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ABSTRACTS

Abstracts

Basic Science and Translational Research

SUBMISSION TITLE: ABLATIVE FRACTIONAL LASER REDUCES GENE EXPRESSION OF HEDGEHOG PATHWAY TARGET GENES IN MURINE BASAL CELL CARCINOMAS

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Background: Basal cell carcinomas (BCCs) are associated with aberrant activation of the hedgehog pathway and can be treated with hedgehog inhibitors such as vismodegib. Preclinical studies show that ablative fractional laser (AFL) can increase the cutaneous uptake of topically applied vismodegib, but the effects of AFL on hedgehog pathway activity have not been explored. This study aimed to investigate the impact of AFL on hedgehog pathway target gene expression in microscopic murine basal cell carcinomas and compare these results to the effect of topical vismodegib treatment.

Study Design/Materials and Method: In 24 mice, a total of 44 skin test sites (1 cm^2) containing microscopic BCCs were exposed to three interventions: (i) a single CO_2 AFL treatment (40 mJ/mb, 5% density, Day 1, $n = 12$); (ii) topical treatment with vismodegib emulsion (3.8 mg/mL, twice daily for 4 days, $n = 8$); (iii) a combination of AFL and vismodegib treatment ($n = 9$). Untreated controls were included for comparison ($n = 15$). On Day 4, test sites were sampled for both qPCR analysis of expression of three hedgehog pathway genes (Gli1, Gli2, and Ptch1 mRNA), and mass spectrometry analysis of cutaneous vismodegib concentration. qPCR results are reported as mean reductions of gene expression in percent, and concentration results as means with standard error of the mean (SEM).

Results: A single AFL treatment led to significant reduction in expression of hedgehog pathway target genes versus untreated controls (Gli1 72% reduction, $p < 0.01$; Gli2 55% reduction, $p = 0.02$; Ptch1 71% reduction, $p < 0.01$). In comparison, eight topical vismodegib applications led to slightly higher mean reductions in gene expression (Gli1 92% reduction, $p < 0.01$; Gli2 83% reduction, $p < 0.01$; Ptch1 83% reduction, $p < 0.01$), which was significantly better than AFL only for Gli1 and Gli2 but not Ptch1 (AFL vs. vismodegib: Gli1, $p = 0.02$; Gli2, $p < 0.01$; Ptch1, $p = 0.18$). Combination of AFL and topical vismodegib did not further decrease gene expression compared to vismodegib alone ($p = 0.29$–0.56). These results might be explained by similar cutaneous vismodegib concentrations in the two groups (combination therapy, 963 ± 255 µmol/L; vismodegib monotherapy 790 ± 156 µmol/L; $p = 0.573$), which could indicate that the murine skin approached maximal vismodegib saturation following either intervention.

Conclusion: A single AFL treatment of microscopic murine BCCs reduced hedgehog pathway target genes to almost the extent as observed for repeated topical applications of vismodegib. Future studies should elucidate the mechanism behind AFL reduction of hedgehog pathway target genes.

SUBMISSION TITLE: ALTERATIONS IN THE MRNA SIGNATURE OF FACIAL SKIN TREATED WITH 524 NM LOW-LEVEL LIGHT THERAPY

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Background: The biological effect of green low-level-light-therapy (LLLT wavelength 520–565 nm) on in vivo human skin has yet to be evaluated. Preclinical studies have demonstrated that green LLLT can accelerate wound healing and reduce inflammatory infiltrate in rodent and human cell culture models. Given the potential for the application of green LLLT in clinical practice, the authors sought to expand on the findings of previous green LLLT studies through gene expression analysis of human tissue samples. In this study, we examined differences in messenger RNA (mRNA) expression between skin treated with green LLLT versus untreated skin in an exploratory RNA sequencing analysis.

Study Design/Materials and Method: Five healthy adult participants (females ages 41–54, Fitzpatrick I–III) were instructed to apply green LLLT (524 nm, MMSphere™) placed 12–24 inches from the skin to a randomized side of their face for 20 minutes daily, three to five times per week. The study duration was 4 weeks. Following 4 weeks of treatment, 3.5 mm punch biopsies were taken from the treated and untreated preauricular cheeks. The tissue was analyzed by RNA sequencing. For statistical analysis, a mixed-effect model was estimated under the R limma package framework. Condition (treated/nontreated) was considered a fixed factor and random effect for the subject. The least squared means were compared using multiple Student *t* tests and *p*-values were corrected using the Benjamini-Hochberg procedure. A fold change absolute value larger than 1.5 and adjusted value less than 0.05 was considered to calculate differential expressed genes. Ingenuity pathway analysis and Gene Set Variation analysis were performed.

Results: A principal component analysis (PCA) was performed to show how the treated and nontreated samples clustered according to their expression. PCA demonstrated significant differentiation, indicating expression patterns for the treated samples were distinct from nontreated samples ($p < 0.05$). To further characterize these differences, the authors identified six differentially expressed canonical pathways with clinically relevant implications in human skin. mRNA expression in the wound healing pathway, the liver-x-receptor-retinoid-x-receptor (LXR-RXR) pathway, and the white adipose tissue browning pathway were significantly upregulated ($p \leq 0.05$, $p < 0.01$, and $p < 0.01$, respectively). Conversely, inflammatory pathways such as interleukin-17 signaling, the T helper cell 17 (Th17) pathway, and crosstalk between dendritic cells and natural killer cells were significantly downregulated in treated skin compared to untreated skin ($p < 0.01$, $p < 0.01$, and $p < 0.05$, respectively).

Conclusion: Overall, the genetic signatures of treated and untreated skin were distinctly different as demonstrated by PCA. Induction of pathways such as wound healing, LXR-RXR, and white adipose tissue browning indicates that green LLLT promotes skin regeneration, lipid modulation, and epidermal barrier maintenance. This suggests green LLLT may be beneficial in the treatment of acne and skin aging, among other common dermatologic concerns. Suppression of the Th17 pathway and immune cell crosstalk in treated samples highlights clinical implications for green LLLT in the treatment of inflammatory skin disease. Overall, the findings presented in this investigation signify the complexity of green LLLT's effect and its vast potential for use in clinical practice.

SUBMISSION TITLE: AN ASSESSMENT OF A NOVEL 3050/3200 NM FIBER LASER SYSTEM WITH A 40 μM SPOT SIZE FOR LASER-ASSISTED DRUG DELIVERY

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Background: Ablative fractional lasers (AFLs) are commonly used as alternatives to fully ablative lasers to achieve skin improvement in dermatology. They are also used to enhance delivery of drugs through skin. For drug delivery, AFLs are employed to create ablation zones (AZs) to bypass the rate-limiting stratum corneum (SC) barrier and the zones serve as a transport pathway to the underlying dermis. Previously, we introduced an investigational fiber laser pumped Difference Frequency Generation (DFG) system that can generate very small ("microfractional") ablative lesions using two highly water-absorptive wavelengths (3050 and 3200 nm). Results revealed efficient ablation with coagulation zone widths between that of the commercially used Er:YAG and CO_2 lasers. The previous DFG prototype had a spot size of 91 μm. In this study, the spot size has been further reduced to 40 μm, making the new DFG laser the fractional laser with the smallest spot size to date. A key advantage of microscopic ablation channels is that treatment with a high number density on surface is clinically feasible, resulting in much higher rates of drug diffusion compared to larger size channels for the same coverage rate. Here, we have investigated the DFG laser-tissue interaction and compared it to the widely used CO_2 laser. Additionally, we aim to assess the potential use of the DFG laser for drug delivery.

Study Design/Materials and Method: Fractional ablation was performed on ex vivo human abdominal

skin with an advanced DFG prototype with a spot size of 40 μm, pulse energies between 2 and 60 mJ and pulse duration ranging from 0.5 to 5 milliseconds. The relationship between increasing radiant exposure and resulting channel morphology, specifically ablation depth, channel diameter, and coagulation zone thickness, was determined through histological analysis using nitro-blue tetrazolium chloride stain. In the second stage, ex vivo human skin was treated with the DFG laser followed by topical application of topical drug formulations. The uptake of the drugs in the skin was monitored via fluorescence microscopy.

Results: The advanced DFG prototype induced a small spot size of 40 μm compared to the 120 μm of the CO_2 laser. The depth of the laser channels increased proportionally with increasing radiant exposure up to over 2 mm depth. Over a range of radiant exposures and at various depths, the channel diameter is consistently narrower for the DFG laser compared to the CO_2 laser. Similarly, the coagulation zones generated by the DFG laser are thinner than by the CO_2 laser. Finally, differences in drug uptake were visually analyzed through fluorescence microscopy.

Conclusion: The investigational DFG laser utilizes two highly water-absorptive wavelengths to generate microscopic ablation zones. The device used in this study is an advanced version of the previous DFG prototype with a reduced spot size of 40 μm. Compared to CO_2 lasers, coagulation zones and channel diameter created by the DFG laser are smaller. These findings suggest that the lesion geometry achieved by the DFG laser could be advantageous for the diffusion of specific drug molecules and can be tailored to particular drugs and therapeutic indications.

SUBMISSION TITLE: AN EX VIVO INVESTIGATION OF HIGH INTENSITY FOCUSED ULTRASOUND FOR TREATMENT OF CUTANEOUS NEUROFIBROMAS

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Background: Cutaneous neurofibromas (cNFs) affect up to 99% of patients with neurofibromatosis type 1 (NF1), a disease with an incidence of up to 1/2500 [1, 2]. cNFs are benign tumors, but can grow in size and increase in number throughout patients' lives. The visibility and prevalence of the cNF on exposed skin negatively affects patients' quality of life due to stigma, pain, and itching [3]. The visibility of cNF lesions independently has the greatest effect on quality of life [2, 4, 5].

Despite the effects of cNFs on patients' quality of life, surveillance or surgical excision of each lesion is the most common method of treatment. Surgical excision is time-consuming, expensive, difficult, and can cause morbidity. Nonsurgical, energy-based treatments that cause local heating and destruction of tissue have been explored for treatment of cNF. These methods destroy local neurofibroma tissue by ablation, and lead to lesion healing and loss of cNF appearance. Electrodissection was used in studies of up to 97 patients to treat more than 500 lesions per session [6, 7]. CO_2 lasers were used to treat 50–100 lesions per session in 106 patients [8]. Eighty lesions per session have been treated with radiofrequency ablation in studies of 8–20 patients [9–11]. These energy-based methods are promising, but cause significant scarring and are not currently used in standard clinical practice.

High intensity focused ultrasound (HIFU) has been investigated for many applications, including for treating malignant tumors in the liver, bone, prostate, and breast [12]. The advantage of HIFU is that it enables precise and accurate delivery of energy to subsurface tissue at relatively low costs. HIFU is fast and reliable and commercial HIFU instruments exist, enabling more rapid translation of technology to clinical settings. Here, we investigate the dosimetry and effects of HIFU on discarded cNF tissue as a first step towards validation and clinical trial translation.

Study Design/Materials and Method: Twenty-one cNF tumors, that were not required for diagnostic purposes, were collected from patients with NF1 who had undergone surgical excision of their cNF lesions. The tissue was rapidly frozen and stored in a −80°C freezer to prevent degradation. All study procedures were approved by the Massachusetts General Hospital Institutional Review Board.

At the time of HIFU treatment, the cNF tumors were defrosted in room temperature saline, that was then heated and maintained at 37°C during the experiments. All experiments were performed using a commercially available HIFU device (System ONE, TOOsonix) operating at 20 MHz. Four different ultrasound

transducers were used with focus depths of 0.8, 1.3, 1.8, and 2.3 mm. cNF lesions were centered on the ultrasound head and acoustic ultrasound gel was used to couple the head to the specimens.

HIFU pulses with durations varying from 150 to 500 milliseconds and acoustic powers varying from 1 to 9 W were applied to the specimens to enable variable delivery of energy at different durations. The effect of single pulse versus multiple pulses spaced temporally were investigated over a range of times and pulse frequencies. The experiments were repeated multiple times, using the same range of experimental parameters on cNF lesion from different patients to assess repeatability and robustness.

Surgical ink was applied to treated samples to mark treatment areas. The specimens were then rapidly frozen in optimal cutting temperature compound with dry ice and sectioned every 100 to 150 μm on a cryostat. The slides were stained with nitro blue tetrazolium chloride (NBTC), scanned with a slide scanner, then manually segmented to assess the size of the treatment area.

Results: At a fixed pulse duration, the treatment area, which was defined as the area of damaged tissue measured on histology, increased with increasing energy, and shorter pulse durations provided larger treatment areas due to higher average power. At a constant pulse duration of 300 milliseconds, the diameter of treatment area increased from 0, 0.4, 1.2, and 1.3 mm at energies of 0.5, 1.0, 1.5, and 2.0 J, respectively. At a constant pulse duration of 150 milliseconds, the diameter of treatment area increased from 0, 0.1, 0.6, 0.9, and 1.3 mm at energies of 0.15, 0.45, 0.75, 1.05, and 1.35 J, respectively. There was no treatment area observed at powers at or below 1 J. At higher energies, the treatment area had less variation in size.

At a fixed energy, the treatment area increased with increasing pulse duration and power. A constant energy of 1 J generated diameters of treatment areas of 0, 0.6, 0.7, 0.9, 1.0 mm at pulse durations of 500, 400, 300, 200, and 150 milliseconds and pulse powers of 2, 2.5, 3.33, 5, 6.7 W, respectively. At a constant energy of 2 J, the diameter of treatment areas were 1.2, 1.4, 1.3, and 1.5 mm at pulse durations of 500, 400, 300, and 230 milliseconds and pulse powers of 4, 5, 6.66, and 8.6 W, respectively. Measuring treatment areas at higher powers were not possible at 2 J due to limits on the HIFU device output power. Treatment area was similar at all powers tested at 2 J.

Increasing the number of applications of HIFU treatments at the same location increased the treatment area, with larger treatment areas resulting from shorter time intervals between treatment applications. For example, a single treatment of 2 J applied for 300 milliseconds generated a diameter of treatment area of 1.3 mm. Applying two treatments spaced 1 second apart, with the same pulse parameters, generated a treatment area of 1.9 mm.

The shape of the treatment area varied. However, a cone shaped treatment area was observed on most specimens. Treatment area increased towards the epidermis, with minimal increase in depth of the lesion at higher energies. This is advantageous since it enables specified treatment depths with variable treatment areas for different sized lesions without increasing the risk of treatment to deeper structures.

Conclusion: Treatment of ex vivo cNFs with HIFU rapidly generated treatment areas ranging from 0.1 to 1.5 mm in diameter, enabling targeted treatment of variable sized cNFs. Larger cNFs can be treated by applying multiple HIFU pulses at several positions over the surface of the cNF. HIFU might be a promising noninvasive treatment for cNFs. Future in vivo studies will be required to validate treatment parameters and clinical response.

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SUBMISSION TITLE: ANTIMICROBIAL BLUE LIGHT CAN DEGRADE B-LACTAMASES AND RESTORE B-LACTAM ANTIBIOTICS ACTIVITY

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Background: β-Lactamase expression in bacteria denotes a meaningful drug resistance mechanism implicated in serious hospital and community-acquired infections worldwide, promoting tremendous impact on human and animal health. Considered the most diverse class of enzymes produced by opportunistic pathogens, β-lactamases are found in Enterobacteriaceae (e.g., *Escherichia coli*, *Klebsiella pneumoniae*) and nonfermenting organisms (e.g., *Pseudomonas aeruginosa*). The enzymatic mechanism is based on β-lactam ring hydrolysis, inactivating β-lactam antibiotics. Bacteria carrying β-lactamase genes concern health authorities, owing to cause complicated infections, limiting the treatment options. In this regard, the search for new antibacterial drugs effective at treating infections caused by antibiotic-resistant bacteria is a high priority in modern medicine. Antimicrobial blue light (aBL; $\lambda = 405$ nm wavelength) has attracted increasing attention due to its intrinsic antimicrobial properties against a wide range of pathogenic microorganisms, including bacteria carrying antibiotic resistance genes. In this study, we aimed to understand aBL effects on bacteria species carrying β-lactamase genes and alterations in β-lactamase activity following aBL. Additionally, we study the β-lactamase and protein damage induced by aBL and the postbactericidal effect of aBL combined with a β-lactam antibiotic.

Study Design/Materials and Method: For this study, three bacterial species (i.e., *E. coli*, *K. pneumoniae*, and *P. aeruginosa*) carrying β-lactamase genes, covering all classes of molecular classification proposed by Ambler1, were selected. All strains were cultured on Brain Heart Infusion (BHI) agar or broth and incubated at 37°C in a stationary or shaking incubator.

To test the susceptibility of the β-lactamase strains to aBL, overnight cultures were centrifuged for 10 minutes at 7378*g*, and the bacterial pellet was washed twice in phosphate-buffered saline (PBS). The bacterial inoculum was adjusted in PBS by the turbidity of the suspension using a spectrophotometer to optical density = 1.0, reflecting to approximately $1–2 \times 109$ colony forming units (CFU)/mL. A light-emitting diode (LED) was used to deliver aBL ($\lambda = 410 \pm 10$ nm). One milliliters of bacterial inoculum was deposited into a 12-well plate and exposed to increasing doses of blue light, corresponding to 0, 22.8, 45.6, 68.4, 136.8, 205.2, 273.6, 342, 410.4, 478.8, and 547.2 J/cm^2. Samples were subjected to serial dilution and seeded on BHI agar plates for CFU quantification. Additionally, the lethal dose for 50%, 90%, 99%, 99.9%, and 99.999% of bacterial killing was determined for each strain using Sabino's algorithm [2].

The chromogenic cephalosporin hydrolysis assay assessed the β-lactamase activity in bacterial strains. Bacterial strains were irradiated to achieve 0%, 50%, 90%, 99%, 99.9%, and 99.999% bacterial killing. Bacterial inoculums were lysed, and the protein was recovered for analysis. Additionally, to confirm direct and extracellular alterations in β-lactamase activity following aBL exposure and the porphyrins' influence on the photoreaction promoted by aBL, the purified β-lactamase enzyme was assessed. One milliliter of the commercial β-lactamase recombinant expressed in *E. coli* at 1 mg/mL was exposed to aBL with or without the addition of Protoporphyrin IX (PPIX) at 1 μM 1 for 0, 34.2, 68.4, 136.8, and 273.6 J/cm^2. The bacterial protein and enzyme sample (5 μL) were placed into 96-well plates, and the β-lactamase activity (represented by nitrocefin hydrolysis rates) was determined by absorbance ($\lambda = 490$ nm measured every minute for 1 hour).

The SDS polyacrylamide gel electrophoresis (SDS-PAGE) was performed to evaluate possible β-lactamase damage induced by aBL. Representatively, we tested *P. aeruginosa*, and the commercially purified β-lactamase recombinant expressed in *E. coli* with or without the addition of PPIX at 1 μM. Samples were prepared and irradiated to 0, 68.4, 136.4, 273.6, 410.4, 547.2, and 684.0 J/cm^2. Bacterial proteins were extracted, processed, and added to a polyacrylamide gel. Protein band intensity was analyzed using Image J software.

Last, we assessed the postbactericidal effect of aBL combined with β-lactam antibiotic against *P. aeruginosa* strain. The dynamic of the bactericidal effect of aBL at a sublethal dose (22 J/cm^2) combined with ceftazidime in different concentrations (i.e., 1024, 512, 256, and 128 μg/mL) and compared to untreated samples, aBL (22 J/cm^2), and ceftazidime + avibactam (1024/128 μg/mL). Aliquots of each experimental sample were collected every hour for 8 hours, subjected to serial dilution, and seeded on BHI agar plates for CFU quantification.

Results: aBL effectively killed all selected strains evaluated in this study and demonstrated efficacy against all molecular β-lactamase classes, according to the classification proposed by Ambler. There was no

significant difference in susceptibility to aBL between strains of the same species. However, diverse levels of susceptibility were observed between species. *P. aeruginosa* shows more than 4-log10 CFU reduction after 68.2 J/cm^2, while *E. coli* required 204 J/cm^2 to achieve the same killing. *K. pneumoniae* was the most tolerant species, requiring more than 204 J/cm^2 to achieve an equivalent reduction.

Regarding the enzymatic activity, we observed a dose-dependent reduction in all tested strains. *E. coli* and *K. pneumoniae* only significantly reduced enzyme activity after doses higher than those required for 2-log10 CFU reduction. However, with doses required for LD50, *P. aeruginosa* strains demonstrated an important enzymatic activity reduction, achieving more than 50% of activity reduction after 1.52 J/cm^2 for *P. aeruginosa*.

Using the purified β-lactamase enzyme, we could confirm direct reductions in β-lactamase activity following aBL. Our results demonstrated an enzyme reduction of about 20% after 34.2 J/cm^2 (i.e., 15 minutes exposure to aBL). The results suggest that blue light alone can significantly reduce enzyme activity, even in extracellular conditions. Interestingly, when we added an exogenous porphyrin to the purified enzyme, we observed a 25% reduction in enzyme activity after 34.2 J/cm^2, reaching a 40% reduction in activity after 64.8 J/cm^2. The increased exposure to aBL did not show a significant reduction and can be explained by the consumption of PpIX during aBL exposure.

Complementary to the enzymatic activity, our SDS-PAGE assay confirmed that aBL induced reduction in the β-lactamase activity by protein degradation. By observing the purified β-lactamase enzyme samples in combination with PPIX, we noticed a reduction in dose-dependent band intensity even with the minimal dose tested in our study (68.4 J/cm^2). Our image analysis shows a 1.8-fold reduction in the band intensity after 30 minutes of aBL exposure. At doses higher than 136.4 J/cm^2, intensity bands are no longer visible. The result demonstrated that the protein breakdowns triggered by aBL led to the formation of smaller fragments of random sizes, reducing the intensity of the bands. However, when we studied purified β-lactamase enzyme using aBL alone (i.e., without supplemental PPIX), we did not observe a reduction in band intensity patterns even after high aBL exposures (684 J/cm^2). Additionally, using a representative *P. aeruginosa* strain, we followed the dose-dependent band intensity reduction in protein with different molecular weights. The result suggests that aBL can promote general protein degradation and shows the role of chromophores in the aBL photoreaction.

Interestingly, aBL at a sublethal dose improved ceftazidime activity in New Delhi Metallo-β-lactamase in the *P. aeruginosa* strain. Specifically, a 4-log10 CFU reduction in bacteria was observed in our study when ceftazidime was combined with aBL at sublethal doses. Our results suggest that class B metallo-β-lactamase susceptibility can be restored after aBL exposure.

Conclusion: In conclusion, our finds demonstrate that aBL can effectively kill strains carrying β-lactamase genes in different bacterial species and reduce the β-lactamase activity covering all classes of molecular β-lactamase enzymes. We also show the role of porphyrins on the photoreaction promoted by aBL and the resulting protein damage. Additionally, we demonstrate that aBL at sublethal exposures could promote ceftazidime activity in a metallo-β-lactamases strain of *P. aeruginosa*. Our finds successfully support the aBL activity against the β-lactamases and encourage future clinical outcomes.

SUBMISSION TITLE: CHARGE TRANSFER AND PH MAPPING DURING ELECTROCHEMOLIPOLYSIS OF EX VIVO HUMAN ABDOMINAL FAT

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Background: The popularity of minimally invasive body fat contouring procedures has increased in recent years, but they can be expensive and technically challenging. Electrochemolipolysis (ECL) is a novel technique that involves inserting electrodes into tissue and applying a direct current to induce redox reactions and alter the pH landscape within the tissue. This study examines charge transfer and pH changes during potentiostat based ECL therapy on ex vivo human adipose tissue.

