cold knife group required repeated intervention for urethral stricture which was significantly higher than laser group. ($p < 0.001$).
Conclusion: Ho:YAG laser internal urethrotomy is a safe and effective minimally invasive treatment modality for anastomotic strictures after prostatectomy.

#229

AN IMAGING-BASED APPROACH TO EVALUATING DENTIFRICE

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Background: Prolonged gingivitis may lead to periodontitis, with permanent damage to tooth-supporting tissues. Goal of this pilot study was to determine whether Optical Coherence Tomography (OCT) imaging can be used as a convenient alternative to laborious clinical indices to track changes in gingival and periodontal health.
Study: In this randomized, controlled, double-blind pilot study (UCI IRB 2002-2805), 10 subjects with periodontitis were recruited. 5 subjects received a novel dentifrice, Livionex Dental Gel, and the other 5, Colgate Total toothpaste. After initial clinical examination, plaque, gingival, periodontal indices, and full pocket charting were documented by a clinician. After OCT and intra-oral images, volunteers received standardized oral hygiene instructions. Patient oral hygiene and indices listed above were documented at weekly intervals for 6 weeks. Periodontal pocket charting was determined at beginning and end of the study. From OCT images, changes in soft and hard supporting tissues of the teeth were measured using a software-based point-to-point measurement capability. Changes in periodontal health over time based on clinical measurements were used as the standard for evaluating images of the periodontium.
Results: Plaque and gingival index were the earliest indicators of changes in gingival inflammation. Reduced redness and swelling of the gingiva were visible in the intra-oral camera images and a reduction of 10–20% in gingival soft tissue swelling was apparent in OCT images after 1 week, and continued progressively to end of the study; rate and amount of change varied considerably between subjects and dentifrice used. Overall, more durable

plaque and gingivitis reduction was observed using Livionex gel ($p < 0.05$).
Conclusion: Improved periodontal health resulting from better oral hygiene can be mapped efficiently using OCT.
Funding: grant RO3 EB014852 and P41EB015890 from the National Institute of Biomedical Engineering; Livionex Inc Los Gatos.

#230

ASSOCIATION OF FLUORIDE AND Er,Cr:YSGG LASER IRRADIATION PROVIDES ENAMEL RESISTANCE TO LOW pH ENVIRONMENT

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Background: Lasers have been widely used in Dentistry in procedures such as caries prevention, caries removal, cavity preparation, and periodontics. The use of lasers has been an available alternative for caries prevention because it promotes dental hard tissues structural changes, making enamel less soluble when submitted to a low pH environment. The objective of the present study is to evaluate the association Er,Cr:YSGG laser irradiation with acidulated phosphate fluoride on bovine enamel, by qualitative morphological analysis, microhardness as well as CaF_2 quantitative analysis.
Study: Enamel blocks (136) from bovine teeth were randomly divided into 4 groups (control, only Er,Cr:YSGG laser irradiation ($? = 2.78\,\mu m$, 20 Hz, $8.5\,J/cm^2$), FFA 4% followed by Er,Cr:YSGG irradiation and Er,Cr:YSGG irradiation followed by FFA). After treatments, SEM, EDS-SEM, AFM, microhardness evaluation and a qualitative analysis to verify CaF_2 formation and retention were performed. Ion specific electrode was used for the quantitative analysis.
Results: EDS under SEM confirmed that the globules formed on the surface were from CaF_2. The results obtained from SEM analysis showed that the control group (no treatment) differ from another groups, in the sense that laser irradiated groups presented micro-ablated regions on the surface with no significative material removal. These results were confirmed using the AFM analysis. The quantitative analysis verified that the highest concentration of fluoride on the enamel is FFA followed by Er,Cr:YSGG laser irradiation while the lowest concentration was on the control group, as expected (Anova/Tukey 5%). Mean of enamel Knoop micro-hardness until $40\,\mu m$ deepness was highest for FFA followed by Er,Cr:YSGG irradiation group.
Conclusion: The present study reveals that FFA 4% application on enamel followed by Er,Cr:YSGG irradiation ($8.5\,J/cm^2$) is a choice for increasing the incorporation of fluoride on the enamel, as well as increase the microhardness of the surface, increasing the overall resistance of the samples to a low pH environment.