Study Design/Materials and Method: Remnant panniculus tissue from abdominoplasty procedures was tumesced with saline. Water content was varied by injected either 10, 20, 30, or 40 cc of saline solution into the treatment region. Three 8 cm long platinum needle electrodes were inserted in parallel tangentially through the subcutis 1 cm below the surface; each separated from one another by 5 mm. The needle geometry consisted of a single reference needle placed in the center flanked by a counter electrode (anode) and working electrode (cathode). A potentiostat set the potential at the working electrode at −1.5, −2.5, or −3.5 V for 5 minutes. Charge transfer was recorded. Immediately following treatment, the tissues were sectioned perpendicular to the needle insertion vector and the cut edges stained with pH-sensitive dye, and photographed. MATLAB program calculated the area of pH effect at the working and counter sites based on dye intensity. Phantom studies were performed in agar gels varying amounts of saline, for comparison.

Results: Total charge transfer following P-ECL (5 minutes) was 99.2 C at −3.5 v, 44.5 C at −2.5 V, and 10.2 C at −1.5 V with 40 cc saline. Charge transfer increased with the amount of saline injected: 1.8 with no additional saline added 2.3 C at 10 cc, 4.9 C at 20 cc, 5.9 C at 30 cc, and 7.5 C with 40cc added when undergoing P-ECL. At the working electrode, the average area of effect was 6.3e-4 cm^2 at 3.5V, 3.3e-4 cm^2 at 2.5 V, and 2.73e-4 cm^2 at 1.5 V. At the counter electrode, average area of effect was 1.7e-3 cm^2 at 3.5 V, 1.0e-3 at 2.5 V, and 8.7e-4 at 1.5 V. pH mapping demonstrated an increasing area of effect at the counter electrode than the working electrode and greater effects at both proportional to voltage.

Conclusion: Charge transfer is proportional to voltage at the working electrode. Water content increases this effect as well. Acid-base effects increase with voltage and are greater at the counter electrode.

SUBMISSION TITLE: CLINICAL STUDY ON LASER ACUPUNCTURE TREATMENT OF DRY EYE DISEASE AND ITS INFLUENCE ON TLR4 SIGNALING PATHWAYS

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Background: Dry eye is a multifactorial chronic ocular surface disease characterized by unstable tear film or imbalance of the ocular surface microenvironment. It can cause various ocular discomfort symptoms and/or visual dysfunction of varying degrees and a decline in the quality of life of patients, hinder everyday life and work, and even cause some patients to have psychological problems such as anxiety and depression, which bring a heavy burden to society and families. With the rapid changes in the living environment, the popularization of video display terminals such as mobile phones and computers, and air pollution, the incidence of dry eye and the rate of consultation are increasing year by year, and the detection rate in China is as high as 6.1%–52.4%. Laser acupuncture combines traditional Chinese medicine acupuncture's unique meridian and acupoint theory and modern physical laser technology. Because it can achieve the therapeutic effect of traditional acupuncture with the advantages of painless and sterile, simple operation, safety, control, and so forth [5], It has drawn people's attention to clinical research for the past 40 years. It has been used to treat various ophthalmic diseases such as myopia, amblyopia, optic atrophy, and thyroid-related ophthalmopathy, and it has achieved good results. In this study, laser acupuncture demonstrated a significant effect on dry eyes.

Study Design/Materials and Method: According to the inclusion and exclusion criteria in the study design, 64 dry eye patients (128 eyes) who visited the TCM Ophthalmology Clinic of Shanxi Provincial Eye Hospital in Shanxi from June to December 2019 were strictly collected. Using the design method of randomized controlled trials, they were divided into a laser acupuncture group and a control group, with 32 cases (60 eyes) in each group. In the course of treatment, two cases in each group fell off. Finally, 30 cases (60 eyes) were in each group after three weeks of treatment.

Laser acupuncture group: According to the operation site, XS-998D06 acupuncture laser (Nanjing Komatsu Medical Instrument) was used. 650 nm (5 mW) from the probe were applied to both sides of Jingming, Qiuhou, Taiyang acupoints. We instructed the patient to close their eyes, use sterile gauze to cover the eyes' surface, and fix the probe on the acupuncture points with medical tape. Each treatment is 20 minutes, once a day, and 10 days is a course of treatment and a total of three courses of treatment.

Control group: use sodium hyaluronate eye drops (Hailu, URSAPHARM Arzneimittel GmbH) eye drops, three times a day, one to two drops each time, 10 days as a course of treatment, a total of three courses of treatment.

Our evaluation criteria include four subjective scores, five serum expression levels, ocular surface inspection, and efficacy evaluation.

Subjective symptom score

The subjective symptom score scale was formulated according to the 2002 "Guiding Principles for Clinical Research on New Chinese Medicines (Trial)," including subjective symptom scores such as eye dryness, foreign body sensation, burning sensation, fatigue, discomfort, and fuzzy sensation. Each subjective symptom is divided into 0, 1, 2, and 3 points for the disappearance, occasional, frequent, and intolerable.

Serum TLR4, MyD88, NF-κB, NLRP3, and NLRP6 expression levels

Blood was drawn from patients to detect serum TLR4, MyD88, NF-κB, NLRP3, and NLRP6 expression levels. Two samples were collected from 8:00 to 8:30 in the morning before and after treatment. The venous blood of the patients in the group was centrifuged (3000 r/min, 10 min), and the serum was collected and placed in a cryopreservation tube, placed in a refrigerator at −80°C for centralized testing. Enzyme-linked immunosorbent assay (ELISA method) was used to detect serum TLR4, MyD88, NF-κB, NLRP3, and NLRP6 protein concentrations. U.S. Baote ELx800 automatic microplate reader was used for absorbance detection.

Inspection of the ocular surface integrated analyzer

The German OCULOS Keratograph 5 M ocular surface integrated analyzer was used to perform specific detection of the Tear film burst time (BUT), Tear River Height (TMH), and The corneal fluorescein staining (FL) values of the two groups of patients.

Efficacy Evaluation

Efficacy evaluation was according to the 2002 "Guiding Principles for Clinical Research of New Chinese Medicines (Trial)"; the curative effect is judged based on the symptom score, FL, BUT, and TMH.

SPSS 20.0 was used for statistical analysis.

Results: All the analysis was measured before the treatment and showed no difference between the laser and control groups to verify the two's comparability.

Analysis of subjective symptoms

The treatment showed a difference in subjective symptoms ($p < 0.05$) for both groups after the treatment within 30 days (observation time). However, the course has no statistical difference between the control and laser acupuncture groups.

Tears height analysis

The TMH level was significantly higher in the laser group than in the control group after 30 days of the treatment ($p < 0.05$).

Average lacrimal rupture time analysis (TMH)

The TMH level was significantly higher in the laser group than in the control group after 30 days of the treatment ($p < 0.05$).

Corneal fluorescein dyeing analysis (FL)

The treatment showed a difference in FL ($p < 0.05$) for both groups after the treatment within 30 days (observation time). However, the course has no statistical difference between the control and laser acupuncture groups.

Comparison of serum TLR4, Myd88, NF-Kb, NLRP3, and NLRP6 expression levels in the two groups of patients

After treatment, the laser acupuncture group and the control group had no statistically significant differences in the expression levels of TLR4, MyD88, and NF-κB. The groups' comparison of NLRP3 and NLRP6 showed differences ($p < 0.05$).

Evaluation of clinical efficacy

After three courses of treatment, the laser group showed better efficacy than the control group ($Z = -2.020$, $p = 0.043 < 0.05$). In the laser acupuncture group, 10 eyes were markedly effective, 37 eyes were effective, and the total effective rate was 78.33%; in the control group, eight were markedly effective, 27 were effective, and the total effective rate was 58.33%.

Conclusion: The results of this test showed that the subjective symptom scores of dry eye patients in the laser acupuncture group and the control group were reduced, and corneal staining was improved; the tear river height increased, the tear film rupture time prolonged, and the serum NLRP3 and NLRP6 expression levels improved in the laser acupuncture group; the total effective rate of the group is higher than that of the control group. Moreover, no serious adverse events occurred during the trial. Laser acupuncture treatment of dry eye can improve the subjective symptoms of dry eye patients, increase the height of the tear river, prolong the average tear film rupture time, and repair the damage to the corneal epithelium. The laser acupuncture group was not statistically significant in regulating serum TLR4, MyD88, and NF-κB. However, in improving the expression levels of serum NLRP3 and NLRP6, two inflammasomes, the $p < 0.01$, with significant statistical differences. This shows that laser acupuncture has a benign regulatory effect on the downstream inflammasome NLRP3 and NLRP6 of the TLR4 signaling pathway. It is speculated that laser acupuncture can reduce the inflammatory response of dry eye by downregulating the expression level of serum NLRP3 and upregulating the expression level of NLRP6. However, in this clinical study, TLR4 There is no statistically significant difference between upstream inflammatory factors before and after treatment, and the regulatory mechanism of laser acupuncture on the TLR4 signaling pathway needs to be further studied. Laser acupuncture's clinical efficacy in treating dry eye is better than sodium hyaluronate eye drops, and it is safer and more reliable. It is worth clinical promotion and has broad prospects.

Laser acupuncture improves the blood circulation of the meridian circulation parts by acupuncture and directly stimulates the eyes to promote the secretion of tears. However, laser acupuncture is not only simply a substitute for acupuncture. It also introduces energy to the body, which causes another type of bio-modulation to the body. Laser acupuncture still needs a lot of optimization and adjustment in terms of treatment parameters and instrument design, and its mechanism needs further exploration. Through continuous optimization, laser acupuncture will have broad application prospects.

SUBMISSION TITLE: COMBINING PICO-SECOND LASER INDUCED OPTICAL BREAKDOWN AND POLYMER DOTS DRESSINGS CAN ACCERATE THE WOUND HEALING PROCESS ON NUDE MOUSE MODEL

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Background: Accelerating wound healing would decline the damage to those who got hurt. Picosecond Laser with diffractive lens array can generate laser-induced optical breakdown (LIOB) for better dermal repair and epidermal regeneration. Polymer dots can

reduce the inflammatory reaction and accelerate the migration of epithelial cells. Here we aimed to combine these to assess the benefits on nude mouse wound healing model.

Study Design/Materials and Method: Twenty rats were assigned to five groups with the punched 6 mm wounds at both right and left side of back. They were Control group, Laser Monotherapy group, Polymer Dots group, Laser combined Polymer Dots group, and PEG1000 vehicle control group. The wound-healing process was photographed and evaluated by Image-J at Immediate, 3rd,5 th, 6 th, 7th, 9th, 18th day post the initial wound creating procedure.

Results: At the 3rd day, each group showed faster wound healing rate than the control group. At the 5th day, the group of Laser combined PD demonstrated the best wound-healing conditions, held lead to the 9th day. The group of polymer dots also presented the faster wound healing rate following the combined group. The group of Laser Monotherapy had provided the better scar pattern existing at the 18th day. Remarkable wound healing rate and better scar conditions were noted in Polymer Dots group than PEG1000 vehicle control group.

Conclusion: Combining Polymer dots and Pico Laser with optical breakdown can provide the synergetic effects on accelerating wound healing with better scar pattern in vivo.

SUBMISSION TITLE: DESIGN OPTIMIZATION OF A PHOTOTHERAPY EXTRACORPOREAL MEMBRANE OXYGENATOR FOR TREATING CARBON MONOXIDE POISONING

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Background: The membrane oxygenator has evolved since the late 1950s to improve gas exchange capabilities during oxygenation. We integrated phototherapy to the ECMO (extracorporeal membrane oxygenation) device to improve CO removal for treating CO poisoning. The photo-ECMO device showed considerable improvement in CO elimination in poisoned animals. In an optical, flow, and thermal analysis of the photo-ECMO device, we showed that red light at 620 nm was the optimal wavelength as it penetrated fully through the device and generated less heat relative to shorter wavelengths. However, there were areas of stagnant flow and photons wasted. The objective of this study is to optimize the geometry of the device to improve blood flow circulation and the phototherapy treatment volume.

Study Design/Materials and Method: Light propagation, blood flow dynamics, and heat diffusion were modeled using the Monte Carlo method and the laminar Navier-Stokes and heat diffusion equations, respectively.

Results: Optimization was performed by modifying the shape of the housing until there was no stagnant flow, while maintaining the priming volume and pressure drop. Additionally, a constraint was placed on the thickness of the device to account for the maximum penetration depth of red light. The number of light sources increased without affecting the viable blood temperature.

Conclusion: The optimized photo-ECMO device should decrease the time needed for treating CO poisoning.

SUBMISSION TITLE: ENHANCING ACID RESISTANCE TO ENAMEL DEMINERALIZATION USING LASER-FLUORIDE APPROACH

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Background: Tooth decay or dental caries is among the most prevalent human diseases that can be prevented entirely with good oral hygiene and nutrition. Caries is caused by acid-generating bacteria in contact with carbohydrates in the oral cavity. Current prevention of dental caries includes fluoride varnishes and pit-fissure sealants. However, these treatments often involve multiple dental visits that are access-limiting for much of the population. Surgical lasers have been noted to improve disinfection and increase fluoride uptake on tooth surfaces. This work examined the utility of various laser wavelengths and doses to improve fluoride incorporation to prevent caries. We hypothesize that laser energy would reduce the energy barrier to convert hydroxyapatite to fluorapatite, that is more acid resistant.

Study Design/Materials and Method: Deidentified extracted human teeth were collected under UB IRB protocol (##00001193) and sectioned so the enamel was intact at its thickest portion. Using a polymer (polymethylmethacrylate, PMMA) and 3D printed (Prusa) blocks, the sections were embedded so that the enamel surface remained exposed. Surfaces of PMMA and Enamel were painted with nail polish, and a 3 mm × 3 mm area of enamel was left untouched for treatment. The small area of each sample was laser treated at different

wavelengths (447, 685, 810, 940, 980, and 1064 nm) after the Silver Diamine Fluoride (SDF) varnish application, and this process was repeated three times. The samples were incubated at 37°C in Lactic acid (10.2 M) solution for 5 days with mechanical agitation. Samples were collected from each vial on Days 0, 1, 3, and 5. Calcium and phosphate resulting from the acid dissolution of the tooth surface were assayed using Arsenazo Red and Malachite Green reagents with a spectrophotometer.

Results: We observed that SDF significantly ($n = 2$, $p < 0.05$) increased resistance to acid demineralization compared to the unmanipulated enamel surface. We noted that a red laser (658 nm at 30 mW/cm^2 for 54 s at 1.62 J/cm^2, 3 p.J/cm^2, 0.7 Einstein) with SDF application was significantly ($n = 2$, $p < 0.05$) more resistant to acid demineralization at Day 1, 3, and 5 compared to SDF applications alone. Some other wavelengths appear to increase susceptibility to acid demineralization, which should be investigated further. Ongoing studies are evaluating the degree of fluoride substitution on the Enamel surface with the laser-fluoride techniques using differential scanning calorimetry and desorption spectroscopy.

Conclusion: These results reveal that the application of SDF followed by treatment with a red laser can improve the Enamel's acid resistance and protect it from dental caries. This novel treatment could have a significant impact on clinical dentistry. Moreover, this approach in dental public health may contribute to the increasing recognition of the importance of oral health in general human health.

SUBMISSION TITLE: EVALUATION OF ELECTROCHEMICAL LIPOLYSIS FOR BODY CONTOURING IN THE IN VIVO PORCINE MODEL

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Background: Fat reduction is a cosmetic procedure that is rapidly growing in popularity. The body fat contouring market was valued over $9 billion in 2021 and is expected to increase to over $17.2 billion by 2028. However, invasive surgical procedures are expensive and have increased associated risks, such as necessitating anesthesia. Electrochemical lipolysis (ECLL) is a new method of minimally-invasive body contouring that is both economical and effective, demonstrating visible results with one treatment.

Study Design/Materials and Method: The subcutaneous tissue on the flanks of an in vivo 50 kg female Yorkshire pig was prepared with 30 mL of normal saline to provide tumescence to ease electrode insertion and to provide an electrolytic medium for the treatment. The right flank was treated using V-ECLL and the left flank was treated using P-ECLL. Due to their high standard potential and minimal risk of electrode oxidation, platinum wire was used as the anode and electroplated platinum-coated needles were used as the cathode 1–3. Based on previous studies 4–7 V-ECLL treatments were conducted using a DC power supply at 5 V for 5, 20, and 30 minutes, and P-ECLL treatments were conducted using a potentiostat at −1.5, −2.5, and −3.5 V for 5 minutes. Digital photographs were captured on Day 0 before and after ECLL and on Days 17, 30, 60, and 90. Following euthanization on Day 90, tissue at the procedure sites were collected and analyzed with both hematoxylin and eosin and alpha-smooth muscle actin staining.

Results: Noticeable differences were observed at the procedure sites: there were visible contours in the treatment areas and subcutaneous fat reconstruction in the histological analysis in a dose-dependent manner.

Conclusion: ECLL is an economical and effective alternative to existing minimally invasive fat reduction procedures. Tissue is selectively contoured with visually detectable results in one treatment. This study is a critical step toward the optimization of ECLL in clinical trials for fat reduction and body contouring.

SUBMISSION TITLE: EXTRACORPOREAL MEMBRANE OXYGENATORS WITH LIGHT DIFFUSING FIBERS FOR TREATMENT OF CARBON MONOXIDE POISONING: EXPERIMENTS, MATHEMATICAL MODELING AND PERFORMANCE ASSESSMENT WITH UNIT CELLS

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Background: Approximately 50,000 emergency department visits per year due to CO poisoning occur in the United States alone. Tissue hypoxia can occur at very low CO concentration exposures because CO binds with a 250-fold higher affinity than oxygen to hemoglobin. The most effective therapy is 100% hyperbaric oxygen (HBO) respiration.

However, there are only a limited number of cases with ready accessibility to the specialized HBO chambers. In previous studies, we developed an extracorporeal veno-venous membrane oxygenator that facilitates exposure of blood to an external visible light source to photo-dissociate carboxyhemoglobin (COHb) and significantly increase CO removal from CO-poisoned blood (photo-ECMO). One objective of this study was to describe in vitro experiments with different laser wavelength sources to compare CO elimination rates in a small unit-cell ECMO device integrated with a light-diffusing optical fiber. A second objective was to develop a mathematical model that predicts CO elimination rates in the unit-cell photo-ECMO (p-ECMO) device design upon which larger devices can be based.

Study Design/Materials and Method: Two small unit-cell p-ECMO devices consisted of a plastic capillary with a length and inside diameter of 10 cm and 1.15 mm, respectively. Either five (4-1 device) or seven (6-1 device) gas exchange tubes were placed in the plastic capillary and a light-diffusing fiber was inserted into one of the gas exchange tubes. Light from lasers emitting either 635 or 465 nm wavelengths was coupled into the light-diffusing fiber as oxygen flowed through the gas exchange membranes. To assess the ability of the device to remove CO from blood in vitro, the percent COHb reduction in a single pass through the device was assessed with and without light. The Navier Stokes equations, Carreau-Yesuda model, Boltzman equation for light distribution, and hemoglobin kinetic rate equations, including photo-dissociation, were combined in a mathematical model to predict COHb elimination in the experiments.

Results: For the unit-cell devices, the COHb removal rate increases with increased 635 nm laser power, increased blood time in the device and greater gas exchange membrane surface to blood volume ratio. The 6-1 device COHb half-life versus that of the 4-1 device with 4 W at 635 nm light was 1.5 versus 4.25 minutes, respectively. At 1 W laser power, 635 and 465 nm exhibited similar CO removal rates. The COHb half-life times of the 6-1 device were 1.25, 2.67, and 8.5 minutes at 635 nm (4 W), 465 nm (1 W) and 100% oxygen only, respectively. The mathematical model predicted the experimental results. An analysis of the in vivo COHb half-life of oxygen respiration therapy versus an adjunct therapy with a p-ECMO device and oxygen respiration shows a reduction from 90 minutes to as low as 10 minutes, depending on the device design.

Conclusion: In this study, we experimentally studied and developed a mathematical model of a small unit-cell ECMO device integrated with a light-diffusing fiber illuminated with laser light.

The unit-cell device forms the basis for a larger device and, in an adjunct therapy with oxygen respiration, has the potential to remove COHb at much higher rates than oxygen therapy alone. The mathematical model can be used to optimize the design in practical implementations to quickly and efficiently remove CO from CO-poisoned blood.

SUBMISSION TITLE: IMMEDIATE RESPONSES TO LOW FLUENCE MULTIPULSE 532 NM LASER TREATMENT IN A ROOSTER WATTLE MODEL OF PORT WINE BIRTHMARKS

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Background: Port-wine stains (PWS) are common congenital vascular malformations. They consist of ectatic blood vessels of different sizes (10–400 μm) and depths (100–1000 μm). (1) Depending on the lesion's clinical appearance, location, and size, patients may experience functional disability or psychosocial morbidity.

Traditionally, pulsed lasers with significant hemoglobin absorption (585 nm, 595 nm, 532 nm, and sometimes 755 nm and 1064 nm) are used to treat PWS. (2) Because conventional laser therapy utilizes a single laser exposure at each location, delivery of sufficient fluence to achieve vascular injury usually results in pain and purpura. Effective therapy with this single pulse high fluence (SPHF) approach requires many treatment sessions, beginning early in infancy and often continuing throughout childhood. As a result, multiple episodes of general anesthesia, with attendant immediate and possibly long-term risks, are required.

(3) According to Arrhenius models, thermal damage is exponentially related to the ratio of the tissue's activation energy to the temperature and linearly related to its rate constant and the time at which tissue is at the given temperature. MPLF—which does not raise tissue temperature as high as the traditional single-pule approach—may be effective in appropriate damage models while causing less pain.

Study Design/Materials and Method: 1. Animal Model:

This nonsurvival study was approved the Massachusetts General Hospital Institutional Animal Care and Use Committee. Roosters were acquired from Charles River Laboratories, and the rooster wattle was used as a model of PWS. Because of its rich dermal vascular network, this model has been used in prior PWS studies. (4, 5) Additionally, due to low melanin content, vascular changes can be observed directly.

2. Laser and Imaging System:

A 532 nm customized diode laser (IPG Photonics, max peak power: 350 W) with a 3 × 3 mm spot size was used for experimentation A Dino-Lite digital microscope (Dunwell Tech, Inc.) was used to assess the wattle before and after laser exposure. Vessel temperature was monitored with a thermal camera (IR Camera, Optris Xi 80, PIX Connect SW, sampling rate 50 Hz) for most exposures.

3. Irradiation procedure and threshold establishment:

Experiments were performed on eight roosters. Induction of anesthesia was achieved with 3%–4% isoflurane delivered via nose cone. Following endotracheal intubation, the animal was maintained at 1%–3% isoflurane throughout the procedure. The animal was placed on an operating table in a left lateral recumbent position; the wattle was placed below the laser aperture, and distance was adjusted as necessary to achieve a focused 3 × 3 mm spot. When temperature was monitored with the thermal camera, no cooling was used. When temperature was not monitored, a small amount of aqueous gel was applied to each exposure site to achieve more rapid cooling. Pulse width (pw) for laser exposures was 2–3 milliseconds.

To establish the SPHF threshold, singles pulse (SP) exposures were performed, beginning at a fluence (F) of 2 J/cm^2 and increasing in increments of 1 J/cm^2. Unlike humans, purpura is not a readily visible endpoint in the rooster wattle; with increasing F, erythema progressively increases until whitening is seen. The F at which whitening was observed was considered the SPHF threshold.

After identifying the SPHF threshold, multiple MPLF regimes were implemented, with F ranging from 40% to 75% of threshold and pulsing frequency (f) ranging from 0.1 to 1 Hz. This frequency range included frequencies that did not allow for thermal buidup (temperature relaxatioin to baseline between pulses, also referred to as the "nonthermal regime") and at frequencies that did result in thermal buildup ("thermal regime").

4. Tissue sampling and histopathological assessments:

The roosters were euthanized with an intravenous injection of pentobarbital following completion of laser exposures. Thirty minutes following euthanasia, tissue specimens were harvested and placed in formalin for subsequent histologic evaluation. Following fixation, all samples were embedded in paraffin, and then cut into 5 μm sections and stained with hematoxylin and eosin (H&E) for routine evaluation. When appropriate, adjacent cuts were stained with von Willebrand factor (vWF), DAPI, and TUNEL stains. This enabled identification of endothelial cells as well as those cells which were in the process of apoptosis.

Results: Clinical responses to laser exposures varied—depending on fluence and pulsing scheme—from no change to severe whitening with tissue contracture. Depending on treatment parameters, histopathologic responses included endothelial cell flattening or pyknosis, perivascular hyalinization of collagen, and TUNEL staining that was positive for apoptosis of endothelial cells. However, the typical results were as follows:

The SPHF threshold for whitening was $F = 4$ J/cm^2 at pw of 2 milliseconds. At this fluence, histologic changes included significant perivascular collagen hyalinization and endothelial cell pyknosis on H&E staining. Apoptosis was detected in endothelial cells using vWF, DAPI, and TUNEL analysis. Collagen hyalinization was determined to be the histologic finding that corresponded to the clinical endpoint of whitening, presumably due to optical scatter causing shielding of the underlying vascular blood.

For MPLF experiments in the nonthermal regime, some of the above histologic endpoints were achieved at 50% of the threshold fluence. Specifically, at $F = 2$ J/cm^2, pw = 2 milliseconds and $f = 0.2$ Hz, significant endothelial cell pyknosis and positive endothelial cell TUNEL staining were observed. However, no significant perivascular collagen hyalinization was seen, and the clinical appearance was reddening of tissue. Whitening was not seen.

Conclusion: Endothelial cell pyknosis and apoptosis were achieved with MPLF at 50% of threshold, similar to the changes seen in SPHF exposures. Collagen hyalinization and tissue whitening, which were seen in SPHF exposures, were not seen in MPLF exposures in the nonthermal regime. These changes were seen in MPLF in the thermal regime, when pulsing was done at higher frequency to allow for thermal buildup between pulses.

This work provides a promising way to achieve histologically evident endothelial destruction without collagen damage by the MPLF approach. Future studies are required in survival studies to determine long-term results and clinical significance of sub-threshold MPLF in comparison to SPHF.

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SUBMISSION TITLE: IMMEDIATE VASCULAR RESPONSES TO LOW FLUENCE MULTIPULSE 532 NM LASER TREATMENT IN A CHORIOALLANTOIC MEMBRANE MODEL OF PORT WINE BIRTHMARKS

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Background: Port wine stain (PWS) birthmarks are congenital vascular malformations characterized by ectatic blood vessels of varying size and depth. Depending on the lesion's location and degree of hypertrophy, patients may experience hemorrhage, functional restrictions, and psychosocial morbidity.

Pulsed lasers at wavelengths with significant hemoglobin absorption have become the standard of care for superficial vascular anomalies (1, 2). Because PWS contain vessels (10–400 μm in diameter) (3), the theory of selective photothermolysis dictates that relatively short laser pulses (e.g., 450 microseconds to a few milliseconds) be used(4). Conventional laser therapy utilizes a single pulse at each location; delivery of sufficient fluence to achieve vascular injury usually results in pain and purpura. Effective therapy requires many treatment sessions, beginning early in infancy and often continuing throughout childhood (5, 6). As a result, multiple episodes of general anesthesia, with attendant immediate and possibly long-term risks, are required (5, 7, 8).

One possible way to achieve effective treatment while minimizing pain—and thus decreasing the need for general anesthesia—is to use multiple pulses at low fluence (MPLF). According to Arrhenius models, thermal damage is exponentially related to the ratio of its activation energy to the temperature and linearly related to its rate constant and the time at which tissue is at the given temperature. MPLF—which does not raise tissue temperature as high as the traditional single-pule approach—may be effective in appropriate damage models.

Although the multipulse (MP) approach has been investigated, reports of successful MPLF have allowed thermal buildup by not allowing tissue to return to baseline temperature between pulses. Thus, the absolute temperature increase over baseline is comparable to that of a single pulse (2, 9–15). In this work, we aimed to assess the ability of MPLF to achieve clinically relevant endpoints with temperature relaxation to baseline between pulses, thus making less painful treatment a possibility.

The chick chorioallantoic membrane (CAM) model was used to assess the response of extra-embryonic vessels to MPLF in comparison to a single pulse at high fluence (SPHF). The CAM model is a well-established in vivo system and has been used for many years to evaluate the microvascular network (16–22). It allows real-time visualization of vessel changes and blood flow with direct inspection (19, 20). Multiple Arrhenius thermal damage models and the kinetic parameters therein, including blood coagulation and cell damage, may be relevant (23).

Study Design/Materials and Method: 1. Chorioallantoic Mebrane (CAM) Model:

The study was exempt from approval by the Institutional Animal Care and Use Committee of our institution. Fertilized chicken eggs were acquired from Charles River Laboratories (Wilmington, MA). Eggs were incubated at 38°C and 55% humidity and were maintained at constant slow rotation. On approximately Day 12 (range: 11–13), embryos were carefully removed from the shell intact and placed in 150 mm Petri dishes. Vessels measuring 75–250 μm were identified for experimentation.

2. Laser and imaging system:

A 532 nm customized diode laser (IPG Photonics) was used for experimentation (max peak power: 350 W). A Dino-Lite digital microscope (Dunwell Tech, Inc.) was used to assess the vessels before and after irradiation. Superficial vessel temperature was monitored with a thermal camera (IR Camera, Optris Xi 80, PIX Connect SW, sampling rate 50 Hz).

3. Irradiation procedure and threshold establishment:

CAM vessels underwent 532 nm irradiation with a square spot of 3 × 3 mm and a pulse duration of 9–10 milliseconds. Formation of a stable coagulum (in which an intravascular thrombus forms without subsequent downstream embolization, resulting in cessation of blood

flow) and vessel collapse, which have previously been identified as two clinical endpoints in laser treatment of vasculature, 24 were used as endpoints. Single-pulse threshold was found by incrementally increasing fluence until the endpoints were observed. After identifying the threshold fluence, MPLF at 40%–75% of the threshold fluence was used in an effort to achieve these endpoints. Thermal imaging was used to ensure that vessel temperature returned to baseline level between pulses, thus avoiding the possible contribution of thermal buildup.

Results: The single-pulse thresholds were 5 and 10.8 J/cm^2, respectively, for the endpoints of stable coagulum and vessel collapse. We achieved stable coagulum with fluence 2.2 J/cm^2 (44% of threshold) with 16 pulses. At lower fluence or with fewer pulses, a coagulum may have formed, but it was unstable and embolized downstrem within a few minutes. Vessel collapse was achieved at 5.9 J/cm^2 (55% of threshold) at the 4th pulse and continued to progress through subsequent pulses.

Conclusion: In the CAM model, clinically relevant endpoints can be achieved using an MPLF approach. Because peak temperatures with this approach are lower than with SPHF, less painful treatment of PWS may be achievable. These results may also be relevant to treatment of other vascular concerns such as telangiectasia and spider veins.

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SUBMISSION TITLE: IMMUNE RESPONSE TO LOCAL SKIN DESTRUCTION BY AFL, CRYOTHERAPY AND ELECTROCAUTERY

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Background: Physical treatment technologies, including ablative fractional laser (AFL), cryotherapy and electrocautery, are widely used in dermatology practice to treat various skin lesions such as scars, actinic keratosis, and superficial skin cancers. Besides their direct destructive impact on the skin, the physical treatment techniques may induce an immunological response; however, the nature of a potential immune response to these treatments is unclear.

Study Design/Materials and Method: In this study, the immune response as well as skin reactions were evaluated following treatment with AFL, cryotherapy and two electrocautery devices: using radiofrequency (RF) and a high temperature cautery pen. A series of treatment intensities were tested and device-specific parameters providing comparable clinical skin reactions were selected for further immunological analysis. Six 1×1 cm areas on the dorsal skin of SKH1 mice were treated with each treatment modality and tissues harvested at Day 1 and 7 after treatment for evaluation of the immune response. Gross clinical skin reactions were monitored from treatment day until final tissue harvest at Day 7.

Results: AFL and RF-electrocautery treatment led to increased CD8 + T-cell infiltration into the skin at Day 1 and 7 posttreatment. All treatment techniques activated CD8 + T cells in the skin as determined by increased interferon-gamma production, which was intensified at Day 7 compared with Day 1. The level of neutrophil infiltration at Day 1 was highest following treatment with the high temperature cautery pen. By Day 7, the neutrophil infiltrate was broadly increased in the skin treated with AFL, cryotherapy and electrocautery.

Conclusion: In conclusion, the immunological analysis of the skin treated with different local destructive therapies, reveals their distinct impacts on immune induction in the skin. Interestingly, increased CD8 + T-cell infiltration and activation in the skin by AFL and RF-electrocautery indicate the potential to activate a cytotoxic immunity against malignant lesions treated by these physical treatment modalities.

SUBMISSION TITLE: IMPACT OF SKIN HYDRATION ON PATTERNS OF MICROTHERMAL INJURY PRODUCED BY FRACTIONAL CO_2 LASER

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Background: The impact of skin hydration on patterns of thermal injury produced by ablative fractional lasers is inadequately examined in standardized settings. Using skin with two different hydration levels, this study assessed the effect of cutaneous water content on microchannel dimensions generated by a fractional CO_2 laser.

Study Design/Materials and Method: In an ex vivo porcine skin model, two hydration levels (hydrated skin and normohydrated control) were achieved by 7-hour submersion in distilled water or no pretreatment, confirmed by differences in surface conductance and sample mass. Subsequently, all skin samples were irradiated with a fractional CO_2 laser at 30 mJ/mb pulse energy and 10% density. Histological assessment of resulting microchannels ($n = 60$) was performed in 120 vertical H&E sections (6 repetitions per group). Standardized endpoints were depth of microscopic ablation zones (MAZs) and coagulation zone (CZ) thickness. As a supplemental in vivo assessment, the same laser settings were applied to hydrated- (7-hour occlusion) and normohydrated skin (no pretreatment) of a human volunteer. Depth of resulting MAZs ($n = 30$) was determined noninvasively using optical coherence tomography (OCT). Microchannel dimensions in hydrated- and control skin were statistically compared using unpaired and paired *t*-tests for ex vivo and in vivo data, respectively.

Results: Increased water content in hydrated skin samples was confirmed by elevated surface conductance (77 μS increase) and mass (0.2-g increase) versus normohydrated controls (4 μS reduction; no change in mass). Overall, skin hydration resulted in an approx. 8% reduction in ablative depth, with mean MAZ depths of 791 μm (range: 720–880 μm) and 860 μm (range: 764–984 μm) in hydrated and normohydrated samples, respectively ($p < 0.0001$). In contrast, no impact on CZ thickness was observed, as mean values were comparable in hydrated (41 μm; range: 27–62 μm) and control skin (40 μm; range: 25–58 μm) ($p = 0.495$).

Before the in vivo assessment, elevated surface conductance was confirmed in hydrated- (164 μS increase) versus normohydrated skin areas (18 μS increase). Corresponding with ex vivo findings, OCT analysis of in vivo skin revealed that hydration was associated with a small but statistically significant reduction in ablative depth. Thus, respective mean MAZ depths of 302 μm (range: 220–420 μm) and

334 μm (range: 220–440 μm) were shown in hydrated and normohydrated skin ($p < 0.0001$).

Conclusion: Enhanced skin hydration can lead to a reduction in ablative depth, but not CZ thickness produced by fractional CO_2 laser. Given its modest impact, variation in skin hydration seems unlikely to influence most laser applications in the clinical setting.

SUBMISSION TITLE: INSIGHTS INTO THE BIOLOGICAL EFFECTS OF LASER-ASSISTED SCAR HEALING (LASH) ON STANDARDIZED HUMAN 3D WOUND HEALING SKIN MODELS USING FRACTIONAL NONABLATIVE 1540NM ER:GLASS OR 1550NM DIODE LASERS

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Background: In postoperative wound healing after surgical operations or ablative laser treatments, recent studies suggest the timely use of nonablative fractional laser treatments to prevent pathological scar formation. This technique is called laser-assisted scar healing (LASH). However, the underlying molecular mechanisms are still poorly understood. The aim of this study was to investigate the effects of the LASH technique at the molecular level and to combine it with other, already established, topical treatments that promote wound healing.

Study Design/Materials and Method: We first irradiated three-dimensional (3D) skin models with a fractional ablative Er:YAG laser to set defined ablative lesions with standardized dimensions in the epidermal and upper dermal part of the skin models. Immediately after wounding, we treated these models with either a nonablative fractional 1540-nm Er:Glass laser or 1550-nm diode laser (LASH approaches). In an additional approach, we also investigated the combination of the LASH technique with direct topical posttreatment using a dexpanthenol-containing ointment. Models that were only injured with the ablative Er:YAG laser and received no posttreatment served as controls.

Results: Histologic analyses revealed that models treated with the nonablative fractional 1540-nm Er:Glass laser or 1550-nm diode laser exhibited an accelerated wound closure after 16 hours, with lesions still visible. In contrast, an additional topical posttreatment with the dexpanthenol-containing ointment led to complete wound closure and an almost complete healing of the epidermal skin damage after 16 hours. A microarray analysis revealed that the treatment with both nonablative laser systems stimulated an upregulation of genes associated with epidermal differentiation (e.g., FLG, LOR). In addition, both nonablative lasers showed mild anti-inflammatory effects at the gene expression level in our skin models. The additional posttreatment with the dexpanthenol-containing ointment enhanced the wound-healing effects of both lasers, especially the anti-inflammatory effects.

Conclusion: In conclusion, our in vitro study showed that LASH treatment with a fractional nonablative 1540 nm Er:glass or 1550 nm diode laser improved wound closure in the early phase of wound healing by exhibiting similar biological effects at the gene expression level. An additional effect on remodeling in later stages of scar formation is to be expected. However, these complex long-term processes of reorganizing a scar cannot yet be depicted in 3D skin models. The additional posttreatment with a dexpanthenol-containing ointment promoted the proliferative and anti-inflammatory effects of LASH and is therefore an useful addition to the nonablative fractional laser treatments. These data contribute to a better understanding of the biological effects of the LASH technique and help to optimize its application.

SUBMISSION TITLE: JUST SCAN IT—THE USE OF AN ELECTRONIC LASER SAFETY AUDIT FORM

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Background: Lasers are used regularly in the operating room (OR) setting for various procedures in both adults and children. Several safety checks are required before using a laser device, and a safety component may be easily overlooked. To help reduce near misses or errors, AORN recommends using a laser safety checklist to ensure that the OR implements appropriate safety checks before each laser procedure (AORN, 2022). Additionally, to uphold to these regulatory safety

standards, health care facility and equipment safety audits should be conducted at least yearly and to the discretion of the laser safety officer (LIA, 2018). On review, our Laser Safety Committee (LSC) found that audits were not being completed consistently throughout the organization. Safety concerns discovered included lack of updated biomed inspection stickers, damaged equipment, and utilization of incorrect laser warning signs. Therefore, the LSC developed an electronic audit tool in hopes of increasing overall completion of the health care facility and equipment safety audits. We propose that providing an electronic audit tool will assist in making these audits easily accessible to all individuals in the OR and increase overall compliance with required audits.

Study Design/Materials and Method: Health care facility and equipment safety audits were transitioned from paper forms to an electronic form using Smartsheet. The electronic form was accessed through a website link, which was used to create a QR code. For convenience, QR codes were placed on the laser devices, laser equipment carts, OR computers, and badge buddies. Education on how to perform the new electronic audit tool was reviewed with all individuals in the OR. These electronic forms were filled out by the laser auditors with every laser procedure by visiting the website or scanning the QR code with a cellphone. Once the electronic form was submitted, the information from the audit automatically collected into a Smartsheet spreadsheet. Hence, the LSC gained easier access to data collected from the audits, which allowed for more rapid identification of safety concerns.

Results: This audit tool has proven to be convenient and easily accessible for OR staff to perform the laser safety audits. Before implementation, the completion rate of paper audits was only 30% ($n = 43$). After implementing the electronic audit tool for 3 months, the audit completion rate increased to 66% ($n = 41$), and then maintained at 66% after 8 months ($n = 119$). Overall, the completion rate of the electronic health care facility and equipment safety audits more than doubled (30% vs. 66%) when compared to the previous paper audit form.

Conclusion: Implementing the electronic health care facility and equipment safety audit tool significantly improved completion of laser safety audits. Individuals in the OR reported the QR code and website link to the electronic audit tool more convenient. Making the audit tool more accessible has improved staff workflow with laser procedures in the OR. The process of collecting the data through Smartsheet has allowed a more convenient way to access and analyze data by the LSC. Additionally, these preliminary findings have assisted with identifying safety issues that may have otherwise been missed and allowed for timely intervention and process improvement when needed. Although we strive to continue to improve the overall audit completion rate, these findings support implementing the electronic audit tool throughout our health care organization in the future.

SUBMISSION TITLE: LARGE AREA FRACTIONAL LASER TREATMENT: INVESTIGATING A NEW CONCEPT OF METABOLIC STIMULATION IN MICE

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Background: Excess weight and obesity represent a public health crisis. Currently, energy-based treatment devices are used for aesthetic body sculpting by decreasing small amounts of excess fat in the treated body area. Therefore, these treatments are not suitable for achieving an overall weight reduction. In this study, we introduce a novel concept of energy-based treatments that aim to stimulate the metabolism and reduce body weight. Large area fractional laser treatments (LAFLT) induce microscopic thermal injuries to large skin surface areas, which results in wound healing thereby increasing the energy expenditure (EE) and browning of adipocytes. Here, we established laser dosimetry parameters that activate the metabolism for ablative fractional lasers (AFL) and nonablative fractional lasers (NAFL) in mice.

Study Design/Materials and Method: Mice were individually housed in metabolic cages where food and water consumption, activity, respiratory exchange ratio, and energy expenditure were measured in real-time. After establishing metabolic baseline measurements for 24 hours, dorsal fur was removed and mice were treated in five groups: (1) Control, (2) AFL—Low, (3) AFL—Medium, (4) AFL—High, and (5)

NAFL. Depending on the group, laser treatments covered 10%–32% of the total body surface area (TBSA) with fractional laser densities of 10%–15%, resulting in 1.5%–8% TBSA burns. After treatment, all mice were returned to the metabolic cages and observed for 6 days. On posttreatment Day 6, fat pads were collected for histopathologic evaluation and assessed for markers of browning of adipocytes. Additionally, the body, lean, and fat mass were evaluated by NMR before and 6 days after LAFLT.

Results: Post laser treatment the energy expenditure (EE) increased significantly ($p < 0.05$) for the AFL—Medium, AFL—High and NAFL groups but not for AFL—Low and control groups. While the food consumption and activity did not change, water consumption increased significantly for all groups. The body composition analysis indicated a fat mass loss in all groups, including the control group. However, fat mass losses tended to be higher for the AFL—Medium and AFL—High groups, correlating to the burn injury severity. Compared to the control group, the lean mass did not change after LAFLT. There was a significant decrease in overall body mass for the AFL—High group after treatment. For all groups, LAFLT induced browning and remote browning of adipocytes in several fat pads.

Conclusion: We showed different ablative and non-ablative fractional laser treatment settings that result in a significant metabolic stimulation in mice. This study is the first of its kind to highlight the specific metabolic effects that large area fractional laser treatments trigger in mice, including EE, body composition, and adipocyte browning. This study highlights that localized laser treatments can have systemic effects. Further, the ability to change metabolism in a controlled way could emerge as a promising therapeutic treatment to increase energy expenditure and serve as a useful tool for weight management.

SUBMISSION TITLE: LINE-FIELD CONFOCAL OPTICAL COHERENCE TOMOGRAPHY IN SQUAMOUS CELL CARCINOMA: PROOF-OF-CONCEPT STUDY IN AN IN VIVO MURINE MODEL

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Background: Squamous cell carcinoma (SCC) is the second most common type of keratinocyte carcinoma in light-skinned populations. Line-field confocal optical coherence tomography (LC-OCT) is a novel high-resolution laser-based imaging device that can support the diagnosis of SCC by non-invasively visualizing morphologic features of skin cancer. Preclinical studies may consolidate the sparse clinical evidence on LC-OCT imaging for SCC management. In this proof-of-concept investigation, we aimed to characterize SCC using LC-OCT in a murine model and determine the inter-assessor agreement on the presence of SCC features.

Study Design/Materials and Method: LC-OCT scans ($n = 18$) of histologically verified ultraviolet (UV)-induced murine SCCs were included in the study. The LC-OCT scans included lesional skin (n = 9) and perilesional skin at the tumor margins ($n = 9$). Blinded analysis of cross-sectional and en-face LC-OCT scans were performed by three physicians with experience in noninvasive skin cancer imaging. The presence of 12 predefined SCC features, derived from histological criteria, were evaluated in the LC-OCT scans, and included: Hyperkeratosis with parakeratosis, epidermal acanthosis, epidermal atrophy, acantholysis, tumor budding, epidermal dysplasia, pagetoid cells, non-outlined dermal-epidermal junction (DEJ), broad strands, keratin pearls, dilated vessels and collagen alterations. Following analysis, the results were discussed to reach consensus.

Results: All assessors were able to confirm the presence of all 12 imaging SCC features in one or more of all scans. Inter-assessor agreement before consensus on presence or absence of SCC features was highest for keratin pearls (83%) and lowest for dilated vessels (17%). In all lesional scans ($n = 9$), epidermal dysplasia (100%), interrupted DEJ (100%), and broad strands (100%) were present whereas well-defined DEJ (100%) was completely absent. In perilesional skin ($n = 9$), acanthosis (78%) and well-defined DEJ (78%) were the most frequently observed features. Keratin pearls and dilated vessels were absent in perilesional scans.

Conclusion: This is the first study to identify histological SCC features using LC-OCT in a murine model. Our results suggest that laser-based LC-OCT imaging may be a supplement to conventional histology to non-invasively characterize and monitor tumor development and treatment in a research setting.

SUBMISSION TITLE: LOCALIZED FRACTIONAL TISSUE INJURY FOLLOWING NON-FRACTIONAL LASER TREATMENT: AN APPLICATION OF NANOPARTICLE-BASED PHOTOTHERMAL THERAPY AND FULL-FIELD 808NM DIODE LASER IN EX-VIVO TISSUES

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Background: While indocyanine green (ICG)-based photothermal therapy at 808 nm has previously been demonstrated, free ICG remains difficult to manipulate as a photothermal agent. ICG is a small amphiphilic molecule that readily diffuses within the tissue. After topical administration, ICG binds locally to proteins in tissues and stains the skin surface. Nanoparticle encapsulation enhances stability, concentrates ICG locally, and enables controlled release of ICG upon laser irradiation. Clinically, this allows the reduction of nonspecific ICG diffusion during photothermal therapy leading to bulk heating, pain, and nonspecific destruction of larger tissue areas. Further, this delivery method coupled with PLGA encapsulation can enable the delivery of additional conjugates such as drugs (i.e., lidocaine) and increased drug functionality relative to free drugs.