#231

HOW WE DO IT: SHARED FOLLOW UP FOR A REGIONAL ONCOLOGICAL TRANSORAL LASER RESECTION PROGRAMME FOR LARYNGEAL CANCER

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Background: The Department of Health (September 2000) NHS Cancer plan advocated surgery in tertiary cancer centres with smaller units diagnosing cancer and referring for definitive surgery. Leeds Cancer Centre (situated at St James University Hospital, Leeds) serves a catchment area of 2.5 million people. For ENT purposes it serves 2 trusts – Leeds Teaching Hospitals with a catchment area of 800,000 people and Mid Yorkshire Trust (MYT) which is 13 miles away and serves 550 000 people.
Study: Cancer surgeons from both trusts attend Leeds Cancer Centre for a weekly combined Head & Neck Cancer Multidisciplinary Team meeting (MDT). They are joined by radiologists, oncologists, pathologists, speech and language therapists and cancer nurse specialists. All new patients with early laryngeal cancer T1/T2 are seen at the MDT and if appropriate offered a choice between Transoral Laser resection with frozen section or Radiotherapy. On average 16 patients per annum opt for surgery. Roughly 50% are from MYT. Transoral Laser resection is only performed by the senior author in Leeds and those patients from Leeds are followed up solely by him. Patients from Mid Yorkshire are followed up jointly by him and the MYT surgeon. The McMillan Laryngectomy & Tracheostomy specialist nurse aids in the support of these patients and facilitates their post-op care with the local Speech & language therapists.
Results: Post operatively all patients are followed up in Leeds at the following intervals: 4–6 weekly in first year; 2 monthly in 2^{nd} year; 3 monthly in 3^{rd} year; 6 monthly in 4^{th} & 5^{th} years. In order to minimize travel times yet be seen by their laser surgeon, MYT patients alternate their appointments between Leeds and MYT.
Conclusion: Our positive patient satisfaction scores (2012 National cancer patient survey) suggest our follow up is practical and effective for both patients and clinicians.

#232

PULSE DYE LASER: LARYNGEAL MICROSURGICAL PROCEDURE BY NON-INVASIVE LASER SURGERY ON OUTPATIENTS ABOUT 57 CASES

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Background: Since 3 years the office laser surgery improved a lot. The PDL is a very impressive technique. It is guided through a fiberscope. As the CO_2 Laser Guide, The Thulium, the PDL proceed on awake patients. The effect of the PDL is working at $585\,\mu m$. It destroys the vessels and creates an anoxia of the lesions.
Study: The study was performed on 57 cases as followed: 21 Papilloma, 8 microvarices, 3 reinke'space oedema- 9 dysplasia, 6 scar, 10 post radiotherapy-oedema. We used a KayPentax video laryngeal fiberscope with an operating channel. The patient is awake or a very low neuro-analgesic (Propofol).
Results: The pathologies and the results that we have proceed on the larynx are - 21 Papilloma, 16 satisfactory and 5 failures results- 8 microvarices, 7 excellent 1 satisfactory results- 3 reinke'space oedema, 2 excellent and 1 satisfactory results- 9 dysplasia, 7 excellent and 2 failures results- 6 scar, 4 satisfactory and 2 failures results- 10 oedema after radiotherapy. 8 excellent and 2 satisfactory results.
Conclusion: This technique, after 3 years of follow up looks an complementary technique of the CO_2 Laser on Laryngeal

Microsurgery on the vocal folds. With such a technique, we avoid general anesthesiology which is fundamental for weak patients (cardiac. . .) On Papilloma with, at least, recurrences every 4 to 6 months a risk of the general anesthesiology. We avoid a week of voice rest. Incidence of PCOS, we recommend mandatory hormonal and sonographic screening prior to initiating laser treatment.

#233

IMAGE GUIDED INTERSITIAL PROSTATE LASER ABLATION

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Biofoundation for Angiogenesis; Sperling Prostate Center, New York, NY

Background: To follow thermal treatment progress of prostate cancers with 3-d power doppler sonography (3d-pds) and 3-T dce mri.

Study: 59 patients with gleason grade 3 or 4 focal prostate cancer were prospectively scanned with a ge voluson e-9 unit employing linear 18 mhz probe with conventional 3d/4d imaging using 3d angio and glass body power doppler image reconstruction. All patient images were imaged by dce-mri with 3.0 t siemens unit within one week of sonogram. Patients (21) from 1/2/12 to 7/1/12 were treated with 980 wavelength diode laser with endfire heat distribution after local ultrasound guided anesthesia of the neurovascular bundles. Safety thermal zones were outlined to protect rectum, bladder and neurovascular bundles using MRI telethermometry.

Results: 3d pds and dce-mri showed the tumor vascularity absent posttreatment in 21/21 patients. Patients returned to work immediately without catheter. No posttreatment complications were noted at 6 months.

Conclusion: Vascular imaging combining DCE-MRI and Doppler ultrasound appears useful in preoperative planning, guidance and follow up of laser ablative treatments.

#234

IN VIVO LASER CARTILAGE RESHAPING WITH CARBON DIOXIDE SPRAY COOLING IN A RABBIT EAR MODEL: A PILOT STUDY

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University of California, Los Angeles, CA; Beckman Laser Institute and Medical Clinic, University of California, Irvine, CA

Background: Similar to conventional cryogen spray cooling, carbon dioxide (CO_2) spray may be used in combination with laser cartilage reshaping (LCR) to produce cartilage shape change while minimizing cutaneous thermal injury. Recent *ex vivo* evaluation of LCR with CO_2 cooling in a rabbit model has identified a promising initial parameter space for *in vivo* safety and efficacy evaluation. This pilot study aimed to evaluate shape change and cutaneous injury following LCR with CO_2 cooling in 5 live rabbits.

Study: The midportion of live rabbit ears were irradiated with a 1.45 μm wavelength diode laser ($12\,J/m^2$) with simultaneous CO_2 spray cooling (85 ms duration, 4 alternating heating/cooling cycles per site, 5 to 6 irradiation sites per row for 3 rows per ear). Experimental and control ears (no LCR) were splinted in the flexed position for 4 weeks following initial treatment. A total of 5 ears each were allocated to the experimental and control groups.

Results: Shape change was observed in all irradiated ears (mean $70 \pm 3^{\circ}$), which was statistically different from control (mean $37 \pm 11^{\circ}$, $p = 0.009$). No significant thermal cutaneous injury was observed, with preservation of the full thickness of skin, microvasculature, and adnexal structures. Confocal microscopy and histology demonstrated an intact and viable chondrocyte population surrounding irradiated sites.

Conclusion: LCR with CO_2 spray cooling can produce clinically significant shape change in the rabbit auricle while minimizing thermal cutaneous and cartilaginous injury and frostbite. This pilot study lends support for the potential use of CO_2 spray as an adjunct to existing thermal-based cartilage reshaping modalities. An *in vivo* systematic evaluation of optimal dosimetries and cooling parameters is required.

Faculty/Speaker Disclosures

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Abdel-Salam	Zeinb	No disclosure
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Khan	Sazzadur Rahman	Consulting fees from Skin Care and Dermatopathology Associates, Caliber Imaging & Diagnostic, Inc., ownership interest with Skin Care and Dermatopathology Associates; served on advisory board for Caliber Imaging & Diagnostics, Inc.
Kielian	Tammy	No disclosure
Kilmer	Suzanne	Consulting fees from Lumenis, Miramar, Syneron-Candela, Zeltiq; honoraria from Lumenis, Solta, Syneron-Candela, Zeltiq
Kim	Beom Joon	No disclosure
Kim	Eun Hee	No disclosure
Kim	Jenny	Consulting fees from Allergan, Medicis; salary, ownership interest, served as officer or director for Allergan
Kim	Ji Hoon	No disclosure
Kim	Jin Yong	No disclosure
Kim	Min Jeong	No disclosure
Kim	Soo-Shin	No disclosure
Kitajima	Hiroumi	Financial grant from St. Jude Medical
Knudsen	Bruce	No disclosure
Koenig	Karsten	Financial grant, travel expenses, salary, royalties, ownership interest, intellectual property rights, served as officer or director for JenLab
Kohanchi	Dillen	No disclosure
Komen	Lisa	No disclosure
Koo	Bonnie	No disclosure
Kooby	David	No disclosure
Kostenich	Genady	No disclosure
Kozub	John	No disclosure
Krasieva	Tatiana	No disclosure
Krauss	Madeline	No disclosure
Kroshinski	Daniela	No disclosure
Kundra	Vikas	Consulting fees and served on advisory board for Malinckrodt; intellectual property rights with Introgen Research
Kwon	Young-Jik	No disclosure
Labat Marcos	Rodrigo	No disclosure
Landaverde	Hugo	No disclosure
Langer	Robert	No disclosure

Last Name	First Name	Disclosure
Lanzafame	Raymond	Financial grant from Apira Science Top Hat 655 Study, J&J (CPUS) Contract Research Project; equipment from Apira Science, J&J (CPUS), NuvoLase; consulting fees from Apira Science, J&J (CPUS), GLG Councils, Leerink Swan; travel expenses and honoraria from ASLMS, SLS; ownership interest with Kodak, Lucid, JAMAR; intellectual property rights with Provisional Patent Conversion Energy Enterprises; consultant to the General and Plastic Surgery Devices Panel of the Medical Devices Advisory Committee of the FDA, CDRH; served as officer or director for ASLMS, SLS, Monroe County Medical Society; editor-in-chief of Photomedicine and Laser Surgery, editorial boards of General Surgery News, Journal of Laparoscopic Surgery, Journal of the Society of Laparoscopic Surgeons and Lasers in Medical Science
Lapidoth	Moshe	No disclosure
Laquer	Vivian	No disclosure
Lask	Gary	Discount and serves on advisory board for Syneron-Candela; travel, honoraria, ownership interest with Invasix
Lazzari	Tiziana	No disclosure
Leal Silva	Hector	No disclosure
Leal-Junior	Ernesto Cesar	No disclosure
Leao	Byanne	No disclosure
Ledon	Jennifer	No disclosure
Lee	Dong Yoon	No disclosure
Lee	Grace	No disclosure
Lee	Jason	No disclosure
Lee	Jong Hee	No disclosure
Lee	Joo Heung	No disclosure
Lee	Jungsoo	No disclosure
Lee	Patrick	No disclosure
Lekka	Stamatina	No disclosure
Leonardo	Patricia Sardinha	No disclosure
Lepselter	Joseph	No disclosure
Lertsakdadet	Ben	No disclosure
Levy	Hanna	No disclosure
Lewis	William	No disclosure
Li	Fang-Hui	No disclosure
Li	Sheng	No disclosure
Libago	MaryLois	No disclosure
Lim	Liang	No disclosure
Lin	Alexander	No disclosure
Lin	Jennifer	No disclosure
Lin	Lin	No disclosure
Linares	Rafael	No disclosure
Lindoso	Jose Angelo	No disclosure
Liu	Gangjun	No disclosure
Liu	Timon Cheng-Yi	No disclosure
Longo	Leonardo	No disclosure
Lopes	Luciana	No disclosure
Lopes-Martins	Rodrigo Alvaro	No disclosure