Study Design/Materials and Method: Experiments were performed on ex vivo human skin samples. ICG and PLGA-ICG were prepared with sterile water to the concentration of 0.1% and kept in an opaque container in a 4c refrigerator 1 hour before the experiment. A meso-gun single needle device was used to inject the ICG and PLGA-ICG solutions at a volume of 10 μL per injection site with five injection sites per sample. Laser treatment samples were exposed to an 808 nm diode laser at 20 milliseconds, 20 J/cm^2, 4 C skin cooling using direct input. Postradiated injections were cryosectioned and collected at 10 μm-thick slices for fluorescent imagery and 20 μm-thick slices for Nitro-blue-Tetrazolium-Chloride (NBTC) staining. The proportion of the NBTC-loss area to the ICG injection area is calculated for each sample to analyze thermal injury.

Results: ICG nanoparticle-based NIR laser therapy exhibited confined and localized thermal injury in the dermis and subcutaneous tissue with preservation of the epidermis. Free ICG-based NIR laser therapy exhibited a significantly larger thermal injury in the dermis and widespread lipolysis in adipose tissue based on the area defined by the loss of NBTC staining. Fluorescent imaging reveals increased confinement of ICG nanoparticles around the injection site relative to free ICG particles, which diffuse widely around the injection site.

Conclusion: Subcutaneous and intradermal injections of polymeric nanoparticles encapsulating ICG are used for nonablative fractional thermal injury using an 808 nm wide-area laser diode. The obtained data reveal selective and localized thermal injury in the dermis and lipolysis when using nanoparticle-based ICG therapy relative to free ICG. Achieving localized fractional thermal injury without damaging the epidermis is desirable for precise tissue remodeling with minimal downtime and risk. In the future, investigations into drug delivery during nanoparticle therapy may allow the facile delivery of drugs or other active agents during relevant clinical procedures.

SUBMISSION TITLE: MACHINE LEARNING MODEL OF SKIN PHOTOTYPING

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Background: The majority of the world's population consists of people who can be classified as Fitzpatrick skin type (III)IV–VI. The US Census Bureau predicts that by 2050, 50% of US population will be composed of Skin of Color. Asians, Hispanics and African Americans are growing disproportionate to the total population, although growth for African Americans was much slower than for the other two groups. This creates an unfulfilled clinical need for expertise in diagnosis and treatment of people of color, both by dermatologists and primary care physicians. Medical textbooks with skin images are the mainstay for education for physicians. Fitzpatrick skin typing is the current standard for

categorization of skin phototypes, but a more nuanced and validated scale is needed. A single site academic dermatology AI project was initiated to create a validated skin photo-type classification through image annotation of a machine learning model in dermatology.

Study Design/Materials and Method: An AI project workflow was designed in collaboration with a computer science undergraduate student and a board certified academic dermatologist. The project workflow consists of five parts including data acquisition, data labeling, feature engineering, model selection, and training. Raw data consisted of 17,600 digital images obtained from the largest publisher of educational textbooks in the United States. Segmentation labeling was deemed most valuable in training the active learning model. Labeling was designated with the six Fitzpatrick skin phototypes, normal skin, hyperpigmentation, and hypopigmentation.

Results: A segmentation labeling program was developed over a two month period incorporating experimental planning feedback. The 17,600 images were classified into skin photographs or other. Each image contained 5–20 unlabeled pixels. On average 2–5 minutes is required for manual labeling per image per labeler. The data set of 17,600 images would require 440,000 minutes of domain expert time for manual labeling.

Conclusion: The biggest barrier to training a machine learning model in skin phototypes and pigmentary alteration is image labeling by domain experts. Manual labeling is time prohibitive and labeling using active learning reduces this time significantly, but still remains the biggest barrier to training a machine learning model. We present an image annotation of a machine learning model in dermatology.

SUBMISSION TITLE: MICROBIOTA CHANGES WITH KTP LASER THERAPY FOR ROSACEA

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Background: Rosacea is a common chronic inflammatory dermatosis that affects 10%–20% of the population. Erythematotelangiectatic (ET) rosacea is a common subtype characterized by background central erythema, flushing, and telangiectasias. Rosacea is strongly associated with deregulation of skin innate immunity and changes in the relative and total expression of specific cutaneous bacterial species. 532 nm potassium titanyl phosphate (KTP) laser therapy is an effective and safe therapeutic modality in the treatment of ET rosacea. Laser therapy has long-lasting effects that can be noted several years following treatment, but often requires maintenance treatment. In ET rosacea, vascular activation is thought to be a driver of inflammation through worsened vascular permeability and recruitment of inflammatory cells necessary for tissue inflammation. Changes in vascular integrity drive innate immunity alteration and inflammation. Separately, there is a strong relationship between demodex mite total abundance and the presence and severity of rosacea. It is unclear whether demodex directly induces inflammatory responses or whether this is due to demodex-associated bacillus species. Demodex levels are significantly reduced following laser therapy in rosacea, and it is likely that secondary changes of cutaneous bacteria occur with reduction of total demodex levels. Studies examining laser therapy of the genitourinary system have observed restoration of natural genitourinary flora in multiple genitourinary disorders, and probiotic therapy may potentiate the efficacy of various laser therapies. However, it remains to be determined whether KTP laser therapy is associated with changes in the abundance of total bacteria and relative bacterial subspecies of the skin. The purpose of this study was to assess whether the skin microbiome could be altered by KTP laser therapy in ET rosacea.

Study Design/Materials and Method: Adult patients with a clinical diagnosis of ET rosacea were recruited for this study. The study underwent IRB review and approval at UCSD (IRB #805738). A total of eight patients were recruited at the UCSD outpatient dermatology clinic. Patients were excluded if they had any history of previous treatment with laser therapy to areas of the cheeks or nose, use of oral antibiotics in the 6 months prior to initial treatment, use of topical antibiotics in the 2 weeks prior to initial treatment, immunocompromised status, or ongoing use of any systemic immunosuppressive therapy. Subjects were then swabbed with cotton swabs on a randomized side (left or right) of the cheek prior to undergoing laser therapy. The entire area bilaterally was then treated with laser, and a repeat swab was taken on the contralateral side. Patients then presented to clinic between 4 and 8 weeks following the initial treatment. At that time, a single swab was again obtained of the cheek followed KTP laser therapy of the entire area and immediate swab of the contralateral cheek. Swabs were stored in DNAShield™ stabilization buffer until all samples for the study were collected. At that time, DNA isolation was performed using PureLink™ microbiome isolation columns and collected into $50 \cdot 1$ of buffer. The total microbiome DNA isolate sample from each timepoint was then quantified for 16S relative abundance per area of skin, and sent for shotgun genomic sequencing on an Illumina NovaSeq. 6000 S4.

Results: Eight patients were ultimately enrolled in the study between 2021 and 2022. A decrease in *Cutibacterium acnes* abundance immediately after initial laser therapy was noted in six out of eight patients. No consistent changes in immediate or delayed total bacterial abundance (as measured by total 16S reads) were observed. Samples have been submitted for shotgun sequencing for analysis of specific species and genera.

Conclusion: Results from this study suggest that KTP laser therapy in the treatment of rosacea is associated with changes in the microbiome. Microbiome alteration may represent a novel mechanism of laser therapy: changes in the microbiome may be essential for the long-term efficacy of laser therapy in rosacea and other conditions treated with laser. Combination therapies, consisting of laser, systemic medications, and topical medications, are commonly used in the treatment of ET rosacea with limited data to support their use. Understanding the role of the microbiome in rosacea, a common dermatologic disease associated with significant morbidity and disfigurement, may lead to advances in the understanding of the disease process and novel therapeutic interventions. Findings from this study may support the use of laser therapy for other cutaneous conditions that are associated with microbiome dysregulation, including atopic dermatitis, hidradenitis suppurativa, and other follicular inflammatory conditions. Future studies will be necessary to fully elucidate the relationship between laser therapy and cutaneous microbiome.

SUBMISSION TITLE: OCM IMAGE SEGMENTATION AND ANALYSIS WITH DEEP LEARNING

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Background: Optical coherence tomography (OCT) is a high-resolution tomographic imaging modality that relies on the intrinsic scattering properties of biological tissues to generate imaging contrast. Optical properties of biological tissues, such as attenuation coefficient, can be quantified by analyzing OCT signals. For example, these signals have been used for differentiating cancer from noncancer in human brain tissues. Scattering and absorption coefficient of tissues varies strongly amongst individuals. Therefore, an adaptive learning technique has been developed based on OCT measurements to develop a predictive model for characterization of the presence of inhomogeneities in tissue phantoms.

Deep learning has been demonstrated to be a novel tool in biomedical problems. More specifically, U-Nets are a type of deep learning network developed for biomedical image segmentation. The goal of U-Net is to perform feature mapping on an image to learn the critical properties of each image given to the network. The system used is an OCX imaging system. The working principle of this imaging system is based on a combination of traditional OCT and Gabor domain optical coherence microscopy (GD-OCM). The system has two operating modes of standard OCT and OCM. The OCM mode is a smaller field of view but a much higher lateral resolution. This option also allows for depth scanning within a sample to collect a Tiff stack of images.

As the rates of skin cancer are rapidly increasing, there is a need for a better detection and diagnosis protocol. The current gold standard of skin cancer detection and diagnosis involves a dermatologist to evaluate suspected lesions. Basal cell carcinoma (BCC) and squamous cell carcinoma (SCC) are two types of skin cancer that affect deeper skin tissue layers. The last type, melanoma, originates in the most superficial layers of skin tissue and is considered the most dangerous due to its ability to metastasize quickly. A method is needed to quickly and accurately differentiate between types of skin cancer, healthy, and cancerous tissues. The research performed utilizes a deep learning U-Net to accurately segment and analyze images collected with OCM.

Study Design/Materials and Method: Tissue phantoms with varying optical properties were used to train a network on a variety of inputs. Phantoms had inhomogeneities in their core with different scattering coefficients. To represent the inhomogeneities as melanoma, phantoms were selected with higher scattering and absorption coefficients. Numerous phantoms of different properties were imaged using LighTopTech OCX. Images were captured in OCM mode with 1000 slices per scan and four scanning depths of focus. The operating wavelength of this system is 860 nm with a super-luminescent diode source and lateral resolution of 2.8 μm. The acquired data was split into 80% for training the network and 20% for validation of the network. A U-Net-based architecture was used to segment the images into three primary regions: surface, normal, and inhomogeneous regions of the phantom. The U-Net takes the input image and puts it through a series of down-sampling, convolutions, maximum pooling, and up-sampling to identify the regions of the image. Then, the network can output the results of feature extraction. This classifies the input set of OCM images to return a final prediction of whether the image contains melanoma or is normal. Additionally, the network calculates a confidence level as to how accurate its prediction is. Lastly, a background removal algorithm is used to differentiate the region of normal tissue versus the lesion. After the network had been validated, a new set of images not previously used were input into the network for final imaging. These phantoms used had different properties than the ones previously used in training and validation. To further show the improvement of this network, the phantoms were also imaged using a Nikon laser-scanning confocal microscope to validate the regions of the inhomogeneities the network predicted.

Results: The results of the final set of phantoms in the network showed distinction in regions of modeled normal and cancerous tissue. The network was able to accurately determine the regions of OCM images that

showed the phantom inhomogeneity. Also, dependent on the optical properties of the phantoms, the network was also able to differentiate between normal and melanoma values with high confidence. Phantoms were also imaged with confocal microscopy to evaluate the accuracy of the network. This provided high resolution to show clear distinctions between the boundaries of the phantom and inhomogeneity within. This confirmed the accuracy of the network as all cases showed the network accurately segmenting between the two regions.

Conclusion: Through the use of deep learning, suspected cancerous lesions can be quickly classified. This can be used as a tool for dermatologists to make more informed decisions about patient care. Furthermore, the final image of the lesion alone can assist doctors in determining clear margins for tumor removal. The results showed accurate segmentation and classification of OCM images using this deep learning network. The tissue phantoms were accurate representations of the properties of normal skin tissue and melanoma. With the rising cases of skin cancer, better methods need to be developed to make testing for cancerous lesions faster and more accurate. This deep learning network has the potential to reduce the level of interpretation needed by dermatologists. This can assist dermatologists and allow them to evaluate more suspected lesions without the long and time-consuming process of taking a biopsy of every lesion. This can help determine the ones where a biopsy is necessary. Future applications of this network can expand to all three types of skin cancer. This would require phantoms with inhomogeneities at varying depths to create a new training set of data. More widescale future work would include the interface of this deep learning network with technology for more accurate and precise tumor removal.

SUBMISSION TITLE: OPTICAL MONITORING OF TISSUE TEMPERATURE

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Background: Accurate tissue temperature monitoring is required for proper light dosimetry. Current methods, such as thermocouples, are invasive. An optical method would provide non-invasive, real time temperature feedback. The goal of this study was to explore the feasibility of using temperature dependent changes in NIR reflectance spectrum for providing real-time temperature feed-back.

Study Design/Materials and Method: Human skin samples were placed on top of a temperature controlled aluminum plate, which was heated up to 60°C. Light from a broadband halogen source was focused on top of samples with a 4 mm spot size. Remitted light was collected by an optical fiber, positioned 10°, 20°, 30° with respect to the samples' normal. Reflected signal was measured and spectrally analyzed using a grating spectrometer in the 900–1700 nm range. Seven reflectance spectra were acquired from each specimen, while they were held at room temperature of 20°C, 36°C, 45°C, and 60°C. Temperature was monitored using an infrared thermal camera. At least eight samples were analyzed at each collection angle.

Results: Reflectance minima were recorded near 980, 1200, and 1450 nm. These wavelengths correspond to water absorption peaks. Blue shifts in peak locations were observed as sample temperatures increased. These shifts were most noticeable at 1450 nm, where a shift of 14 ± 4 nm was found with a 10° collection angle, 15 ± 3 nm with 20°, and 11 ± 2 nm with 30°. No differences in blue shifts were found between healthy and cancerous tissues.

Conclusion: The results from this study point to feasibility of providing real time optical feedback for monitoring temperature of biological tissues.

SUBMISSION TITLE: PHOTOBIOMODULATION IN AN IN VITRO MODEL OF EXERCISE ALTERS BIOCHEMICAL AND CONTRACTILE PROPERTIES OF MUSCLE FIBERS

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Background: Photobiomodulation therapy (PBMT) has been shown to have several beneficial physiologic effects in a wide range of tissues. The muscoskeletal system can be irradiated with wavelengths in red and near infrared (NIR) regions which penetrate deep into the body. Recent studies are suggesting that PBMT can reduce muscle damage, pain, inflammation and enhance physical performance. However, the activation of cellular responses by PBMT in muscle is not clearly understood. There are no consistent parameters

for PBMT with researchers using various wavelengths and fluences in their experimental settings. Different wavelengths may activate different cellular mechanisms, and a more thorough understanding of these effects could lead to new treatment modalities for muscular injuries that are effective. Therefore, the goal of this study is to compare the biological effects induced in contracting muscle fibers irradiated with two wavelengths in the NIR, 810 and 980 nm.

Study Design/Materials and Method: All experiments were performed on a mouse muscle progenitor cell line (C2C12) that differentiates into myotubes. For irradiation treatments, we built a custom-made LED device for 24-well cell culture plates, modified from a previously developed open-source LED-based platform by Gerhardt et al. (Scientific Reports; 6: 35363). Following treatment, myotubes were induced to contract by electric pulse stimulation (EPS) to mimic exercise. In this in vitro model of exercise, carbon electrodes are immersed into the cell culture media and an electric pulse is set using an external power supply. To evaluate changes in mitochondrial proteins via immunoblots we isolated protein from cell pellets. To assess myotube fatigue, we measured intracellular ATP and lactate secretion in cell culture media using luminescent based assays. We did live cell imaging during EPS to observe changes in contractile motion and after EPS to assess frequency of spontaneous contraction of myotubes. Experiments were performed three times with 3–6 replicates/well per experiment. Each experiment also included no PBMT and no electric stimulation controls. Changes in contractile motion was measured in ImageJ from ~15 individual fibers. Student *t* tests were performed in Graphpad with significance reported as $p < 0.05$. All data is reported as mean ± SD.

Results: Treatment of both wavelengths in contracting myotubes resulted in a significant 1.3 ± 0.2 fold increase in intracellular levels of ATP and 1.5–2-fold increase in mitochondrial proteins, SDH and UQCRC1, when compared to non-PBMT myotubes. Interestingly, only 810 nm treatment resulted in a 1.2 ± 0.1 fold reduction in lactate secretion into cell culture media. 810 nm treated myotubes also had a smaller change in myotube width during contractions, $5 \pm 3\%$ versus $8 \pm 3\%$ increase for 980 nm, suggesting the myotubes were contracting with less force. Although the contractile motion was reduced, 810 nm treated myotubes had a higher frequency of spontaneous contraction after removal of EPS, $42 \pm 21\%$ versus $13 \pm 28\%$ for 980 nm. This finding suggests that 810 nm treatment in contracting myotubes may have resulted in a greater endurance capacity.

Conclusion: Our study suggests that both wavelengths act differently and 810 nm may have a greater role in reducing anaerobic respiration in exhaustive exercise and a potential in enhancing muscle endurance capacity by preventing fatigue.

SUBMISSION TITLE: PRELIMINARY TESTING OF AN IMPLANTABLE OPTICAL SENSOR TO MEASURE OXYGENATION IN MUSCLE IN ELEPHANT SEALS

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Background: Through the evolutionary need to hunt prey and escape predators, marine mammals have developed a unique cardiovascular physiology that allows them to free-dive deeply and for prolonged periods without emerging for air. Diving deeper to escape a predator can lead to an extended hypoxic state that stresses the system and depletes muscle and blood oxygen reserves [1]. Increasing noise pollution due to oceanic traffic from trade and fishing industries can be perceived as a threat by these mammals and unnecessarily induce longer and deeper dives. To investigate the effect of disturbances from predatory sounds and sonar during free diving, we developed an implantable muscle oxygen sensor for elephant seals to log oxygen exchange between blood and muscle. In this work, we present the preliminary testing results of the sensor and the biolog data in elephant seals. Understanding the physiology of aquatic mammals can improve our understanding of analogous human behaviors.

Study Design/Materials and Method: The probe response was characterized using Monte Carlo and in vitro experiments. The oxygen sensor was tested in elephant seals within a controlled environment. Within the confinement of the laboratory, the sensor was surgically implanted and left to monitor the elephant seals overnight. The signals were acquired continuously over approximately 10 hours.

Results: The probe was implanted successfully and registered drops in oxygenation over periods of several minutes, which correspond to sleep apnea events. Elephant seals are known to experience sleep apnea under normal physiological conditions.

Conclusion: We developed a surgical procedure for sensor implantation and successfully measured oxygen saturation in elephant seal muscle tissue.

SUBMISSION TITLE: PROLONGED HYPOPIGMENTATION SUBSEQUENT TO COOLING AND LASER THERAPY: A PRE-CLINICAL SWINE MODEL

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Background: Congenital melanocytic nevi (CMN) are at elevated risk for malignant transformation and can have substantially impact on quality of life for many patients. Currently, there are limited options for removal. Of therapies available, complete resolution is often not achieved. In addition, current approaches have considerable risks. Surgical interventions are accompanied by risk of anesthesia, tissue distortion, cosmetic effects, and functional impairment. Nonsurgical interventions such as dermal abrasion, chemical peel and laser can be effective, but often take many attempts and fail to completely eradicate the lesion. Here, we share cooling as a possible treatment for CMN, as explored through a preclinical Hampshire swine model.

Cryotherapy has been proposed to treat many dermatologic and nondermatologic conditions. In the field of dermatology, cryotherapy is used successfully to manage warts, seborrheic keratoses and molluscum. In addition to these conditions, cryotherapy can be used on melanocytic lesions, with the intent to selectively target and destroy melanocytes while sparing neighboring cell bodies. In cells of neural crest origin, such as adipocytes and melanocytes, destruction occurs at temperatures for which cells of ectodermal origin survive. This selective destruction creates opportunity for clinical applications. Our interest is treating giant congenital melanocytic nevi, which have significant medical and psychosocial implications.

Cryotherapy has resulted in successful depigmentation of melanocytic tissue without permanence, but nonetheless is promising. This technique offers the advantage of treatment without distorting collagen architecture, producing fibrous scars or subjecting the patient to the risks of anesthesia. Therefore, it is a potentially superior option to current therapies, as it may achieve depigmentation through fewer interventions with improved efficacy and reduced risk.

Various works have demonstrated the temperature sensitivity of melanocytes as well as the gross necrosis that can result from overcooling. Melanocytes are unable to survive at temperatures cooler than −15 to −20°C, a temperature at which keratinocytes are spared. The temperature dependence of melanocytic destruction is evident, but a critical temperature for permanent depigmentation without necrosis has not yet been established. This is in part due to the techniques used for cooling, which often consist of dry ice application below the survival temperature of keratinocytes. Furthermore, previous efforts with milder cooling temperatures (−20°C or higher) have resulted in transient depigmentation with the eventual return of pigment in a perifollicular pattern, suggesting that melanocytes associated with hair follicles may be responsible for the repigmentation. We are investigating a new approach of contact cooling, coupled with laser hair removal, that could achieve permanent death of melanocytes without producing ulceration or necrosis. Here we share cooling with loss of pigment that has persisted for 6 weeks in an ongoing study of a Hampshire swine model.

Study Design/Materials and Method: All animal experiments were approved by the Massachusetts General Hospital Institutional Animal Care and Use Committee (IACUC). One Hampshire Miniature pigs (~30 kg) was used for this study. The animal underwent general anesthesia with monitoring (i.e., heart rate, blood pressure, arterial oxyhemoglobin saturation, and end-tidal carbon dioxide). All hair was removed by shaving before treatment. Treatment sites were tattooed with India ink before device application to longitudinally track wound contraction.

An aluminum cup with a circular base (60 mm in diameter) was filled with dry ice and covered. The sides of the cup were insulated with foam tape but the bottom was not covered to produce direct contact with the tissue. Before treatment, pure glycerol was applied to the skin surface for 1 minute. Thirteen treatment sites were created by applying the cup directly to the flank of the pig ($n = 13$). Force was applied at a target of 30 N throughout the treatment cycle, as detected by a force gauge coupled to the device. The pressure of application was calculated to be around 78 mmHg using device dimensions. Duration of application and number of application cycles ($n = 1$ cycle or 2 cycles) were intended to be the only variables in this treatment course ($t = 15$ seconds, 1 minute, 5 minutes, 10 minutes) (Table 1). If the treatment required two application cycles, pure glycerol was applied after the first cycle, 1 minute before the next application cycle.

Dressings were placed on the wounds immediately post procedure (Telfa covered by Duoderm, Tegaderm™). Carprofen was provided for analgesia for 3 days postintervention. One week after the sites were treated, images were taken and continued to be captured at 1 week intervals.

At 4 weeks postinjury, select sites were treated with 755 nm alexandrite laser (100 J/cm^2, 8 mm spot size, 3 milliseconds pulse duration. Sites were selected based on re-epithelialization of tissue and were observed to have sparsely distributed hair that was shaved before

treatment. Control sites that had not been subjected to cold injury also underwent laser exposure. Treatment sites were divided into four quadrants, as not all of the site had hair on visual inspection (site 1 = hair, treated with laser, site 2 = hair, not treated with laser, site 3 = hair, not treated with laser, site 4 = no hair, not treated with laser).

At 8 weeks postinjury, punch biopsies were collected. The pig was euthanized. Punch biopsies were fixed in buffered formalin and embedded in paraffin. All samples were stained with hematoxylin/eosin (H&E) and selective biopsies were stained with Fontana Masson.

Treatments were replicated at various time intervals between 30 seconds and 5 minutes. These sites were biopsied 2 hours posttreatment to evaluate for cell death from cooling. During cooling, temperatures were recorded at a target depth of 2–3 mm in the dermis approximated near the location of the hair follicle bulb.

Results: Immediately after cold

Upon removal of the device, treated sites became erythematous and indurated; ice formation was observed on visual inspection. There was a central depression where the cup was applied. Sites continued to be erythematous and indurated up until application of bandages.

Weeks 1–4 after injury, pre-laser

On gross inspection, all sites continued to appear erythematous and indurated 1 week after cold injury, with the exception of the 15 seconds site, which appeared analogous to untreated skin. No evidence of ulceration or necrosis was observed but epidermal sloughing was present at all treatment sites except for 15 seconds. By Week 2, collections formed at treatment sites of 5 minutes or greater. Depigmentation was observed in treatment sites 5 minutes or less. Epidermal sloughing and granulation tissue was visualized. The 15 seconds treatment site continued to look like untreated skin. By Week 3, epidermal sloughing continued and dermal necrosis as well as contraction were seen for longer treatment sites. In sites treated less than 5 minutes, reepithelization and evidence of depigmentation was observed. On Week 3, it was observed that the 15 seconds treatment site had a border of hypopigmentation without pigmentary change of the center. On Week 4, treatment sites longer than 5 minutes demonstrated loculated pockets of blood and pus. Drainage and culture were performed. All sites treated for 5 minutes or greater demonstrated evidence of contraction. Evidence of a few isolated, annular, brown macules about 1–2 mm in size were detected inside of hypopigmented areas for sites that were treated greater than 5 minutes. Borders of treatment sites greater than 5 minutes were noted to have punctate pigmentation at the periphery suggestive of repigmentation or migration from cells in uninjured skin.

Week 4, laser treatment

After treatment with laser, tissue was erythematous. The 15 seconds site treated with laser demonstrated loss of epidermis secondary to laser. Loss of epidermis was also observed in the control sites treated with laser.

Weeks 5–6, after laser treatment

Sites continued to remain depigmented. Laser treated sites did not produce any new hair or evidence of pigmentation. An isolated, annular, macule with a variegated border about 7 mm in diameter was visualized on the 1 minute L-sided treatment site. The site was first observed at 2 weeks and has become slightly larger (1–2 mm) in size over the duration of the experiment.

Week 8, end of study

All sites demonstrated depigmentation without evidence of perifollicular repigmentation and minimal, if any repigmentation at treatment edges. The 1 minute treatment sites were completely depigmented with the exception of the mentioned macular spot and did not display contraction on gross inspection. These sites demonstrated white hair in nonlaser treated sections. The macular spot appeared to be larger than previously observed during Week 6. Further analysis will be conducted upon processing of biopsies to evaluate for structural changes of tissue with H&E and special stains including Melan-A to identify melanin.

Complete depigmentation was achieved for a period of 8 weeks subsequent to cold contact application.

Conclusion: Hypopigmentation persisted in all treatment sites for the 8-week duration of the study subsequent to cooling with dry ice and treating with laser at 4 weeks after cooling. Treatment times of 15 seconds and 1 minute are promising candidates for further evaluation, given the evidence of hypopigmentation and lack of contraction on gross inspection. Each of these treatment areas did not show evidence of repigmenting at the end of 8 weeks. While the 1 minute treatment site developed epidermal sloughing, the 15 seconds treatment site did not have sloughing. However, this treatment site was only depigmented at the periphery of the contact, where the flat application device likely created the most pressure. The loss of pigment at this site occurred between 2 and 3 weeks; no changes in pigmentation were observed when evaluated at 2 weeks. Finding a time that creates for complete hypopigmentation with reduced evidence of epidermal damage would be optimal.

Treatment times of 1 minute for two cycles and greater disrupted the architecture of the tissue and demonstrated contraction. Some of these sites became infected, resulting in antibiotic treatment. Therefore, it is concluded that dry ice contacted tissue is not viable when subject to treatment times greater than 1 minute. Given the epidermal sloughing of the 1 minute treatment site, there may be a time in between 15 seconds and 1 minute that can be optimized for depigmentation with reduced tissue injury.

Cold induced depigmentation without evidence of frank necrosis has not been demonstrated for this length of time in the literature. This temperature profile and treatment approach may serve as a model that can be applied to treat congenital melanocytic nevi, which are of great interest given their impact on patients risk of malignancy and self-concept. Characterization of the temperature profile at which these changes occurred is of

great importance to understand what is happening on a biophysical level. This can be approximated with direct insertion of thermocouples during the cooling period as well as thermal camera imaging of the rewarming period. On-going work includes histological analysis to understanding what changes are occurring at a microscopic level that produces loss of pigmentation, evaluation of depigmented tissue with immunohistochemical staining against specific markers for Langerhans cells (CD1a+), melanocytes (Melan-A), and fibroblasts (Vimentin), and determining the extent of cell death after different cooling durations using TUNEL staining (dsDNA breaks) in tissue collected 2 hours after treatment.

Follow up experiments will be performed with additional animals to further optimize treatment parameters, primarily through evaluating the variables of contact temperature and exposure time. Tissue response to various parameters for an extended study duration is of interest to evaluate and characterize the possibility of permanent depigmentation without necrosis. The intention of this preclinical model is to develop an approach to depigmentation of ex vivo CMN tissue and eventually a novel CMN treatment therapy.

SUBMISSION TITLE: QUANTITATIVE ASSESSMENT OF HUMAN BURN WOUNDS BY COMBINING TWO OPTICAL TECHNIQUES

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Background: Our group has introduced a novel approach to noninvasive assessment of the structure and composition of human skin in-vivo. The approach combines two optical techniques diffuse reflectance spectroscopy (DRS) and pulsed photothermal radiometry (PPTR). For analysis numerical modeling of light and heat transport in human skin is used. In this study, we apply this approach to quantitate characterization of skin parameters during the healing of incidental burn wounds in humans was performed.

Study Design/Materials and Method: PPTR measurements involved pulsed irradiation with 1 millisecond pulses at 532 nm from a medical-grade laser (DualisVP, Fotona) and recording of the transient change in mid-infrared emission from the tissue surface with a fast IR camera (FLIR, X6801sc) at 1200 frames per second. DRS in the visible spectral range (400–650 nm) was measured using an integrating sphere (ISP-REF by Ocean Optics) and a compact spectrometer (USB4000, Ocean Optics). All the properties of healthy and burned skin were obtained using Monte Carlo simulation by the simultaneous fitting of the data from both PPTR and DRS measurements.

The study involved two volunteers (a 33-year-old male and a 60-year-old female, both Fitzpatrick skin types II) with incidental burn wounds. The male volunteer had burns caused by water vapor on the middle and the ring finger on the right hand, the female volunteer had a burn wound on the ventral part of the forearm caused by ironing. As a control, a healthy contralateral site was measured. The female volunteer was measured 1 week after the injury, and measurements of the male volunteer were performed 2–10 weeks after the injury.

Results: Preliminary results indicate changes in the thicknesses of both the epidermis and the dermis. The thickness of the dermis is increased, while the thickness of the epidermis is reduced in burn wounds in comparison with the control. Scattering in the dermis is significantly weaker in burn wounds than in the healthy control, scattering powers of the epidermis and dermis are increased.

Conclusion: The presented methodology allows noninvasive assessment of burn wounds and might offer a way for their clinical classification.

SUBMISSION TITLE: RAPID SEALING AND REPAIR OF SKIN USING LASER-ACTIVATED SEALANTS

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Background: Sutures and staples are most commonly used devices for the closure of skin incisions in clinics. Despite their strength in holding the edges of the incision together, they suffer from poor initial strength, wound dehiscence, and scarring. The mechanical mismatch between the sutures and skin leads to the activation of inflammatory pathways leading to the formation of scar tissues. These problems are further exacerbated in diabetic and immunocompromised patients because of their increased susceptibility to infections. To address this problem, silk-based adhesive films, doped with

light-activating chromophores (dyes, nanoparticles) were fabricated. Silkworm-derived silk fibroin protein acts as a primary adhesive and the chromophore functions as a photothermal conversion agent upon laser illumination. A near-infrared (NIR) laser set at wavelength 808 nm was used to activate the chromophore in the silk films that converts light energy into heat. This conversion causes the denaturation of tissue and sealant proteins. When the laser application is stopped, these proteins anneal and form a strong bond between the edge of the incision and the sealant. It is hypothesized that these sealants will increase the rate and quality of healing by creating a continuous seal as opposed to an interrupted seal created by sutures and staples. These light-activated sealants (LASEs) can also be loaded with antibiotics, proteins and small molecules that aid in wound healing to enhance the speed and quality of healing.

Study Design/Materials and Method: LASEs were prepared by extracting silk fibroin protein from silkworm cocoons. The silk solution was then loaded with different chromophores including indocyanine green (ICG) which is an FDA-approved green dye that is commonly used in the clinical to measure cardiac output, silver nanoprisms (AgNPr), or cuprous chloride ($CuCl_2$) solution. For antibacterial films, vancomycin hydrochloride was loaded into the films and the efficacy of the films against multidrug-resistant *Staphylococcus aureus* (MRSA) was evaluated in vitro and in vivo in Balb/c and *db*/*db* animal models. The silk-chromophore solution was then cast onto the plastic coverslips to prepare the sealant films. Dynamic mechanical analysis of films was carried out to determine their ultimate tensile strength and Young's moduli. Photothermal characterization was performed by subjecting the films to the NIR laser using on-off cycles of specific durations.

A murine incisional model was developed to test the efficacy of these films in vivo. Three strains of mice–immunocompetent Balb/c, immunodeficient with Severe Combined Immunodeficiency (SCID) Balb/c SCID, and a commonly used diabetic and obese mouse strain *db*/*db* were used in the study. The incision was hydrated and a film of the size of the wound was placed between the edges of the incision and allowed to form a paste. Next, an 808 nm continuous wave laser was irradiated over the film at power densities ranging from 2 to 5 W/cm^2 for 1.5–2 minutes. An infrared camera was used to continuously monitor the temperature of the film and the surrounding tissue; optimal temperatures, 55–65°C, were used to facilitate tissue sealing. Incisions closed with nylon sutures were used as controls. The efficacy of sealing was evaluated by measuring the trans-epidermal water loss (TEWL) and ultimate tensile strength (UTS) of the healed tissue at Day 2 (to study the immune response in early phases of wound healing) and Day 7 (late phase of healing) post wounding. TEWL is a measure of the barrier function of the skin; lower TEWL values indicate better barrier function. Immuno-histological studies were also performed to characterize the immune response to the LASE approach and compared to sutures. Further, the epidermal and dermal gap calculated using histology was confirmed using 22-MHz, high-resolution ultrasound, in vivo. Realtime high-resolution ultrasound imaging, paired with photoacoustic imaging of excised tissue samples enabled the visualization of LASE within the depth of the incision. All data were collected with at least three biological replicates and relevant statistical tests (one-way or two-way ANOVA with Fisher's LSD) were performed to determine significance.

Results: LASE-treated incisions provided a continuous seal and succeeded in keeping the incision closed until the day of necropsy—Day 7 in Balb/c and Day 2 in Balb/c SCID and *db*/*db*. In Balb/c and *db*/*db* mice models, the mechanical restoration of skin on day 2 measured by UTS was significantly higher in AgNPr- and CuCl2-LASE-treated incisions compared to the incisions treated with sutures. Further, we observed that Balb/c incisions treated with ICG-LASE resulted in higher barrier function (TEWL) and mechanical recovery (UTS) of skin compared to sutures. By Day 7, sutures and LASEs performed similarly. The enhancement of TEWL values in LASE-treated incisions can be attributed, in part, to the continuous seal provided by LASE compared to interrupted closures characteristic of suturing. Even though the epidermal gap in the LASE-treated incisions was higher, the LASE film was present in the gap and this difference was negligible by Day 7, indicating the gradual healing of the wound in LASE-treated incisions. No differences were observed in the dermal gap in all groups in Balb/c model. The epidermal and dermal gap values calculated using histology and ultrasound imaging were found to correlate linearly, confirming the histological findings and the use of high-resolution ultrasound with a 22-MHz transducer for determining healing outcomes. Realtime ultrasound imaging at 50-MHz coupled with photoacoustic imaging signal at 800 nm demonstrated that as the incision heals, LASE is pushed off the incision and is replaced by the healed tissue gradually. Finally, vancomycin-loaded LASEs were effective in combating surgical-site MRSA infections compared to antibacterial sutures, indicating the multi-functionality of this approach.

Immunohistochemistry (IHC) studies indicated that Balb/c incisions treated with ICG-LASE and AgNPr-LASE significantly reduced neutrophil (Ly6G+ cells) migration towards the incision measured. Interestingly, CuCl2-LASE-treated incisions attracted a swarm of Ly6G+ neutrophils and Arg-1+ macrophages at the edges of the incision in a spatially distinguishable profile, but ICG-LASE, AgNPr-LASE, and sutures attracted neutrophils around the incisions. This finding suggests that Cu^{2+} ions likely create a zone of clearance around the incision, which is devoid of the neutrophils, and hence they concentrate in large numbers at some distance

around the incision. The number of new blood vessels formed was investigated and a-SMA staining indicated similar levels of myofibroblast activation, likely indicating similar scarring outcomes in all groups.

Conclusion: LASEs result in rapid sealing and effective repair across different mouse strains and are an effective alternative to suturing. The type of chromophore used in the sealant can influence the immune response to LASEs; relatively inert chromophores, ICG and AgNPr, suppress inflammation, but $CuCl_2$ significantly increases inflammation. LASE also enables the delivery of bioactives to the incision to accelerate the healing and can be used effectively for combating surgical site infections. High-resolution ultrasound, coupled with photoacoustic imaging provides an effective strategy to noninvasively assess the wound healing process.

SUBMISSION TITLE: ROLE OF LOW LEVEL LASER ACUPUNCTURE THERAPY IN AUTISTIC CHILDREN AND ITS INFLUENCE ON BRAIN DERIVED NEUROTROPHIC FACTOR

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Background: Autism spectrum disorder (ASD) is a neurodevelopmental disabilities that influence social interaction and overall individual behavior. The adaptation during COVID-19 pandemic may have brought major problems to families to control different symptoms of the disorder. Although the recommended current standard pharmacologic therapy involved can only help to minimize irritability, hyperactivity, and repetitive, but it was reported not to reduce impaired social interactions and language deficits. Brain-derived neurotrophic factor (BDNF) could be linked to oxidative stress in ASD. Low power Laser acupuncture is a safe complementary modality which is urgently required in such disorder.

Study Design/Materials and Method: A randomized, case-control clinical trial involved 30 patients in two groups. The treatment group received low level laser acupuncture and the control group maintained on their routine medications only. Both speech ability and social interaction in addition to BDNF were evaluated before and and after the course of treatment.

Compliance on treatment was observed for both groups. There was statistical significant difference regarding improvement of social interactions and language deficits in addition to serum level of BDNF between the case and control group.

Results: Compliance on treatment was observed for both groups. There was statistical significant difference regarding improvement of social interactions and language deficits in addition to serum level of BDNF between the case and control group.

Conclusion: Applying successive courses of low level laser acupuncture therapy to the routine treatment of ASD is highly beneficial without reported any adverse effect.

SUBMISSION TITLE: SELECTIVE CRYOLIPOLYSIS OF VISCERAL ADIPOSE TISSUE WITH ICE SLURRY

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Background: Reduction in visceral adipose tissue volume has been shown to reduce metabolic disease risk factors in obese patients. We developed a new method of cryolipolysis with an injectable ice slurry that can selectively reduce adipose tissue volume. The aim of this study was to investigate safety, feasibility and mechanism of ice slurry induced cryolipolysis in visceral fat.

Study Design/Materials and Method: We used male diet-induced obese C57BL/6J mice and male diet-induced obese Sprague–Dawley rats in this study. Epididymal fat pads in animals in the test and sham treatment groups were exposed to cooling with ice slurry or sham treatment. Body weight and blood chemistry were monitored, and tissue samples were collected for histology and RNA sequencing (RNA-Seq) at Day 1, 3, 7, 14, 28, and 56.

Results: Ice slurry treatment of epididymal fat was tolerated well in all animals without any signs of distress, skin damage, bleeding, or infection. Blood chemistry was not affected in rats at any time points post slurry injection. Slurry treatment induced selective cryolipolysis in visceral adipose tissue and led to significant weight loss. Body weight of mice in slurry treatment group were significantly less than the sham group at Day 21 post slurry treatment when normalized to its baseline

(105.61% ± 6.68 g vs. 114.99 ± 5.42 g; $p < 0.05$ by two-tailed Student's t test). Weight loss was not sustained while the animals continued high-fat diet. RNA-Seq analysis of tissue samples showed increased expression of genes involved in immune response, collagen biosynthesis and wound healing post cooling treatment.

Conclusion: In this study, we examined safety, feasibility, and potential mechanism of action of injectable ice slurry in visceral adipose tissue in two rodent models. We demonstrated that a single cooling cycle of visceral adipose tissue induced cryolipolysis with concordant transcriptomic changes and weight loss. fat cooling could potentially serve as a nonsurgical treatment for obesity.

SUBMISSION TITLE: SINGLE APPLICATION OF TOPICAL LASER-ASSISTED VISMODEGIB IN A MICROEMULSION FORMULATION DELIVERS CLINICALLY RELEVANT INTRATUMORAL DRUG CONCENTRATIONS AND REDUCES EXPRESSION OF HEDGEHOG TARGET GENES IN HUMAN BASAL CELL CARCINOMAS

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Background: Preclinical studies have demonstrated the potential of laser-assisted topical delivery of hedgehog pathway inhibitor vismodegib in microemulsion formulation. Our aim was to evaluate the topical delivery in a clinical setting by comparing intratumoral vismodegib concentrations in human basal cell carcinomas (BCCs) from topical and systemic administration and to assess the related impact on hedgehog pathway target gene expression.

Study Design/Materials and Method: In an open-label explorative Good Clinical Practice-monitored trial, 16 histologically verified nodular BCCs in nine patients received CO_2 ablative fractional laser (40 mJ/microbeam, 10% density) followed by a single application of vismodegib microemulsion (3.8 mg/mL). After 3–4 days, tumor biopsies ($n = 15$) and plasma were analyzed for vismodegib concentrations by mass spectrometry and compared with steady-state concentrations of three BCC patients receiving oral systemic vismodegib treatment. Biological response was assessed quantitatively as reduction of GLI1, GLI2, PTCH1 and PTCH2 gene expression by qPCR ($n = 7$ biopsies) and as qualitative analysis of GLI1 levels by in situ hybridization ($n = 3$). Clinical photographs documented local skin reactions.

Results: Following a single laser-assisted topical vismodegib administration, drug was detected in 14/15 nodular BCC tumors at a median concentration of 6.2 μmol/L, which was comparable to those in BCC tissue from systemically treated patients (9.5 μmol/L, $n = 3$, $p = 0.8588$). Topical vismodegib reduced intratumoral GLI1 expression by 51%, GLI2 by 55%, PTCH1 by 73% and PTCH2 also by 73% ($p = 0.0092$–0.0304), confirming a substantial biological response. In situ hybridization demonstrated that GLI1 expression was upregulated in tumor tissue specifically and decreased in response to vismodegib exposure. The topical administration generated mild to moderate local skin reactions and no detectable systemic uptake of vismodegib.

Conclusion: A single laser-assisted topical application of vismodegib resulted in intratumoral vismodegib concentrations comparable to steady-state concentrations following systemic administration, concurrent with a significant reduction of hedgehog pathway target gene expression.

SUBMISSION TITLE: THE IMPORTANCE OF THE TYPE OF DEVICES AND FILLERS IN LASER- OR DEVICE-ASSISTED FILLER DELIVERY: HISTOLOGIC EVALUATION

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Background: Lasers and energy-based devices are used to enhance transcutaneous delivery of fillers. However, little has been published on the histologic findings of this form of laser/device assisted delivery to determine the optimal devices and fillers. We aim to objectively evaluate the histological effects of laser and energy-based device-assisted filler delivery.

Study Design/Materials and Method: Ex vivo human abdominoplasty skin samples were treated with fractional CO_2 laser (ECO_2, 120 μm tip, 120 mJ),

fractional radiofrequency microneedling (FRMN, Genius, 1.5 mm, 20 mJ/pin), and microneedling (2.0 mm). Immediately after poly-L-lactic acid (PLLA), hyaluronic acid gel, calcium hydroxyapatite, and black tissue marking dye were topically applied. Following treatment biopsies were collected for histologic evaluation.

Results: Histology revealed that PLLA and black dye were found in greatest abundance, hyaluronic acid was found to a lesser extent, and calcium hydroxyapatite was least found within channels created by fractional CO_2 laser. Microneedling was effective only at delivering black dye, whereas FRMN failed to show significant channel formation nor delivery of the studied products.

Conclusion: This study confirms that among the devices and fillers studied, fractional ablative CO_2 laser and PLLA proved to be ideal for laser-assisted filler delivery. Of note, this is the first study to objectively evaluate the histological effects of fractional ablative CO_2 laser and microneedling with application of calcium hydroxyapatite particles and hyaluronic acid. Overall, our study highlights that clinicians should be familiar with the size of dermal fillers and channels created by lasers or devices to perform evidence-based laser and device-assisted filler delivery.

SUBMISSION TITLE: THE SIMULTANEOUS APPLICATION OF MONOPOLAR RADIOFREQUENCY AND TARGETED ULTRASOUND FOR STIMULATION OF HYALURONIC ACID PRODUCTION: THE SUMMARY OF CURRENT EVIDENCE FROM ANIMAL RESEARCH

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Background: The monopolar radiofrequency (RF) generates heat, with the targeted ultrasound (TUS) delivering the heat to the dermal layer, ensuring deep and homogenous heating of the skin tissue. The heat induces regenerative response in the skin, namely increasing the fibroblast activity, leading to the increased production of various compounds of extracellular matrix, including the hyaluronic acid (HA). This work aims to review the current knowledge gained by animal research, investigating the effect of standalone RF treatment with the simultaneous application of RF + TUS on stimulation of the hyaluronic acid production.

Study Design/Materials and Method: The author's review identified two studies with a combined number of 24 large white pigs. The treatment protocol consisted of four 30-minute procedures spaced 2–3 days apart. Two treatment groups were established based on the modality, which they were receiving. Group A ($n = 15$) was treated with simultaneous application of RF + TUS, with group B ($n = 12$) serving as a control group receiving standalone RF treatment only. PCR, MALDI-TOF, and ELISA were used for the quantitative evaluation of the changes in HA production. The distribution of hyaluronic acid within the skin tissue was then visualized with confocal and light microscopy.