Last Name	First Name	Disclosure
LoPiccolo	Mat	No disclosure
Loren	David	Consultant for Pinnacle Biologies, Boston Scientific, Cook Medical
Loureiro	Vivian	No disclosure
Lu	Zongshun	No disclosure
Luebberding	Stefanie	No disclosure
Lupin	Mark	No disclosure
Lyke	Stephanie	No disclosure
Machado	Patricia	No disclosure
Magdalou	Jacques	No disclosure
Mahoney	Leysin	No disclosure
Maimaran	Jean-Jacques	No disclosure
Maithel	Shishir	No disclosure
Makura	Zvoru	No disclosure
Maloney	Ryan	Salary from Primcogent Solutions
Maltz	Lidya	No disclosure
Mandre	Shyam Kishan	No disclosure
Mang	Thomas	No disclosure
Mann	Margaret	No disclosure
Mansour	Stephanie	No disclosure
Manstein	Dieter	Financial grant and equipment from Lumenis; consulting fees from Syneron, Zeltiq; royalties from Massachusetts General Hospital (from license with Palomar, Syneron, Zeltiq); ownership interest with GME, Zeltiq; intellectual property rights with Massachusetts General Hospital; served on advisory board for Zeltiq
Manuel	Cyrus	No disclosure
Manuskiatti	Woraphong	No disclosure
Marini	Leonardo	No disclosure
Mariwalla	Kavita	No disclosure
Marple	Eric	Salary, ownership interest, intellectual property rights, served as officer or director for Emvision LLC
Marqa	M. Feras	No disclosure
Martins	Luis	No disclosure
Martorano	Danielle	No disclosure
Massa	Mary	No disclosure
Massaki	Ane	No disclosure
Mathews	Marlon	No disclosure
Matioli	Pamella	No disclosure
Mazloomfard	Mohammad Mohsen	No disclosure
McDermott	Laura	Salary from DermaSweep; director of training and education at DermaSweep
McNichols	Roger	No disclosure
Menezes	Honorio	No disclosure
Messias	Felipe	No disclosure
Mihm Jr.	Martin C.	No disclosure
Miller	Joann	No disclosure
Miller	Lee	No disclosure

Last Name	First Name	Disclosure
Milner	Thomas	Royalties from the University of California; ownership interest with Dermalucent, Insight Photonics, Volcano; intellectual property rights with Dermalucent; served on advisory board for Insight Photonics
Mirkov	Mirko	Travel, salary, ownership interest with Cynosure
Mishra	Vineet	No disclosure
Mittal	Richa	No disclosure
Mochizuki	Amane	No disclosure
Moeini	Aida	No disclosure
Moerk	Gro	No disclosure
Mohamed	Nagwa	No disclosure
Monetta	Lina	No disclosure
Moon	Hye-Rim	Financial grant from Lutronic
Mordon	Serge	No disclosure
Morgan	Janet	No disclosure
Morrison	Sara	No disclosure
Morsoleto	Maria José	No disclosure
Mourvillier	Bruno	No disclosure
Moy	Justin	No disclosure
Moy	Wesley	No disclosure
Mraz Robinson	Deanne	No disclosure
Mroz	Pawel	No disclosure
Mulla	Omar	No disclosure
Munavalli	Gilly	Financial grant from Lumenis, Ulthera, Zeltiq
Murray	Clinton	No disclosure
Nabelsi	Tasneem	No disclosure
Naeser	Margaret	No disclosure
Nakata	Leticia Simon	No disclosure
Narurkar	Vic	Financial grant from Solta
Nash	Jay	No disclosure
Navarro	Artemio	No disclosure
Negishi	Kei	Equipment from Cutera, Ellipse, Sciton; honoraria from Cutera, Sciton; served on advisory board for L'Oreal
Nehal	Kishwer	No disclosure
Nelson	Andrew	Honoraria and served on promotional speaker's bureau for Invasix
Nelson	J. Stuart	Financial grant, equipment, travel expenses, royalties, honoraria, intellectual property rights with CoolTouch (New Star), Syneron-Candela, Pfizer/Wyeth
Nestor	Mark	Financial grant from DUSA, Erchonia, Galderma, LEO, Medicis, Noven, Transdermal, Ulthera; consulting fees from Erchonia, Galderma, Medicis, Pyratine, Transdermal, Ulthera; travel expenses from Erchonia, Galderma, Medicis, Transdermal; royalties from GSK; honoraria and served on romotional speaker's bureau with Medicis; served on advisory board for Beiersdorf, Ferndale, Galderma, Genentech, LEO, Medicis, Renew Advantage
Nguyen	Paul	No disclosure
Nguyen	Tony	v
Niamtu	Joe	Served on promotional speaker's bureau for Lumenis
Nie	Shuming	No disclosure