Results: The PCR focused on assessing the production of HAS1 and HAS2, enzymes responsible for HA synthesis. PCR results of group A revealed a +98% and +32% increase in HAS1 and HAS2 production after the treatments, respectively. The MALDI-TOF revealed a +218% increase in measured hyaluronic acid 2 months after the treatments, with ELISA showing a +95.2% increase. The changes were also visible by both the confocal and light microscopy. The control group showed no significant ($p > 0.05$) results in either of the studies.

Conclusion: Based on the animal data, there is strong evidence that the simultaneous application of RF + TUS shows superior results for inducing the production of hyaluronic acid in the skin than radiofrequency alone. Supposedly, concurrent application of targeted ultrasound significantly enhances the natural regenerative processes in skin tissue. However, although the porcine animal model shares a great degree of similarity with human tissue, performing similar studies on human subjects in future would be a welcomed addition to this research.

SUBMISSION TITLE: USE OF PHOTOBIOMODULATION FOR HAIR LOSS: A SYSTEMATIC REVIEW

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Background: Hair loss is a condition that affects up to 50% of males and females, and has varying etiology, contributing to complexity with treatment. The complexity of hair loss is not only limited to the etiology, but also the financial and psychological burden collectively impacting the individual's quality of life. Thus, assessing efficacy of treatments of hair loss is important to streamline treatment recommendations for patients. Photobiomodulation (PBM), also known as low-level laser therapy (LLLT), utilizes visible red light (600–700 nm), or near infrared light (700–1400 nm), composed of laser diodes (LD) or light emitting diodes (LED) as a treatment for hair loss. This technology has been approved by the US Food and Drug Administration for treatment of androgenic alopecia (AGA) and can

be used concomitantly with minoxidil for treatment. Thus, the objective of this study was to broadly analyze studies that use PBM by wavelength for treatment of various types of hair loss.

Study Design/Materials and Method: A search was conducted in Medline (PubMed) and Embase. The search used controlled vocabulary terms (MeSH and Emtree) and free text keywords for the concepts of photobiomodulation and alopecia resulting in a total of 434 studies. Duplicates, non-English, nonhuman, and irrelevant studies were excluded from review, resulting in 27 studies included for final analysis. Participant demographics, type of photobiomodulation, wavelength used, type of hair loss, efficacy measure and results were noted.

Results: Randomized, prospective, retrospective, and case reports/case studies that used visible light up to infrared were included in this analysis. The most common types of hair loss examined were 74% androgenic alopecia (AGA) (20/27) and 11% alopecia areata (AA) (3/27). Upon stratification of demographics, 37% (10/27) studies examined photobiomodulation in males and females. Thirty-three percent (9/27) of studies exclusively examined PBM in females and 26% (7/27) exclusively examined males. The majority of studies assessed efficacy by assessing hair regrowth, density, count, and severity of alopecia tool (SALT). The remainder of studies used a combination of varying efficacy measures. Overall, 96% (26/27) of studies reported success with their chosen efficacy measure. In terms of wavelength distribution, 7% (2/27) assessed from 311 to 599 nm, 30% (25/27) examined wavelengths from 600 to 700 nm. LLLT was effective for treatment of AA in 100% (3/3) and AGA in 93% (19/20) of studies. LLLT utilizing light diodes (LD) and light emitting diodes (LED) as the source of light had equal efficacy in the examined studies. LD alone was effective in 100% (5/5) of studies, while LED alone was effective in 100% (8/8) studies, the combination of LD/LED was effective in the treatment of hair loss in 100% (3/3) studies.

Conclusion: Our results suggest that photobiomodulation from 311 to 665 nm is an effective tool in the treatment of androgenic alopecia and potentially other forms of hair loss. Although the included studies for alopecia areata suggest success with PBM, further research is needed to evaluate the use of photobiomodulation for alopecia areata.

SUBMISSION TITLE: VARIABILITY OF OPTICAL COHERENCE TOMOGRAPHY-MEASURED BLOOD VESSEL CHARACTERISTICS WITHIN SINGLE PORT-WINE BIRTHMARKS: A MAPPING STUDY

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Background: Port-Wine Birthmarks (PWB) are congenital capillary malformations which occur in an estimated 0.3%–0.5% of the population and usually occur on the head and neck [1]. These birthmarks may evolve over time, hypertrophying and causing complications, including hemorrhage and overgrowth, as well as possibly psychosocial issues [1,2]. Although pulsed-dye laser (PDL) is the first-line treatment in much of the world for PWB, patients rarely achieve full clearance of their lesions and about one-fifth of lesions may not achieve any blanching at all [3]. Optical coherence tomography (OCT) is a noninvasive imaging device which can be utilized to measure vessel characteristics, including vessel density, vessel diameter, and superficial vascular plexus depth. Previous studies have shown OCT-measured blood vessel characteristics of PWBs vary with color and body location of the lesion [4,5]. However, there are limited studies utilizing OCT to understand heterogeneity of vessel characteristics that may exist within single PWBs of a single anatomic location. Vessel heterogeneity within PWBs may affect laser settings utilized for treatment. Therefore, the objective of this study was to use dynamic-OCT (D-OCT) to measure blood vessel characteristics within single PWBs to understand variability in vessel characteristics between adjacent sites of a single lesion.

Study Design/Materials and Method: This study was conducted with IRB approval (#2008-6307). D-OCT (VivoSight; Michelson Diagnostics UK Ltd.) was used to measure separate spots of individual PWBs. The D-OCT device utilized measures a 6×6 mm field of the skin to a depth of 1 mm and produces horizontal and vertical cross-sectional images of the measured area. For all measured areas, the D-OCT device's software allows calculation of superficial vascular plexus depth (micrometers), vessel diameter (micrometers), and vessel density (percent). The machine also has the capability to measure vessel diameter and vessel density at 0.05 mm increments in depth from the skin surface, with the ability to take reliable measurements down to 0.5 mm, which was the primary feature utilized in this study.

Between 8 and 25 individual, adjacent areas were measured with D-OCT for each PWB. An additional one to two control areas were also measured with D-OCT for each PWB. Control areas consisted of D-OCT measurement of skin of the same body part on the contralateral anatomic side. Quantitative data for superficial vascular plexus depth, vessel diameter, and vessel density was collected from the machine. Horizontal "en face" and vertical "B-scan" images of the skin, produced by the machine, were also collected for each area measured. These images depict the network of cutaneous blood vessels.

History was collected from patients, including age and previous treatments and color of PWB was noted. As

the D-OCT machine can measure vessel density between 0 and 0.5 mm from the skin surface at increments of 0.05 mm, quantitative analysis involved description of mean and range of vessel density and vessel diameter at these different depths. Specifically, vessel density and vessel diameter were analyzed between 0.15 (approximate depth for superficial dermis) 6 and 0.5 mm.

Results: A total of 101 individual spots of PWBs on the forehead, cheek, ventral forearms, and chest were measured. Participants, including two males and two females, were recruited from clinic. The average age of participants was 40 years (range: 12–72 years). Skin types ranged from Fitzpatrick type I–IV.

Vessel density and vessel diameter was analyzed between 0.015 and 0.05 mm. Average vessel density across affected spots was 10.25% (range: 3.60%–36.00%), while average vessel density across control spots was 10.33% (range: 0.62%–33.47%). Average vessel diameter across affected spots was 83.98 μm (range: 13.31–315.39 μm), while average vessel diameter across control spots was 85.40 μm (11.35–191.62 μm). There was a great deal of variability between PWBs and between different spots on the same PWB. There were no identifiable trends between specific depths and greater/lesser density or diameter. Individual PWB maps were created and will be provided. In some subjects with extensive history of treatment, quantitative results for vessel density and diameter were similar in control to those of affected spots. In addition, review of several D-OCT scans revealed identification of dark areas which were not measured by the software. These were thought to be areas of low flow.

Conclusion: The results of this study indicate that, not surprisingly, there is a great deal of vessel heterogeneity between different PWBs and within individual lesions. Similarity in measurements between clinically uninvolved and involved skin in patients with history of treatment may indicate that multiple laser treatments may target superficial vessels and eliminate clinically appreciable birthmark; however, vessel ectasia may still exist at deeper depths. Dark areas thought to be areas of low flow were not measured by the software. This needs to be taken into consideration when calculating PWB vessel characteristics, understanding trends, and treatment planning. Further study of this topic should include more accurate assessment by machines of vessel characteristics as well as further analysis of vessel characteristics in skin that appears clinically unaffected.

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Clinical Applications

SUBMISSION TITLE: A NOVEL FACE MASK APPLICATION POST PICOSECOND LASER WITH A DIFFRACTIVE OPTIC TREATMENT

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Background: Although there is a wide variety of cosmetics available in the market, there is still a need to expand the use of medical grade skin care and establish post treatment regimens that enhance device treatment experience. As the demand for skin care products is growing, it is important for physicians to assist patients with finding the right product to work synergistically with their device treatments. While many nonablative aesthetic laser treatments have minimal side effects that are transient in nature, there is still a need to improve the recovery process and improve treatment experience with skin care products.

Study Design/Materials and Method: Thirteen subjects were enrolled and received treatment from a picosecond laser with a 755 nm handpiece with a diffractive optic. A newly developed biocellulose face mask containing hyaluronic acid (HA) and vitamin B5 was applied to the full face immediately post treatment. 2D photos and thermal imaging were taken at baseline, immediately post treatment, and then 5, 10, 20, and 30 minutes after the face mask was applied, alongside a patient questionnaire.

Results: On average, skin temperature increased by 0.8°C following laser treatment and then after application and removal of sheet mask, skin temperature was lowered by 1.5°C. The sheet mask was effective in cooling the skin by decreasing skin temperature 0.6°C when compared to baseline.

After application of the face mask post laser treatment, 100% of the subjects agreed the mask felt good and immediately soothed their skin. Ninety-two percent agreed the face mask reduced the discomfort and the burning sensation on their skin post treatment. Additionally, 85% agreed their skin felt more hydrated after using the face mask and would recommend the use of the face mask to family and friends. One hunddred percent agreed the sheet mask improved their overall treatment experience and would prefer to use it alongside further treatments.

Conclusion: The use of the novel HA face mask post nonablative laser treatment can complement and enhance recovery and treatment experience.

SUBMISSION TITLE: A RETROSPECTIVE STUDY TO INVESTIGATE DEMOGRAPHICS OF PATIENTS WHO PRESENTED WITH HAIR LOSS AT A SINGLE MEDICAL CENTER TO BE TREATED WITH LOW LEVEL LASER LIGHT THERAPY, PLATELET RICH PLASMA AND COMBINED THERAPY WITH BOTH

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Background: Low level light laser therapy (LLLT) and platelet-rich plasma (PRP) have been used individually for alopecia, but the combination therapy has shown better preliminary results in the clinical setting. The objective was to study the patient population differences using LLLT or PRP or combination therapy of LLLT and PRP for the treatment of androgenetic alopecia at a single medical center in New York, over a period of 3 years.

Study Design/Materials and Method: This is a retrospective study including 361 patients clinically diagnosed with alopecia, primarily androgenetic alopecia over a period of 3 years. Patients were treated with either LLLT, PRP or the combination therapy of LLLT and PRP. These therapy sessions were 4 weeks apart. All patients who received the combination therapy were first treated with LLLT followed by PRP injections on the scalp.

Results: Total of 316 patients were studied over a span of 3 years. Mean age of patients who received the LLLT treatment only was 48.71 ± 19.7 years, whereas the mean age of patients who received PRP treatment alone was 46.89 ± 16.5 years and 52.29 ± 18.1 years for patients who received the combination therapy. 26.4% men and 73.6% women received only the LLLT. 28.1% men and 71.9% women got PRP alone and among those who got combination therapy 23.8% were men and 76.2% were women. No statistically significant differences in age ($p = 0.080$) and gender ($p = 0.769$) were observed in patients opting for different treatment options.

Conclusion: LLLT and PRP are the primary treatment options for alopecia, but the combination therapy has shown better preliminary results in the clinical setting. Demographic differences in patients treated with one of these or combination of these two are unclear. Thus, the objective of the study was to assess the patient population differences using these individual modalities and combination therapy in the setting of androgenetic alopecia. Based on our data, no statistically significant differences in age and gender were found. More research is encouraged in the future.

SUBMISSION TITLE: A SAFETY REVIEW OF MICROCORING IN 200 PATIENT TREATMENTS

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Background: Micro-coring represents a new minimally invasive, first-in-class device that removes 420+ μm of skin with each core. The size of the microcores were created to be below the size threshold that cause scars. Once the cores of skin are removed by needles and suction there is bio-mechanical remodeling with near immediate hole closure. With this new procedure it is important to understand the safety issues and possible complications of mechanical skin removal.

Study Design/Materials and Method: Two hundred patients (skin types I–V) were treated with one to three treatments of dermal microcoring over a 12-month time period in our private practice. Side effects were monitored daily and weekly after each treatment visit.

Results: Review of clinical records including 1 and 7 day postoperative communication with patients revealed 21/200 had minor adverse events after micro-coring. The most common adverse events included postinflammatory hyperpigmentation (PIH), postinflammatory erythema (PIE) and bruising. The bruising was presumed secondary to the injectable anesthesia. The postinflammatory hyperpigmentation/erythema presumed to be either hemoglobin turning into hemosiderin trapped in core channels or activation of the melanocytes at the dermal-epidermal junction due to injury of coring. The most common location for PIE/PIH were upper lip or off-face

treatments. 15/21 patients were treated with either pulsed dye laser or nonablative fractional laser with full resolution of the adverse event. In all other patients the adverse events resolved within 26 weeks with no treatment.

Conclusion: Dermal microcoring appears to be a safe noninvasive aesthetic treatment with 200 patients being treated and adverse events limited to postinflammatory dyschromias and bruising. Although the overall rate of complications in this review is low an appreciation of all complications is important as we learn more about dermal microcoring technologies.

SUBMISSION TITLE: ASSESSING AND TREATING HYPERHIDROSIS IN RESIDUAL LIMBS: A SINGLE CENTER EXPERIENCE

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Background: There are over two million people in the United States with an amputation [1]. Over 50% of people with amputations report discomfort related to perspiration(hyperhidrosis) inside their prosthesis [2]. Hyperhidrosis of the residual limb can compromise both skin health and function within a prosthetic device [3,4]. Despite the prevalence of excessive sweating affecting residual limbs, there are very few studies devoted to assessment or treatment of this condition in persons with amputation.

Major methods used for objective assessment of sweat production include gravimetry and vapometry. Gravimetry is the measure of the mass of sweat per area per unit time. No standardized gravimetric cutoff values exist for hyperhidrosis of the residual limb. Vapometry measures the gas output of the skin using transepidermal water loss (TEWL). A practical and validated device used to measure TEWL is the VapoMeter (Delfin Technologies Ltd.) [5]. No standardized vapometric cutoff values exist for hyperhidrosis, or excessive sweating affecting the residual limb.

There is currently no hyperhidrosis qualitative assessment tool that is validated for use in the residual limb. The Hyperhidroisis Disease Severity Score (HDSS) is a brief, single item scale that has recently been found to demonstrate a correlation with excessive sweating and impaired prosthetic function [6].

Treatment of residual limb hyperhidrosis includes consideration of prosthetic components, topical, oral and injectable pharmacologic interventions as well as energy-based modalities. In our practice, microwave thermoablation is typically used as a last resort for refractory residual limb hyperhidrosis. Microwave thermoablation was approved by the FDA for the treatment of axillary hyperhidrosis in 2011. It uses microwave energy to selectively destroy water-rich eccrine glands in the skin. This modality was first successfully used off-label for refractory residual limb hyperhidrosis in 2016 [7].

Study Design/Materials and Method: Sweating on a patient's residual limb is measured before and after 15 minutes of exercise on a treadmill at 60% of their max heart rate in a temperature-controlled room. Both Gravimetry and vapometry are utilized. For gravimetry the patient's surface area of the residual limb is measured and then the total mass of sweat is measured after exercise and reported in units of $mg/cm^2/h$. For vapometry the patients transepidermal water loss is measured with the average of three consecutive measurements obtained before and after Exercise in four locations on the residual limb reported in units of $g/m^2/h$.

Microwave thermoablation is performed on the residual limb in two consecutive treatments separating the limb by half(anterior/posterior) to avoid any theoretic possibility of compartment syndrome given the large amount of swelling associated with treatment. Treatment is conducted at level 5, a widely accepted setting for treating hyperhidrosis, or as tolerated by the patient. We have used sedation, nerve blocks and tumescent anesthesia as well as combinations of those three for pain control during the procedure.

Results: For one patient that underwent microwave thermoablation on a lower extremity residual limb there was a 96.6% reduction in sweating when compared to an untreated area 4 years after treatment as measured by vapometry. For three patients that underwent microwave thermoablation on lower extremity residual limbs there was an average reduction of 2 points in HDSS scores, or 80% reduction in sweating. Improvement was sustained 4–6 years after treatment.

Side effects associated with microwave thermoablation of the residual limb are typically mild and include postprocedural pain. This is controlled with ibuprofen and acetaminophen in our experience. Edema is significant within the treatment area, and we utilize a cold compression unit to control and reduce swelling. Fibrotic bands/lumps are occasionally noted in patients but resolve with time. A notable beneficial side effect of microwave thermoablation in persons with amputation is hair loss especially for those with lighter hair that is resistant to laser hair removal.

We report one patient that experienced a popliteal deep vein thrombosis 6 days post procedure. This same patient developed retiform purpura followed by full-thickness skin necrosis in part of the area treated on the posterior lower extremity. These lesions eventually healed, and she returned to using her socket. Underlying coagulopathy is suspected and laboratory work-up is pending. Otherwise, skin biopsy demonstrated a vasculopathy with thrombus/emboli present in deep dermis vessels without any signs of surrounding vasculitis.

Conclusion: For patients with refractory residual limb hyperhidrosis, microwave thermoablation has demonstrated to be an overall good option with measurable effectiveness and long-lasting results. Our data support that patients have both objective and subjective decrease in sweating on the residual limb leading to overall satisfaction with the procedure. In our experience most of the side effects were mild, however, one of our patients had a major complication following the procedure that led to a prolonged period of time out of their prosthesis while the wounds healed.

A standard set of objective and subjective cut-off values could help to diagnose hyperhidrosis of a residual limb. If cut-off values for hyperhidrosis became better understood or standardized, perhaps quantitative assessment of hyperhidrosis using gravimetry or vapometry would be clinically viable. Even if these quantitative methods are of limited diagnostic value, they can still play a role in assessing and monitoring response to treatment.

The views expressed in this abstract are those of the author(s) and do not necessarily reflect the official policy of the Department of Defense or the U.S. Government

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SUBMISSION TITLE: CHANGES IN MELANOCYTIC NEVI TREATED WITH LASER HAIR REMOVAL: A SYSTEMATIC REVIEW

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Background: Incidental treatment of melanocytic nevi during laser hair removal has been noted to cause clinical and dermoscopic changes that may appear similar to findings seen in atypical or neoplastic melanocytic lesions. The rate and characteristics of these changes has not been well-studied. The objective of this review article is to assess the literature for reported changes in melanocytic nevi following laser hair removal to guide clinical practice.

Study Design/Materials and Method: PubMed was searched December 5, 2022 for articles evaluating changes in melanocytic nevi after laser hair removal treatment using the following search terms: "nevi laser hair removal," "nevi diode," "nevi long pulse alexandrite," "nevi long pulse neodymium doped yttrium aluminum garnet," and "melanoma laser hair removal." All English language patient-based reports discussing incidental treatment of melanocytic nevi while undergoing laser hair removal with a laser were eligible for inclusion, while reports of changes following hair removal with nonlaser devices such as intense pulsed light (IPL) were excluded. Studies evaluating nonmelanocytic nevi such as Becker's nevus or nevus of Ota were excluded as were those evaluating the intentional ablation or removal of melanocytic lesions.

Results: Ten relevant studies were included, consisting of seven case reports or series and three observational trials, two of which were prospective and one retrospective. Among the seven case reports or series there were a total of 11 patients, six of which had multiple affected nevi. Clinical and dermoscopic changes to nevi following laser hair removal appear to be common in clinical practice, though not well studied. Clinical and dermoscopic changes have been noted to present as early as 15 days after treatment and persist to the maximum time of follow up at 3 years. Commonly reported changes include regression, decreased size, laser induced asymmetry, bleaching, darkening, and altered pattern on dermoscopy. Histologic changes include mild atypia, thermal damage, scar formation, and regression. Although some of the clinical and dermoscopic alterations may be concerning for malignancy, to our knowledge, there are no documented cases of malignant transformation of nevi following treatment with laser hair removal.

Conclusion: This study is limited by the low number of relevant reports and their generally small sample size, many of which is limited to single cases. Additionally, comparison of available data was limited by variable reporting of treatment regimens and outcomes.

Changes to nevi treated during laser hair removal are not uncommon. Modifications to nevi may occur and look similar to changes seen in dysplastic or neoplastic melanocytic lesions. Notably, despite the widespread use of laser hair removal since the first device was FDA approved in 1995, a time span of nearly three decades, there have been no reported cases of melanoma or severe dysplastic changes within treated nevi. However, dermatologists should be aware that morphologic and dermoscopic alterations can occur after LHR to prevent unnecessary surgical procedures. Although melanoma has not been reported to occur in nevi treated with laser hair removal nor with any other laser exposures, further long-term data is needed to fully elucidate this concern. Optimally, nevi should be examined by a dermatologist before laser hair removal to determine a baseline clinical and dermoscopic morphology. If there is concern for potential atypia, laser should be avoided over such nevi to avoid confusion at future follow up visits.

SUBMISSION TITLE: CHARACTERIZING MICROVASCULAR FEATURES IN ACTINIC KERATOSES GRADE I-III AND PHOTODAMAGED SKIN USING DYNAMIC OPTICAL COHERENCE TOMOGRAPHY

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Background: The current clinical grading system for actinic keratoses (AK) is an imperfect measure for assessing disease stage and exhibits high interobserver-variation. Dynamic optical coherence tomography (D-OCT) enables in vivo evaluation of cutaneous vessels, potentially adding subclinical information on imaged AKs. This study characterized microvasculature in AK grades I-III and photodamaged skin (PD), aiming to explore the utility of D-OCT as a supplement to clinical evaluation.

Study Design/Materials and Method: A two-center explorative study assessed clinical AK Grades I–III and adjacent PD skin on the face or scalp of patients. AKs were clinically evaluated using the Olsen classification scheme and dermoscopy. D-OCT was used to visualize microvasculature at 150- and 300 μm depths in each AK grade (I–III) and adjacent PD skin. D-OCT scans were assessed qualitatively based on vessel morphology; shapes, pattern- and direction, as well as quantitatively by measuring vessel density- and diameter. Qualitative and quantitative results were compared between AK grades and lesional versus nonlesional skin.

Results: In 47 patients, D-OCT scans ($n = 294$) and dermoscopic images ($n = 250$) were acquired of 207 AKs in total, consisting of AK I ($n = 93$), II ($n = 65$), III ($n = 49$) as well as PD skin ($n = 87$). Qualitative evaluation at 150 μm depth, showed minimal variation in vascular morphologies between the AK grades and PD skin. In contrast, at 300 μm depth, the distributions of vessel patterns and -direction differed significantly depending on both AK grade and lesional versus nonlesional skin. Thus, the predominant pattern in AK I (40%) and PD skin (51%) was a structured branching/mesh. Contrastingly in AK II (52%), pattern was unspecific/chaotic, while a mottled pattern was observed in AK III (67%) (all groups; $p < 0.001$). Vessel direction represented another distinct feature of AK III, as the majority of lesions (67%) showed accentuation of vessels towards a hyperkeratotic center, frequently combined with radiating vessels (35%). Quantitative evaluation of microvasculature revealed higher vessel density in AK I and II compared to PD skin at both 150 μm ($p \leq 0.025$) and 300 μm ($p \leq 0.020$) depths, while thick hyperkeratosis seen in AK III limited representative group comparison.

Conclusion: Through qualitative evaluation of vessel pattern and direction, as well as quantitative assessment of vessel density and diameter, D-OCT enabled in-vivo characterization of differences in microvasculature between different AK grades and PD skin. Noninvasive microvascular assessment using D-OCT may be a useful supplement to AK evaluation in clinical and research settings.

SUBMISSION TITLE: CLINICAL STUDY EVALUATING SIMULTANEOUS EMISSION OF ND:YAG AND ALEXANDRITE WAVELENGTHS ON PERMANENT HAIR REMOVAL

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Background: Laser hair removal is a popular procedure that has been demonstrated to be the most

effective method for hair reduction. However, a key challenge in the field is to develop a fast, safe, and effective treatment that can be used on all skin types, including dark or tanned skin. In this study, we evaluated a novel device that simultaneously emits Nd:YAG and Alexandrite wavelengths, allowing users to adjust the settings of each wavelength within a pulse. The primary aim of this study was to determine the safety and effectiveness of using a blend of wavelengths in simultaneous emission for the temporary removal of unwanted hair and the permanent reduction of hair on all skin types.

Study Design/Materials and Method: This was an open-label, prospective, randomized, double-arm, and multi-center study. The treatment schedule involved visits at 6–8 week intervals, with follow-up visits at 3, 6, and 12 months. The treatment areas included the axillae, bikini, and legs using simultaneous emission of Nd:YAG and Alexandrite wavelengths. At each treatment visit, photographs were taken, and skin responses, adverse events, and subject assessments were recorded. Hair characteristics were also assessed at each visit.

Results: Fifty-five female subjects (Fitzpatrick I–VI) with brown or black hair were recruited into the study. Due to Covid, a total of 41 subjects returned to all visits and follow ups. The treatment using simultaneous emission resulted in improved hair coarseness and color in all treated areas at 3 and 6-month follow-up visits. Specifically, hair reduction in the axillae, bikini area, and leg area improved by 71%, 80%, and 79%, respectively, at the 6-month follow-up visit. The treatment was well-tolerated by all patients and did not require the use of numbing cream. The anticipated posttreatment endpoints of erythema and edema passed within 24 h. At the 3-month follow-up visit, 74% of participants reported "good" to "very good" improvement, which increased to 79% at the 6-month follow-up visit. Overall, most participants were "satisfied" or "very satisfied" with the outcomes at the follow-up visits.

Conclusion: The use of a novel blend of simultaneous laser emission with Nd:YAG and Alexandrite wavelengths provided a safe and effective treatment for a wide range of skin types, with minimal discomfort and high patient satisfaction.

SUBMISSION TITLE: COMPARISON OF COSMETIC OUTCOMES OF SCARS FOLLOWING ELECTRODESICCATION AND CURETTAGE OR CONTROLLED HYPERTHERMIA FOR TREATMENT OF NONMELANOMA SKIN CANCER

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Background: Electrodesiccation and curettage (ED&C) is part of the standard-of-care treatment of nonmelanoma skin cancer (NMSC) [1,2]. However, it has been reported that patients are less satisfied and more bothered with the cosmetic outcome of ED&C for the treatment of NMSC compared to treatment with excision or Mohs surgery [3]. The long-pulsed 1064 nm Nd:YAG laser has been used to effectively treat nonaggressive basal cell carcinoma (BCC) [4–6]. Laser treatment may offer a more satisfactory cosmetic outcome compared to currently utilized treatments [4–6]. The objective of this study was to compare physician-assessed cosmetic outcome of scars following NMSC treatment with ED&C vs the long-pulsed 1064 nm Nd:YAG.

Study Design/Materials and Method: This was a retrospective study conducted with IRB approval (#2008-6307) in patients treated with either ED&C for BCC and squamous cell carcinoma in-situ (SCCis), or with the long-pulsed 1064 nm Nd:YAG for BCC. Two techniques of the long-pulsed 1064 nm treatment were included: "conventional" 120-140 J/cm^2 nonoverlapping scanned pulses with 1–3 passes, or Controlled Hyperthermia and Monitoring Protocol (CHAMP) method using a thermal imaging camera (Teledyne FLIR™) with a series of lower fluence pulses producing average tumor tissue temperatures of 55°C for 60 seconds. Only scars of the trunk and upper extremities from these procedures that had been photographed in-office were included.

Thirty clinical images of a total of 30 scars (10 treated with ED&C, 10 treated with conventional treatment, and 10 treated with CHAMP treatment) 7.99 months to 1.63 years following procedures were

evaluated by two blinded investigators (board certified dermatologists and Mohs surgeons not previously involved in the study) using the modified Manchester Scar Scale (MSS). The modified MSS includes analysis of five categories: (1) Visual Analog Scale (1–10, excellent to poor), (2) color (perfect-1, slight mismatch-2, obvious mismatch-3, gross mismatch-4); (3) matte or shiny (matte-1, shiny-2); (4) contour (flush with surrounding skin-1, slightly proud/indented-2, hypertrophic-3, keloid-4); (5) distortion (none-1, mild-2, moderate-3, severe-4). Scores between 5 and 24 are possible, and 5 is a perfect score implying a well-healed scar. Statistical analysis was conducted using the one-way analysis of variance (ANOVA) test.

Results: Thirty photographs of posttreatment scars were obtained from 19 male and 11 female patients, including 10 following treatment with ED&C (8 male, 2 female) 10 following treatment with conventional long-pulsed 1064 nm Nd:YAG (6 male, 4 female), and 10 following treatment with CHAMP long-pulsed 1064 nm Nd:YAG (5 male, 5 female). Age at the time of procedure was an average of 69.59 years (range: 56.65–82.93) in the ED&C group, 63.84 years (range: 46.00–76.00) in the conventional group, and 59.27 years (range: 37.00–75.00) in the CHAMP group. There were 27 BCCs (19 superficial, 3 nodular, 3 superficial and nodular, and 2 whose type was unspecified) and 3 SCCis overall (all SCCis were in the ED&C group). Average time since treatment was 1.05 years overall (range: 0.67–1.63 years), being 1.13 years (range: 0.72–1.63 years) in the ED&C group, 0.99 years (range: 0.67–1.19 years) in the conventional group, and 1.03 years (range: 0.99–1.16 years) in the CHAMP group.

The average score on the modified MSS was 11.9 (range: 7–17.5) overall. The average score in the ED&C, conventional, and CHAMP groups was 11.3 (range: 7–14.5), 11.4 (range: 7–17.5), and 13.1 (range: 9–17.5), respectively. There was no statistically significant difference between the procedure groups using a one-way ANOVA ($p = 0.357$, $F = 1.070$). The average score in each of the subcategories of the modified MSS for ED&C, conventional treatment, and CHAMP treatment, respectively, are as follows: (1) Visual Analog Scale—3.8, 4.4, 4.9; (2) color—2.55, 2.5, 2.6; (3) matte or shiny—2.55, 2.5, 2.6; (4) contour—1.6, 1.55, 1.8; (5) distortion—1.6, 1.4, 1.8.

Conclusion: This study reveals that there were no significant differences in scar scores on the modified MSS for NMSCs treated with ED&C compared to conventional and CHAMP 1064 nm Nd:YAG treatment. Long-pulsed 1064 nm Nd:YAG treatment of NMSC is currently under development and at this phase achieving scars equivalent to ED&C is promising. As clinical trials of laser treatment of BCC are currently ongoing at our centers, further study of this topic involving standardization of electrodesiccation and curettage, and analysis of number of passes and exact laser settings in a larger sample is required to fully understand the differences between groups.

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SUBMISSION TITLE: COMPARISON OF FRACTIONATED RADIOFREQUENCY MICRONEEDLING AND MICRONEEDLING FOR TREATMENT OF ATROPHIC ACNE SCARS: A RANDOMIZED SPLIT-FACE CLINICAL STUDY

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Background: Microneedling with or without radiofrequency (RF) is a popular treatment for acne scars, but there are no split-face comparative trials. The purpose of this study was to evaluate the clinical effectiveness of combining RF with microneedling, a popular treatment for acne scars, in a split-face comparative trial. This

study aimed to determine the contribution of RF to the overall treatment of acne scars when used in conjunction with microneedling. To the best of our knowledge, there have been no previous split-face comparative trials on this topic.

Study Design/Materials and Method: This was a single-blinded, randomized split-face, single center study. Patients with moderate to severe atrophic acne scars on both sides of the face were randomized to receive RF microneedling (heat on) versus microneedling alone (heat off) to either right or left side of the face. Subjects received a total of three treatments 4 weeks apart. At 12- and 24-week follow up visits, scars were scored qualitatively and quantitatively. Additionally, three blinded dermatologists evaluated the improvement in acne scarring, erythema, and skin texture by comparing digital images. Patients were also asked to provide a self-evaluation of satisfaction for efficacy and safety. Adverse events were recorded after each treatment.

Results: In this study, 12 patients were recruited and 11 completed the study. The patients were divided into two groups, with one group receiving RF microneedling and the other receiving microneedling alone. The Goodman and Baron Quantitative Acne Scores improved more in the RF microneedling group (-1.82 ± 1.54 at 12 weeks and -1.91 ± 1.3 at 24 weeks) compared to the microneedling alone group (-1.36 ± 1.57 at 12 weeks and -1.64 ± 1.43 at 24 weeks). However, these improvements were not statistically significant. Investigator improvement scores were also higher for the RF microneedling group compared to the microneedling alone group at both 12 and 24 weeks. At the 24-week follow-up, the decrease in Goodman and Baron Qualitative Acne Scores was similar for both treatment groups (-0.55 ± 0.69 for RF microneedling vs. -0.55 ± 0.52 for microneedling alone, $p > 0.05$). Blinded investigators also rated similar improvements in scarring, erythema, and skin texture at the 24-week follow-up for both treatment groups. Participants rated their improvement as mild to moderate for both sides treated. One patient reported worsening of acne flare after the initial treatment session, and 33% of participants reported moderate erythema and edema immediately posttreatment. No other adverse events were noted.

Conclusion: Radiofrequency microneedling and microneedling alone are both effective treatments for acne scarring. In our small, randomized split-face trial, treatment with RF microneedling did not show significantly different improvements compared to microneedling alone. More studies with additional treatment sessions or divided by acne scar subtype are needed to determine if either of these treatment modalities may be more effective for different types of acne scars.

SUBMISSION TITLE: CONTROLLED HYPERTHERMIA AND MONITORED PROTOCOL FOR BASAL CELL CARCINOMA; INTERIM REPORT

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Background: This three-center IRB-approved prospective study of $n = 90$ lesions examined the use of a novel procedure, "Controlled Hyperthermia and Monitoring Protocol" (CHAMP) using FLIR thermal imaging for in-procedure temperature control and OCT imaging for tumor margin and treatment response monitoring in the treatment of basal cell cancers (BCC) with long-pulse Nd:YAG laser. The objectives were to compare efficacy of the CHAMP method with conventional Nd:YAG treatment without temperature control, and to determine benefits of OCT scanning for tumor margin mapping and monitoring.

Study Design/Materials and Method: To date 73 biopsy proven BCCs on the trunk and upper limbs were carefully examined, photographed and marked with a 5 mm margin around obvious clinical tumor. They were then systematically mapped to assess lateral margins with an OCT device (Michelson Diagnostics™). The mapped tumors were then treated with the long pulse 1064 nm laser (Sciton™ Palo Alto) using randomly either a "conventional" 120–140 J/cm^2 nonoverlapping pulses with 1–3 passes, or "CHAMP" method using a thermal imaging camera (Teledyne FLIR™) with a series of lower fluence pulses producing average tumor tissue temperatures of 55°C for 60 seconds, after injecting local 1% lidocaine. Patients were rescanned by OCT at 3–12 months for any signs of residual tumor and if positive were retreated. Finally, lesions were excised for evidence of histological clearance.

Results: To date, 17/17 (100%) CHAMP treated tumors and 13/15 (87%) conventionally treated tumors were histologically clear at the end point of the study. Using the CHAMP method, ulceration was uncommon and patients healed with modest erythema. Pretreatment OCT mapping of BCCs indicated that tumors extended beyond their 5 mm clinical margins in 11/73 (15%) of cases. Increased vascularity measured by dynamic OCT was noted in most patients immediately after irradiation, suggesting that apoptosis, as opposed to vascular destruction, was the primary mechanism of tumor response.

Conclusion: Treatment of superficial and nodular BCCs with the long pulse 1064 nm laser is useful for a subset of patients who are not Mohs surgery candidates. OCT and FLIR thermal imaging provide a rapid method for identifying, mapping and treating these tumors. Preliminary histological evidence from this study suggests that the CHAMP treatment is at least as efficacious as treatment with conventional multiple-pass high power Nd:YAG laser pulses, and provides the advantages of reduced risk of ulceration and improved wound healing. OCT images provide accurate analysis of tumor margins and guide as to the necessity of further treatments for histological clearance. Skin cancer surgeons might take note that preoperative assessment of tumors by OCT will likely improve accuracy of margin control using any modality including Mohs surgery, excision or laser treatment.

SUBMISSION TITLE: DEEP-LEARNING: ASSESSING THE ACCURACY OF CNNS IN PREDICTING THE EFFICACY OF TREATMENT FOR PORT-WINE-STAIN BIRTHMARKS

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Background: Convolutional neural networks (CNNs) have the capability to reliably identify features from digital images. In the field of dermatology, convolutional neural networks have demonstrated potential for image classification and malignancy prediction. Unlike traditional methods, these networks are able to learn features from the raw image data, instead of requiring analytically extracted features. For this reason, CNNs seem well-suited for predicting the efficacy of treatments for PWS, as treatment efficacy has been linked to image cues like birthmark's area and skin colour. However, training CNNs from scratch using a small sample size can be challenging. To address this issue, transfer learning can be utilised to extract PWS information from medical images using CNNs that have been pretrained for nonmedical tasks, thus eliminating the need for large datasets.

Study Design/Materials and Method: This study looked at 44 Caucasian patients ranging from 8 to 59 years old who received treatment with 3–29 laser sessions. Standardised 3D photographic imaging was done before and after treatment with the 532 nm laser with large spot and contact cooling. Using a pre-trained, state-of-the-art ResNet-50 CNN, an Artificial Intelligence (AI) model was trained to predict the numerical improvement (total clearance) of patients based on 2D snapshots of their 3D digital images before treatment.

Results: The AI demonstrated consistent 71% accuracy in categorising previously unseen patients into buckets like "less than 62% improvement" or "more than 62% improvement." Several models, data augmentation strategies, and groupings were evaluated, providing slightly different results with a consistent correlation towards correct predictions. Training and validation losses showed convergence throughout the multiple training runs.

Conclusion: The study conducted has shown the capability of an AI to make predictions concerning the effectiveness of a PWS's treatment by using CNN and transfer learning. Since it is challenging to pinpoint the exact accuracy of this assessment as data is limited, the level of accuracy may vary slightly. With further data being added to the AI model, it has the potential to provide a precise numerical prediction of the success of the treatment.

SUBMISSION TITLE: DERMATOLOGIC PROCEDURES FOR TRANSGENDER AND GENDER DIVERSE PATIENTS: ASSESSING BARRIERS TO CARE FOR COMMON PRESENTING ISSUES

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Background: Dermatologic procedures are integral to comprehensive care for transgender and gender diverse patients. Despite the growing number of publications documenting these procedures in recent years, evidence suggests underutilization with wide-ranging barriers to care that have yet to be sufficiently examined. The aim of this literature review was to (1) identify the most common gender-affirming dermatologic procedures and (2) assess potential barriers to care for these treatments. This review seeks to highlight areas of research required to enhance dermatologic gender-affirming care.

Study Design/Materials and Method: The PubMed database was reviewed in October 2022 to identify common dermatologic procedures for gender-affirming care. Procedures were then assessed for barriers to care by a secondary search examining factors for healthcare delivery and utilization.

Results: A total of 112 relevant publications were reviewed. The most common dermatologic procedures identified were facial feminization/masculinization, body contouring, hair removal/growth, acne and scarring, and postsurgical scar management. These procedures can be categorized as: direct management of gender dysphoria, addressing complications of hormone replacement therapy, and perioperative adjunct treatments. In a secondary review, four primary categories of barriers to care were

identified: representation in literature, provider training and education, insurance coverage, and patient adoption.

Regarding representation in the literature, common dermatologic procedures for gender-affirming care are increasingly well documented. A notable exception is in the management of acne scarring in transgender and gender diverse individuals. Given the high prevalence of acne induced by masculinizing hormone therapy (88% of transmasculine patients in one study), more research is indicated. While publications on dermatologic procedures exist, studies documenting outcome measures, patient satisfaction, and quality of life following gender-affirming procedures are universally lacking.

Regarding provider training for gender-affirming dermatologic procedures, studies on physician education are not well documented in the literature, limited to a single survey-based study that assesses only some available procedures.

Regarding publications on insurance coverage for gender-affirming dermatologic procedures, wide variations exist due to differences at the federal, state, and private level. This results in significant barriers to care for transgender and gender diverse patients. The few identified studies on insurance coverage only address hair growth/reduction and facial transformation with injectables.

Regarding patient adoption of dermatologic procedures, studies show that utilization of available treatments are generally low (less than 10% of respondents in respective studies). When compared with incidence of their associated conditions (e.g., acne scarring, hypertrichosis, etc.), there is demonstrable undertreatment implying substantial barriers to care.

Conclusion: Despite increasing representation of gender-affirming dermatologic procedures in academic literature, barriers to care for this patient population remain significant. Barriers may result from a lack of inclusive dermatologic curricula, inadequate and varied insurance coverage, or low patient awareness and adoption. Additional research examining these barriers is essential to advancing dermatologic care for the transgender and gender diverse patient population.

SUBMISSION TITLE: DUAL-WAVELENGTH LONG-PULSED 755-NM ALEXANDRITE/1,064-NM ND:YAG LASER VERSUS ND:YAG ALONE FOR TREATMENT OF PALMOPLANTAR VERRUCA

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Background: Palmoplantar warts are caused by human papillomavirus and characterized by epidermal hyperplasia with neovascularization. Pulsed dye laser, intense pulsed light, and long-pulsed neodymium: yttrium–aluminum–garnet (Nd:YAG) laser have been reported to be effective for treatment of warts. To date, evidence on the use of 755-nm alexandrite laser for palmoplantar warts is limited to a single case report. We compared the effectiveness and safety of long-pulsed Nd:YAG alone and dual wavelength alexandrite/Nd:YAG laser in the treatment of palmoplantar warts.

Study Design/Materials and Method: Total 102 lesions in 30 patients were divided into two groups and received either two passes of Nd:YAG alone or Nd:YAG combined with alexandrite laser monthly for four times. Treatment response was evaluated 1 month after the last treatment based on clinical photographs and dermoscopic findings. At initial and final visits vascular and hyperkeratosis scoring was done for each lesion. Efficacy was graded according to clearance rates; excellent (>75%), good (50%–75%), fair (25%–50%), poor (<25%). Patient satisfaction was evaluated on a 4-point scale; very much satisfied, satisfied, somewhat satisfied, not satisfied.

Results: Fifty-two lesions in 15 patients were assigned to dual wavelength group, while 50 lesions in 15 patients were assigned to Nd:YAG alone group. In the dual wavelength group, the number of lesions with each treatment response were as follows; 21 (40.4%) excellent response; 8 (15.4%) good response; 9 (17.3%) fair response; 14 (26.9%) poor response. In the Nd:YAG alone group, 26 (52.0%) lesions showed excellent response, 10 (20.0%) lesions showed over 50% clearance, 7 (14.0%) lesions showed fair response, and 7 (14.0%) showed poor response. The difference between the two groups was not significant ($p = 0.348$, χ^2 test). Patient satisfaction assessment in the dual wavelength group was as follows; very much satisfied 7 (46.7%), satisfied 4 (26.7%), somewhat satisfied 3 (20%), not satisfied 1 (6.7%). Subjects in the Nd:YAG alone group responded as follows; very much satisfied 9 (60%), satisfied 2 (13.3%), somewhat satisfied 4 (26.7%). The difference between the two groups was not significant ($p = 0.560$, χ^2 test). The average numeric pain scale was 7.12 in the dual wavelength group and 7.00 in the single wavelength group ($p = 0.728$, independent t-test).

Conclusion: Both long-pulsed Nd:YAG laser alone and Nd:YAG combined with alexandrite laser are equally effective treatment options for recalcitrant palmoplantar warts.

SUBMISSION TITLE: EARLY VERSUS MID VERSUS LATE-STAGE INITIATION OF LASER INTERVENTION LEADS TO DIFFERENT OUTCOMES IN THE TREATMENT OF BURN HYPERTROPHIC SCARS

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Background: There is controversy on the topic of when to optimally begin laser interventions for patients with burn hypertrophic scars (HTSs). Historic guidance suggested waiting 1 year from injury, but potential benefit of earlier intervention has been acknowledged. An expert panel recently recommended initiating laser within 4 months of injury. This study aimed to evaluate timing for initiation of FLSR for HTS.

Study Design/Materials and Method: Patients received FLSR (~70–120 mJ, 1% density) at 4–8 week intervals, with pretreatment and posttreatment scar evaluations. Treatment started 3–6 months (early), 6–12 months (mid), or >12 months (late) from injury ($n = 10$ patients per group). Patients from each group were evaluated on 6 subjective scales. The MWHC Scar Comparison Scale (MWHC-SCS) asks patients to rank improvement in scar with treatment. The Patient and Observer Scar Assessment Scale asks patients (POSAS-P) or observers (POSAS-O) to score multiple parameters (vascularity, pigmentation/color, thickness, relief/stiffness, pliability, surface area/irregularity, and overall opinion). These scores can then be either totaled (POSAS-O or -P total) or averaged (POSAS-O or-P avg). The Vancouver Scar Scale (VSS) ranks scars based on multiple parameters (thickness, pliability, height, pigmentation) and this score is totaled. For all scales, a higher score indicates a worse scar. A two-way ANOVA with multiple comparisons and Dunnett's correction was used to compare scores from the pretreatment to posttreatment evaluations.

Results: All groups demonstrated an overall improvement in scars with treatment ($p < 0.05$). In early initiation, for POSAS-O total Pre versus LSR session 2 was significantly different ($p < 0.05$), for MWHC-SCS LSR session 1 versus 2 ($p < 0.05$) and 2 ($p < 0.001$) were significantly different, for POSAS-P total Pre versus LSR session 3 ($p < 0.01$) was significantly different. For POSAS-O avg, POSAS P-avg, and VSS there were no differences. There were only differences in 3 of 6 scales for early. In mid initiation, for POSAS-O total Pre versus LSR session 2 ($p < 0.05$) and 3 ($p < 0.05$) were significantly different, for POSAS-O avg Pre versus LSR session 2 ($p < 0.05$) was significantly different, for POSAS-P avg Pre versus LSR session 2 ($p < 0.05$) and 3 ($p < 0.01$) were significantly different, for MWHC-SCS LSR session 1 versus 2 ($p < 0.01$) and 2 ($p < 0.05$) were significantly different, for VSS Pre versus LSR session 2 ($p < 0.05$) and 3 ($p < 0.01$) was significantly different. In POSAS-P total there were no differences. There were differences in 5 of 6 scales for mid. For late initiation, for MWHC-SCS LSR session 1 versus 2 ($p < 0.05$) and 2 ($p < 0.001$) was significantly different. For POSAS-O total, POSAS-O avg, POSAS-P total, POSAS-P avg, and VSS there were no differences. There were only differences in 1 of 6 scales for late.