Last Name	First Name	Disclosure
Nieri	Ana Carolina	No disclosure
Nieto	Silvana	No disclosure
Nishida	Joen Akemi	No disclosure
Nour	Sherif	No disclosure
Nouri	Keyvan	No disclosure
Nowroozi	Bryan	No disclosure
Nuijs	Tom	Salary from Philips Research
Nunez	Silvia	No disclosure
Obara	Yoshiko	No disclosure
Ogden	Neil	No disclosure
Oh	Christian	No disclosure
O'Hara	Michael	No disclosure
Oliveira	Nicole Cristine Rigonato	No disclosure
Oliveira Silva	Andréia Aparecida	No disclosure
Omi	Tokuya	No disclosure
O'Neil	Michael	No disclosure
Ontaneda	Miguel	No disclosure
Orenstein	Arie	No disclosure
Ortiz	Arisa	No disclosure
Oron	Uri	Financial grant from Johnson & Johnson
Osorio	Nuno	No disclosure
Ostrowski	Rafael	Consulting fees from Tria Beauty
Ovtcharov	Tracy	No disclosure
Owens	Patricia	Consulting fees from Rockwell Laser Industries; honoraria from Dermatology Nurses Association, ASLMS, Malady Cengage Publishing Company
Ozog	David	Other from Lumenis
Paasch	Uwe	No disclosure
Paiva	Érika Carolina	No disclosure
Pallota	Rodney Capp	No disclosure
Palm	Melanie	Discount from Lutronic, consulting fees and honoraria from Lumenis, Lutronic
Palomar	Maria Angustias	No disclosure
Paoli	John	No disclosure
Parada	Carlos	No disclosure
Park	B. Hyle	No disclosure
Park	Gyeong Hun	No disclosure
Park	Hyun Sun	No disclosure
Park	Hyunhee	No disclosure
Park	Kui Young	No disclosure
Parra	Camila	No disclosure
Patel	Rakesh	No disclosure
Patel	Shahzad	No disclosure
Patriota	Régia	No disclosure
Paulis	Marianna	No disclosure

Last Name	First Name	Disclosure
Payongayong	Lea	No disclosure
Perchuk	Igor	No disclosure
Pereira	Benedito	No disclosure
Pereira	Mara	No disclosure
Pereira	Thiago Martini	No disclosure
Pérez	Bibiana	No disclosure
Pérez	Paz	No disclosure
Persichetti	Paolo	No disclosure
Pestoni Porven	Carmela	No disclosure
Petrell	Kathleen	No disclosure
Philipsen	Peter Alshede	No disclosure
Pinheiro	Antonio	No disclosure
Pinto	Claudio	Travel expenses, salary from Pierre Fabre Dermo Cosmetique; served on advisory board for SPSSCS/ASAPS
Pinto	Juliana Guerra	No disclosure
Pinto	Michael	No disclosure
Pinto	Nathali Cordeiro	No disclosure
Piombino	Luca	No disclosure
Plapler	Hélio	No disclosure
Pogue	Brian	No disclosure
Poitevin	Nordon	No disclosure
Pomerantzeff	Pablo	No disclosure
Postiglione	Marco	No disclosure
Potma	Eric	No disclosure
Powell	Tracy	No disclosure
Pozner	Jason	Equipment from Cutera, DEKA, Dermawave, HOYA ConBio, Sanuwave, Sciton, Syneron, and Zimmer MedizinSystems; stockholder with Invasix, Plastic Surgery Channel, Real Self, Revance, Sciton, and Zeel; board of directors for Allergan/Clinique, Canfield, Coapt Medical, Eclipse, Medicis, Mentor, Plastic Surgery Channel, Real Self, Ultrashape, Zeel, Biopelle, QMP-Pulse, and the Journal of Cosmetic and Laser Therapy
Prasad	Ratna	Financial grant from NIH SBIR Phase II; salary from Vanderbilt
Prates	Renato	No disclosure
Premerl Fernandez	Cristina Josefina	No disclosure
Price	Lori Lynn	No disclosure
Protsenko	Dmitriy	No disclosure
Pryor	Brian	Salary, ownership interest, served on advisory board, officer or director for Litecure
Purschke	Martin	No disclosure
Qiu	Jinze	No disclosure
Quon	Harry	No disclosure
Rahouadj	Rachid	No disclosure
Ramaprasad	Vidyunmala	No disclosure
Rao	Bin	No disclosure
Rao	Masaru	No disclosure

Last Name	First Name	Disclosure
Rhee	Do-Young	Financial grant from Lutronic
Ribe	Adriana	No disclosure
Ribeiro	Carlos	No disclosure
Ribeiro	Livia Machado Oliveira	No disclosure
Ribeiro	Martha	No disclosure
Riggs	William	No disclosure
Rigual	Nestor	No disclosure
Rivera	Fabian Perez	No disclosure
Rivera	Katiuska	No disclosure
Robertson	John	No disclosure
Rodriguez	Zulybeth	No disclosure
Rogers	Gary	No disclosure
Rogers	Nicole	No disclosure
Roh	Mi Ryung	No disclosure
Rohrbach	Daniel	No disclosure
Rohrer	Thomas	Honoraria and served on promotional speaker's bureau for Syneron-Candela, Solta; ownership interest with Julia, Radiancy; served on advisory board for Syneron-Candela, Radiancy; served as officer or director for Syneron-Candela
Rokhsar	Cameron	No disclosure
Roma	Alan	No disclosure
Romero	Rebecca	No disclosure
Ross	E. Victor	Financial grant from Alma, Palomar, Sciton, Stateris, Syneron-Candela; equipment from Lumenis; consulting fees from Palomar, Miramar, Sebacia; honoraria from Alma, DEKA, Lumenis, Palomar, Syneron-Candela; served on advisory board for Miramar
Ross	Gerald	Royalties and officer or director for Laser Light Canada
Ross	Patrick	No disclosure
Rossi	Anthony	No disclosure
Rossi	Wagner	No disclosure
Rossmeisl	John	No disclosure
Rylander	Christopther	Financial grant from Candela/Syneron; intellectual property rights with DermaLucent
Ryu	Hwa Jung	No disclosure
Sabokpey	Sara	No disclosure
Sabino	Caetano	No disclosure
Sachdev	Mukta	No disclosure
Saedi	Nazanin	No disclosure
Saidu	Edward	No disclosure
Sakamoto	Fernanda	Consulting fees from Galderma, Living Proof
Salinas	Harry	No disclosure
Samad	Ricardo Elgul	No disclosure
Sanches	Iris	No disclosure
Santana	Eduardo	No disclosure
Santin	Giada	No disclosure
Santos	Moises Oliveira	No disclosure

Last Name	First Name	Disclosure
Santos	Roberto Euzebio	No disclosure
Santos	Xavier	No disclosure
Sarraf	Amin	No disclosure
Sasaki	Gordon	No disclosure
Savas	Jessica	No disclosure
Schneblen	Wendy	No disclosure
Schomacker	Kevin	Travel expenses, salary from Syneron-Candela; ownership interest with Syneron Medical
Seiji	Kawana	No disclosure
Sella	Valeria	No disclosure
Sen	Priya	No disclosure
Sensing	Whitney	No disclosure
Seo	Kyle	No disclosure
Serowka	Kathryn	No disclosure
Serrão Junior	Nelson Francisco	No disclosure
Shaffer	Natalie	Tria Beauty paid for registration, travel, and hotel expenses to attend ASLMS Annual Conference
Shanks	Steven	Travel expenses, salary, royalties, honoraria, ownership interest, intellectual property rights, served on advisory board and as an officer or director for Erchonia
Sharma	Manu	No disclosure
Shek	Samantha	No disclosure
Shen	Jen-Hsiang	No disclosure
Shen	Jin	Financial grant from NIH SBIR Phase II; Vanderbilt Discovery Grant; salary from Vanderbilt; intellectual property rights with Vanderbilt
Shigeru	Sato	No disclosure
Shih	En-Chung	No disclosure
Shinji	Hayashibara	No disclosure
Shofner	Joshua	No disclosure
Shu	Chunying	No disclosure
Shumaker	Peter	No disclosure
Sierra	Rafael	Employee of Cynosure
Silva	Bianca	No disclosure
Silva	Gina	No disclosure
Silva	Jessica	No disclosure
Slayton	Michael	Salary, royalties, intellectual property; served as officer or director for GTS
Sliney	David	Received consulting fees from Palomar Medical Technologies, Procter and Gamble, Carl Zeiss, Meditec, Abbott Medical Optics, SpectraGenics, LensAR, Tecnolas, Vistakon, Calhoun Vision, Philips Healthcare; travel expenses from Palomar Medical Technologies, Procter and Gamble
Small	William	No disclosure
Smirnov	Mikhail	No disclosure
Smith	Jason	No disclosure
Smotrich	Mike	Travel expenses, salary, ownership interest, officer or director for Palomar Medical Technologies
Song	Kye-yong	No disclosure

Last Name	First Name	Disclosure
Soto	Claudine	No disclosure
Soukos	Nicos	Scientific founder of PhotOral, Inc.
Sousa	Marcelo	No disclosure
Soyama	Sieko	No disclosure
Spangler	Charles	Financial grant, travel, salary, ownership interest, intellectual property rights and served as board or officer for SensoPath Technologies
Sperling	Dan	No disclosure
Sprague	Rebecca	No disclosure
Staley	Charles	Consulting fees from Bayer
Stankiewicz	Kelly	No disclosure
Struck	Steven	No disclosure
Sun	Chung-Ho	No disclosure
Sun	Victor	No disclosure
Sunar	Ulas	No disclosure
Taghados	Seyed Javid	No disclosure
Taha	Hanaa	No disclosure
Tam	Joshua	No disclosure
Tan	Wenbin	No disclosure
Tanaka	Shiho	No disclosure
Tanghetti	Emil	Equipment from Cynosure, DUSA, Palomar; served on advisory board and promotional speaker's bureau for Cynosure, DUSA
Tanghetti	Margo	No disclosure
Tannous	Zeina	No disclosure
Tanzi	Elizabeth	Equipment from Cynosure, CoolSculpting, Lumenis, Palomar, Solta, Syneron-Candela; consulting fees from Miramar; honoraria from Ulthera; served on advisory board for CoolSculpting, Miramar
Tarvido	Joao Paulo	No disclosure
Tasca	Mariana	No disclosure
Taub	Amy	Equipment from Pollagen; discount from Syneron; consulting fees and honoraria from DUSA; travel expenses and served on advisory board for Renew Advantage
Taudorf	Elisabeth H.	Financial grant from Pantec Biosolution
Tawfik	Abeer	No disclosure
Tay	Yong-Kwang	No disclosure
Taylor	Zachary	No disclosure
Taylor	Mark	No disclosure
Tenna	Stefania	No disclosure
Thaysen-Petersen	Daniel	Financial grant and equipment from Procter & Gamble
Thompson	Scott	No disclosure
Thornfeldt	Carl	Salary and ownership interest with Episciences
Tingey	Chad	No disclosure
Togsverd-Bo	Katrine	Honoraria from Galderma
Tobita	Saori	No disclosure
Tome	Mohamed	No disclosure
Tomimura	Suely	No disclosure

Last Name	First Name	Disclosure
Torezan	Luis	No disclosure
Torres	William	No disclosure
Touma	Dany	No disclosure
Town	Godfrey	No disclosure
Travassos	Ana Rita	No disclosure
Trelles	Mario	No disclosure
Tremaine	Anne-Marie	No disclosure
Tromberg	Bruce	No disclosure
Truong	Samuel	No disclosure
Tuby	Hana	No disclosure
Tunnell	James	Financial grant from National Institutes of Health, Texas Higher Education Coordinating Board, DermDx, Inc., royalties from the University of Texas at Austin; ownership interest with Dell, Inc., DermDx, Inc.
Uebelhoer	Nathan	No disclosure
Uzunbajakava	Natallia	Salary and intellectual property rights with Philips
Vacas-Jacques	Paulino	No disclosure
Vaezy	Shahram	No disclosure
Vairetti	Mariapia	No disclosure
Valera	Marcia Carneiro	No disclosure
van der Veen	Wietze	No disclosure
Van Drooge	Anne Margaret	No disclosure
van Vlimmeren	Marijke	No disclosure
Vanscheidt	Wolfgang	No disclosure
Ventura	Kim	No disclosure
Verebelyi	David	Discount from Cutera, Cynosure, Lumenis, Zeltiq; travel expenses from Skin Medica; honoraria from Lumenis
Vermandel	Maximilien	No disclosure
Vezzoni	Paolo	No disclosure
Victor	Garcia	No disclosure
Viera	Nilson Dias	No disclosure
Vila Echague	Augustina	Research grant and equipment from Candela-Syneron
Villanueva	Michelle	No disclosure
Vogt	William	No disclosure
von Leden	Ramona	No disclosure
Vrahas	Mark	Consulting fees from Synthes; ownership interest with Pioneer Medical
Vrba	Jan	No disclosure
Waibel	Jill	Financial grant from ASDS; equipment Alma, Lumenis, Lutronic, Palomar, Sciton, Syneron-Candela; honoraria from Loreal, Lumenis, Sciton, Syneron-Candela; intellectual property rights with Laser Assisted Delivery of Stem Cell
Wakamatsu	Shingo	No disclosure
Walker	Jessica	No disclosure
Wang	Alex	No disclosure
Wang	Bingqing	No disclosure
Wang	Etienne	No disclosure

Last Name	First Name	Disclosure
Wang	Lihong V.	Ownership interest with Endra, Microphotoacoustics
Wang	Michael	No disclosure
Wang	Tianyi	No disclosure
Wang	Yan	No disclosure
Wang	Ying	No disclosure
Wanitphakdeedecha	Rungsima	No disclosure
Wanner	Molly	Consulting fees, travel expenses, served on advisory board for Nu Skin
Wasilenchuk	Jennifer	No disclosure
Weaver	Chad	No disclosure
Wei	En-Xiu	No disclosure
Weinigel	Martin	No disclosure
Weiss	Elliot T.	No disclosure
Weiss	Margaret	Financial grant from Allergan, Cabochon, Fibrocell, Galderma, Medicis, Palomar, Revance, Zeltiq; equipment from BTL Industries, CoolTouch, Palomar, Syneron-Candela; discount from CoolTouch; consulting fees from CoolTouch, Merz; travel expenses from Fibrocell, Merz, Palomar; honoraria from Allergan, Bioniche, BTL Industries, CoolTouch, Fibrocell, Merz, Palomar; served on advisory board for CoolTouch, Fibrocell, Merz, Palomar; served on promotional speaker's bureau for Fibrocell, Palomar
Weiss	Robert A.	Financial grant from Allergan, Cabochon, Fibrocell, Galderma, Medicis, Palomar, Revance, Zeltiq; equipment from BTL Industries, CoolTouch, Palomar, Syneron-Candela; discount from CoolTouch; consulting fees from CoolTouch, Merz; travel expenses from Fibrocell, Merz, Palomar; honoraria from Allergan, Bioniche, BTL Industries, CoolTouch, Fibrocell, Merz, Palomar; served on advisory board for CoolTouch, Fibrocell, Merz, Palomar; served on promotional speaker's bureau for Fibrocell, Palomar
Westgate	Gill	Consulting fees from Philips Electronics
Wiener-Kronish	Jeanine	No disclosure
Wilder-Smith	Petra	No disclosure
Wilkinson	Ashley	No disclosure
Wink	Cherie	No disclosure
Winstanley	Doug	No disclosure
Wolkerstorfer	Albert	No disclosure
Won	Chong-Hyun	Financial grant from Lutronic
Wong	Brian	Financial grant from Infralase, Lockheed-Martin, Candela, OCT Medical; equipment from New Star Lasers, Lockheed-Martin; consulting fees from Allergan, Johnson & Johnson; travel expenses from Allergan, Aerin Medical, Johnson & Johnson; ownership interest with Aerin Medical, Praxis BioSciences, Silhouette Medical; intellectual property rights and served as an officer of director for Praxis BioSciences, Silhouette Medical; served on advisory board for Allergan, Aerin Medical
Wong	Carson	Consulting fees from American Medical Systems
Wong	Titus	No disclosure
Woodrum	David	No disclosure
Woodward	Julie	Consulting fees from Lutronic, SkinCeuticals, Medicis, Merz; served on advisory board for SkinCeuticals
Wronski	Adam	No disclosure
Wu	Edward	No disclosure
Wu	Xingjia	No disclosure

Last Name	First Name	Disclosure
Wulf	Hans Christian	No disclosure
Wulkan	Adam	No disclosure
Xiao	Yan	No disclosure
Xu	Yang-yi	No disclosure
Xuan	Weijun	No disclosure
Yaghmai	Dina	No disclosure
Yang	Bruce	No disclosure
Yang	Jun Mo	No disclosure
Yang	Kelly	No disclosure
Yang	Owen	No disclosure
Yaroslavsky	Anna	No disclosure
Yaroslavsky	Ilya	Financial grant, travel expenses, salary, ownership interest with Palomar
Yeung	Chi-Keung	No disclosure
Yin	Rui	No disclosure
Yoshimura	Elisabeth	No disclosure
Yoshimura	Tania	No disclosure
Yuki	Yamamoto	No disclosure
Yun	Seok Hyun	No disclosure
Zachary	Chistopher	Equipment from Cutera, Cynosure, Lutronic, Solta, Zimmer; discount from Solta; consulting fees from Cutera; travel expenses from Cutera, Solta; honoraria from Solta, Zeltiq; ownership interest with Lumany; served on promotional speaker's bureau for Alma, Medicis
Zamataro	Claudia Bianchi	No disclosure
Zamora	Genesis	No disclosure
Zapol	Warren	No disclosure
Zarraga	Matthew	No disclosure
Zedlitz	Ann	No disclosure
Zeitouny	Mounir	No disclosure
Zeitouni	Natalie	No disclosure
Zelickson	Brian	Equipment from Lumenis, Palomar, Syneron-Candela; consulting fees from Medicis, Miramar; honoraria from Alma, Cutera, Lumenis, Palomar, Syneron-Candela, Ulthera, Zeltiq; ownership interest with Zeltiq; intellectual property rights with Alma, Syneron-Candela
Zezell	Denise	No disclosure
Zhang	Yunsong	No disclosure
Zheng	Shijun	No disclosure
Zhu	Ling	No disclosure
Zibert	John	Salary from Leo Pharma A/S
Zorn	Telma Maria Tenorio	No disclosure

Author-Abstract Index*

*Numbers represent the abstract number, not the page number.