Conclusion: Early, mid, or late-stage treatment initiation led to improvement in burn scar in at least one scar scale. The MWHC-SCS showed the most improvements across all groups. Treatment initiation at 6-12 months led to the most significant improvements in postburn HTS among all scales and should be considered when initiating FLSR treatment in burn scars.

SUBMISSION TITLE: EFFECTIVENESS OF THE 250 PICOSECOND LASER FOR THE TREATMENT OF MELISMA WITH A LOW FLUENCE 1064NM ND:YAG LASER

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Background: Melasma is an acquired pigment disease mainly acquired by skin exposed to sunlight. Melasma is a pigmented lesion that we often encounter, but is always difficult to treat. For the treatment of melasma, nanosecond lasers have been developed into picosecond lasers, and many picosecond lasers have been developed and are being tried for treatment. This study was conducted to confirm how effective the 250 picosecond laser is in treating melasma among picoseconds.

Study Design/Materials and Method: This study is a retrospective analysis of the cases treated using 250

picosecond 1064-nm laser treatment in patients diagnosed with melasma or pigmentation from April 2022 to September 2022. A clinical picture of the patient was taken using the Mark-Vu skin analysis program, and quantitative values for skin pigment and skin tone were obtained. Patient satisfaction was assessed through a 5-point Likert scale questionnaire after treatment sessions. All adverse effects and complications were reviewed based on medical records.

Results: A total of 87 patients were included in the study. As a result of the paired-sample t-test, when comparing the difference in PL (polarized light) pigmentation for the whole and for each part, the average was decreased from 22.38 to 20.02 ($p < 0.05$). When comparing differences in UV (ultraviolet) pigmentation by the same area using the same analysis method, the average was from 22.10 to 20.06 ($p < 0.05$). In the analysis of skin tone, it can be seen that the higher the score, the better. The average score of skin tone changed from 55 to 57, showing statistically significant results. When comparing the satisfaction of the patients before and after the procedure, the patients' satisfaction about skin tone increased from 2.53 points to 3.34 points ($p < 0.05$), and about pigmentation increased from 2.36 points to 3.21 points ($p < 0.05$).

Conclusion: Through this study, it was confirmed that the 250 picosecond laser was effective in treating melasma and blemishes. In particular, it is meaningful that the statistical significance of the numerical values using the objective markview program was confirmed, rather than the subjective score given by the doctor while looking at the patient's picture.

SUBMISSION TITLE: EFFECTS OF IPL AND RF ON MEIBOMIAN GLAND HEALTH IN THE FACE OF DRY EYE AND MEIBOMIAN GLAND DYSFUNCTION

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Background: While many studies have shown intense pulsed light (IPL) to be a successful treatment of acute relief of dry eye disease (DED) due to meibomian gland dysfunction (MGD), little information is available on its use alone or in combination with topical radiofrequency (RF) to preserve and improve the function of meibomian glands. Our novel study explores the ability of this combined modality treatment to improve upon meibomian gland health.

Study Design/Materials and Method: Patients ($n = 11$) with a previous diagnosis of DED and MGD with Ocular Surface Disease Index (OSDI) survey scores higher than 23 indicating at least moderate dry eye symptoms were identified. Inclusion criteria included the ability to read, 22 years of age or older, signs of MGD as detected by biomicroscopy, modified meibomian gland score (mMGS) over 12 in the lower eyelid of at least one eye, and Fitzpatrick skin type I–IV. All patients received four treatments (each 2 weeks apart) of IPL to the lower eyelid, surrounding malar region, and nose, followed by 7 minutes of topical radio frequency treatments (1 and 4 MHz) extending to the inferior, lateral and superior orbital rim. Evaluation of meibomian gland expression (MGX) and quality of meibom upon expression was conducted following each treatment session, with a final evaluation 4 weeks after the final treatment session. Meibum quality was also evaluated on a scale of 0–3 representing clear (0), cloudy (1), inspissated (2), and blocked (3) meibum, respectively. Patient data from the prescreen (before the IPL treatments) was then compared with patient data from the final evaluation (after the IPL treatments) using a paired *t*-test. During the study, patients were disallowed from utilizing any prescription drugs, heat masks, or other implementations, other than artificial lubricants to treat DED or MGD, to isolate the benefits from our treatment protocol alone.

Results: Following treatment, MGX and meibom quality improved in all eyelids. Upper lids (UL) and lower lids (LL) both showed statistically significant improvement in gland expression. MGX increased following the IPL treatment procedure (Figure 1) in the upper lids (UL) and the lower lids (LL) of the right eye (OD) and the left eye (OS). The number of OD UL expressible glands increased from 13 to 27.9 ($p < 0.001$), the number of OD LL expressible glands increased from 14.6 to 28.2 ($p < 0.001$), the number of OS UL expressible glands increased from 13.3 to 27.3 ($p < 0.001$), and the number of OS LL expressible glands increased from 14.8 to 26.8 ($p < 0.001$). The overall percentage improvement in MGX (Figure 2) was 82.7% for OD UL, 136.6% for OD LL, 82.9% for OS UL, and 112.2% for OS LL. When comparing upper against lower lids, MGX increased 124.4% and 82.8%, respectively. Additionally, meibum quality improved in all four eyelids (Figure 3). The OD UL meibum quality improved from 1.91 to 0.46 ($p < 0.001$), the OD LL meibum quality improved from 2.00 to 0.82 ($p = 0.0012$), the OS UL meibum quality improved from 2.00 to 0.46 ($p < 0.001$), and the OS LL meibum quality improved from 1.91 to 0.73 ($p = 0.0025$). Combined, meibom quality in upper lids improved from 1.96 to 0.46. Comparatively, in lower lids, meibom quality changed from 1.96 to 0.78.

Conclusion: Combined IPL and RF treatment for DED due to MGD resulted in a more than doubling of expressible, productive meibomian glands on upper and lower eyelids (Figure 2). However there was a disparity between upper and lower lid improvement in both MGX and meibom quality. While lower lids improved more

significantly in number of expressible MGX, upper lids displayed a superior improvement in meibom quality. More investigation is needed to isolate treatment and anatomic factors that could lead to these disparities. Energy-based treatments are becoming an increasingly prominent treatment for dry eye disease and meibomian gland dysfunction. This novel combination of IPL with topical RF should be considered as a new viable treatment option to revitalize meibomian glands, aiding patients with DED and MGD.

SUBMISSION TITLE: EFFICACY AND SAFETY OF FRACTIONAL 1064-NM PICOSECOND LASER FOR THE TREATMENT OF HYPERTROPHIC MAMMOPLASTY SCAR IN ASIANS: A PROSPECTIVE, RANDOMIZED, SPLIT-SIDE, COMPARATIVE STUDY

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Background: Hypertrophic scar is an abnormal increase of collagen production during wound healing especially in the dark-skinned individuals whom are more genetically susceptible. Treatment of hypertrophic scars remain challenging. Pulsed-dye laser (PDL) is a standard treatment for this condition yet PDL has high cost of maintenance. Recent studies have shown promising outcome of fractional 1064-nm picosecond laser in the treatment of hypertrophic scar. This study aimed to evaluate the efficacy and safety of using fractional 1064-nm picosecond laser for treatment of hypertrophic mammoplasty scar in Asians.

Study Design/Materials and Method: Fourteen patients with bilateral hypertrophic mammoplasty scar were included in the study. One side of the mammoplasty scar was randomly assigned to be treated with four sessions of picosecond laser 1064-nm at 4-week intervals, while the other side did not receive any treatment and served as untreated control. Scar height was measured by a caliper. Skin texture, volume of elevation, melanin index and erythema index were quantified using Antera® 3D imaging system. Clinical evaluation and values of a Patient and Observer Scar Assessment Scale (POSAS) were done by blinded dermatologist and patient themselves. All assessments were evaluated at baseline, a month after each treatment and during follow-up visits at 1, 3, and 6 months after the final treatment. Adverse effects were also recorded during each visit.

Results: Thirteen out of 14 subjects completed the study protocol. Most subjects were female (92%) with a mean age of 36□8 years old and a scar duration of 12.75 months. The height of hypertrophic scar that was treated with picosecond laser decreased significantly at 1 month after three treatment sessions, 1 month and 3 months after completing four treatment sessions when compared to baseline and untreated control group ($p = 0.008$, 0.006 and 0.003, respectively). However, at 6-months follow up, there was no significant difference in scar height between both groups. After completing four sessions of treatment, POSAS patient scale improved significantly at 3 and 6 months follow up compare to control ($p = 0.023$ and 0.012 respectively). POSAS observer scale, likewise, improved significantly 1 month after each treatment and during follow-up visits 1, 3, and 6 months after the last treatment compared to control ($p = 0.022$, 0.002, 0.001, <0.001, <0.001, and <0.001, respectively).

Conclusion: Fractional 1064-nm picosecond laser appears to be effective and safe for the treatment of hypertrophic mammoplasty scar in Asians. It significantly improved the overall appearance of the scar according to POSAS observer and patient scale.

SUBMISSION TITLE: EFFICACY AND SAFETY OF HIGH-INTENSITY, HIGH-FREQUENCY, PARALLEL ULTRASOUND BEAMS FOR CELLULITE

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Background: Ultrasound technology has been demonstrated to improve fine lines and wrinkles and lift lax skin. More recently, a new-generation ultrasound device (Sofwave) was developed, which utilizes seven synchronous ultrasound parallel beams to deliver thermal energy to the dermis. This novel technology can safely target the mid-dermis at a depth of 0.5–2.0 mm, while increasing

tissue temperatures to 60–70°C with simultaneous feedback-controlled skin cooling. This ultimately stimulates neocollagenesis and neoelastogenesis. This study evaluates the efficacy and safety of this novel technology in improving the appearance of cellulite.

Study Design/Materials and Method: A multicenter, prospective, self-control clinical study was conducted at four sites in the United States. Sixty-nine women with mild to moderate cellulite were enrolled for two treatment sessions on the lateral/posterior thighs and/or buttocks. Two independent masked reviewers were asked to identify correct photographs and score the 6-point Cellulite Severity Scale (CSS) using images at 3 months posttreatment. Safety was monitored throughout the study. Subjects ranked discomfort using 10-point VAS scale.

Results: Sixty-five subjects completed the 3-month follow-up. Subjects were 24–59 years old with Fitzpatrick Skin Types II–VI and with a BMI of 18.54–29.71. Subjects maintained stable weight through the study. Two blinded reviewers were in agreement for the selection of the majority of pretreatment and posttreatment photographs and correctly identified 89% of the images. Mean CSS score was 2.80 ± 1.14 (moderate) at baseline, which significantly reduced to 1.19 ± 1.09 (mild) at 3-month follow-up ($p < 0.01$; 95% confidence interval [1.39, 1.82]). The significant reduction of 1.61 ± 0.89 demonstrated an improvement of 57% compared to baseline. Subjects reported mild to moderate discomfort during treatment (mean 4.55 ± 2.06). No related-device adverse events were recorded, and anticipated immediate responses were limited to transient erythema and transient edema.

Conclusion: A novel ultrasound device utilizing synchronous ultrasound parallel beam technology can safely and effectively improve the appearance of cellulite.

SUBMISSION TITLE: EFFICACY AND SAFETY OF NONABLATIVE MONOPOLAR RADIOFREQUENCY FOR THE REDUCTION OF FACIAL PORES AND SEBUM EXCRETION

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Background: Enlarged facial pores are visible topographic features of the skin that have been associated with cutaneous photoaging and increased sebum production. It has remained a common dermatologic concern gaining significant number of in-clinic consults. Available treatment modalities often operate on a single mode of action, consequently offering limited and short-term outcomes.

Study Design/Materials and Method: This study aimed to evaluate the long-term efficacy and safety of a nonablative monopolar radiofrequency for pore tightening and reduction of sebum output in Asians. Nineteen patients with enlarged pores underwent two sessions of a nonablative monopolar radiofrequency at 4-week intervals. Measurements of pore volume, skin texture, average pore size, sebum production and skin elasticity were quantified using Antera® 3D imaging system, dermoscopic image analysis with ImageJ software, Sebumeter® and Cutometer®. Clinical evaluation by two dermatologists were done using blinded clinical photographs. All assessments, both objective and subjective were done at baseline, a month after the first treatment and during follow-up visits 1, 3, and 6 months after the last treatment. Adverse effects were also recorded during each visit.

Results: Seventeen out of 19 subjects completed the study protocol. The mean of pore volume significantly reduced by 24% from baseline at 1 month after the first treatment ($p < 0.016$). The pore volume continued to decrease by 34% and 38% a month ($p < 0.001$) and 6 months ($p < 0.001$) following the final treatment, respectively. Sebum excretion likewise significantly decreased from baseline by 39% ($p = 0.002$) and 36% ($p < 0.001$), 3 and 6 months after the second treatment, respectively. Skin texture and skin elasticity also significantly improved following the two nonablative monopolar radiofrequency sessions. Objective assessments of the pore appearance corresponded to subjective clinical evaluations. The treatment was well-tolerated without significant side effects such as dyspigmentation, textural alteration, or scarring.

Conclusion: Nonablative monopolar radiofrequency appears to be effective and safe for the reduction of pore size and sebum production with therapeutic outcomes persisting up to 6 months after two treatment sessions.

SUBMISSION TITLE: ENHANCED MELANOGENESIS USING BLUE LIGHT TO MODULATE PRIMARY MELANOCYTES IN COCULTURE MODEL AND BILAYERED SKIN SUBSTITUTES

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Background: The mechanism of action of visible (VIS) and near-infrared (NIR), especially regarding the modulation of melanocytes, has yet to be established. Recent studies have shown that some wavelengths in the

VIS spectrum can modulate melanocytes, and thus melanogenesis, particularly in the blue and green spectra. Nonetheless, primary cell cultures of melanocytes are difficult to grow in vitro unless they are grown in cell media containing oncogenic substances like phorbol ester.

Study Design/Materials and Method: The study aims to find a safer method to stimulate melanocytes in vitro. We hypothesize that low-intensity VIS light may support and improve cell growth of primary melanocytes in vitro by modulating melanogenesis in a monolayered coculture model of primary keratinocytes and melanocytes. This assumption is further analyzed on a human 3D bilamellar skin model, using a self-assembled method.

This study involves four different populations of melanocytes taken from patients undergoing breast surgery (mean age: 45.7, min: 41, max: 52). Cocultures and 3D skin models are grown using populations of keratinocytes and fibroblasts exclusively from the same donor (F44). Melanin contents are evaluated by spectrophotometry (Varioskan LUX plate reader) and validated by histology using Warthin-Starry1 staining. Also, promelanogenic enzymes are screened by western blot analysis and immunohistochemistry. The population doubling levels (PDLs) of primary melanocytes are calculated using a cell counter (i.e., Beckman Coulter Z1 Counter) at every media change.

Results: Compared to blue light, red light does not seem to stimulate melanogenesis. Melanocytes irradiated with red light (LEDpeak: 660 nm, 8 mW/cm^2, and 10 J/cm^2) show a mean daily PDL of 0.20 and a ratio of 1.14 to mean sham control. Furthermore, red light demonstrates PDLs slightly below ($p < 0.05$) the commercial medium MGM4 (Melanocyte Growth Medium 4; Lonza Bioscience). However, cocultures of melanocytes combined with keratinocytes show statistically significant higher melanin content in conditions using blue light (LEDpeak: 455 nm, 8 mW/cm^2, and 15 J/cm^2) compared to their respective controls ($p < 0.001$). Moreover, upregulation of key promelanogenic enzymes is observed (tyrosinase, MITF, p-CREB at Ser 133, TRP2, and PMEL) when using blue light conditions. Finally, the bilamellar 3D skin model confirms coculture results histologically and by immunohistochemistry.

Conclusion: Primary melanocytes are difficult to grow in vitro. Currently, many promelanocytic media are commercially available but they contain numerous prooncologic factors, making them useless for potential therapeutic applications (i.e., skin grafts). Self-assembled skin substitutes (SASSs) already play an essential role in the survival of severely burnt victims by providing autografts. However, grafted SASSs express insufficient pigmentation so newly grafted patients need to stay away from the sun forever to avoid photodamage. Blue light exposure may palliate these problems and provide a safe and effective method to stimulate melanogenesis in SASS pregrafting.

In addition, the study shows that blue light can better enhance melanogenesis in vitro when melanocytes are in the presence of keratinocytes. Further studies are needed to clarify this interaction.

SUBMISSION TITLE: EVALUATING THE USE OF HIGH INTENSITY NON-FOCUSED ULTRASOUND TREATMENT TO IMPROVE SKIN LAXITY AND FACIAL WRINKLES IN ASIAN PATIENTS

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Background: The aging process produces skin thickness and elasticity loss, resulting in progressive skin atrophy, laxity, and wrinkling. With the advent of new technologies, the demand for noninvasive and effective procedures to treat skin laxity has increased. This study objects to evaluate the safety and efficacy of high intensity nonfocused ultrasound treatment to improve skin laxity.

Study Design/Materials and Method: Up to 50 Asian male and female subjects, aged 35–80, with mild to severe facial wrinkles are recruited. A single treatment over the entire face, neck, and submental will be performed on the subjects. The treatment area and parameters are determined by the physician after assessment. Standardized photography is taken at baseline and 3, 6, 9 months posttreatment follow-up. Any adverse effects were recorded. At follow-up visits, subjects will assess improvement and satisfaction.

Results: The study is ongoing with 20 subjects undergoing treatments. Patients reported mild to severe pain (4.4 ± 1.85, 1.5–7.0) during the treatment but no pain after. At 30 minutes posttreatment, two subjects found trace or slight edema, and 14 subjects found trace or slight erythema.

Nineteen subjects completed 3 months follow-up visits. 5-Global Aesthetic Improvement Scale was conducted by physician. 78.9% have improved in the submental and neck area, among that, 26% have much improved and 11% have very much improved. No adverse effects were recorded.

Conclusion: The preliminary data demonstrated that the new high intensity non-focused ultrasound device is promising for treating facial laxity in Asians.

Acknowledgment: This study was supported by SofWave Medical Ltd.

SUBMISSION TITLE: EVALUATION OF A 1927-NM DIODE LASER ALONE OR IN COMBINATION WITH BROAD BAND LIGHT FOR THE TREATMENT OF PHOTODAMAGED SKIN

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Background: Over the last several years, there has been an increase in patient demand for facial rejuvenation. The 1927-nm diode laser is an attractive option for patients seeking nonablative, fractional treatments with minimal downtime. These lasers are used to reduce the appearance of rhytides, photopigmentation, telangiectasias, and other epidermal issues. Given the superficial penetration of 100–400 μm with standard fluences, the risk of scarring and hyperpigmentation is low. We set out to evaluate the safety and efficacy of a 1927-nm nonablative fractionated diode laser for skin rejuvenation alone and in combination with broadband light (BBL), another treatment modality commonly used for photorejuvenation.

Study Design/Materials and Method: In this open-label, prospective, uncontrolled study, 29 subjects (age 35–55, Fitzpatrick skin type I–V) received up to six treatments with a 1927-nm nonablative fractionated diode laser alone ($n = 4$; mean, five treatments) or in combination with BBL using 515 or 560-nm filters ($n = 25$; mean, four treatments with 1927 nm, two with BBL) at 2–4-week intervals. All subjects had moderate sun damage and/or aging facial skin with visible areas of fine rhytides, pigmentation, erythema, or telangiectasias. Subjects were scheduled for follow-up visits 1–6 weeks after their final treatment. The primary endpoints were safety and efficacy for skin rejuvenation as measured by the Physician's Global Assessment Scale (1-4). Patient pain levels during treatment were evaluated with the Numeric Pain Rating Scale and patient satisfaction levels were assessed with the Subject Global Assessment and Subject Satisfaction Questionnaires 6 weeks posttreatment.

Results: Treatments were well-tolerated with an average pain score of 3.9 (scale of 0–10). Adverse events were mild to moderate and included erythema, edema, and peppering. Two subjects with Fitzpatrick skin types IV and V experienced transient postinflammatory hyperpigmentation, which resolved within 90 days. No serious adverse events occurred.

Six weeks after the final treatment, subjects and investigators reported a 50% improvement in fine lines, and a 50%–100% improvement in pigment, skin tone, and texture.

Conclusion: Both the 1927-nm nonablative fractional diode laser alone and in combination with broadband light were safe and effective for treating facial pigmentation and rhytides. Overall, patients were satisfied with their results and tolerated treatments well.

SUBMISSION TITLE: FACIAL SKIN TIGHTENING WITH THERMAL THREAD TECHNIQUE UTILIZING SYNCHRONOUS ULTRASOUND PARALLEL BEAM TECHNOLOGY

Authors: Kentaro Oku

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Background: Skin tightening with wrinkle/fine line reduction is a highly demanded procedure in the aesthetic field. Although there are studies focused on the kinds of energy sources, the total amount of thermal energy, and the affected depth, there have been no reports examining the shape of thermal energy in the skin tissue. We have developed a specific method for applying thermal energy into the dermis in continuous parallel lines perpendicular to the Relaxed Skin Tension Line (RSTL), utilizing the fact that the synchronous ultrasound parallel beam technology creates thermal energy in a cylindrical shape. This study aims to evaluate the safety and efficacy of this method.

Study Design/Materials and Method: Twenty subjects (Fitzpatrick skin type II–IV, 19 females and 1 male, mean age 44 ± 7 years) participated in the study. All subjects received one treatment to cover the full face and submental area. Since the device delivers thermal energy in the dermis in the form of a cylinder with a height of 5 mm parallel to the skin surface, Pulsed irradiation was performed with a 6-second cycle so that the long axis of the cylinder was extended by 5 mm, creating a linear thermal thread in the dermis that is perpendicular to the RSTL. 3D clinical images were constructed before, immediately after, 4 weeks after, and 8 weeks after the treatment. Quantitative image analysis to objectively measure the direction of tightening and degree of

tightening. Independent study investigators ranked the improvement using the Global Aesthetic Improvement score (GAIS) and subjects reported on their improvement. Anticipated tissue responses and safety issues were recorded throughout the study. Subjects ranked their discomfort during treatment using a 5-point numerical scale (0 = no pain; 5 = worst possible pain).

Results: A total of 20 subjects completed the study with validated preimages and postimages. Objective measurements with 3D images demonstrated significant skin tightening. In the 3D construction image, the tightening was represented as a vector parallel to the RSTL, the direction of tightening was parallel to the thermal thread, and the degree of tightening was greatest in the preauricular area. The maximum tightening distance was 3.10 mm. Mean pulse energies were 3.19 J for the submental, 3.19 J for the cheeks and temporal area, and 2.99 J for the forehead. Blinded investigators assessed improvement in 90% of the subjects. GAIS rating at 8 weeks from the treatment was as follows; 5 (25%) Excess improvement, 8 (40%) Very improved, 7 (35%) Improved, 0 (0%) Unaltered, 0 (0%) Worsened. 85% of patients reported the improvement as very satisfied or satisfied. Subjects reported a mean pain level of 3.1 ± 1.0. Anticipated immediate responses included mostly transient erythema and edematous erythema. No severe adverse reactions were observed.

Conclusion: Facial skin tightening with thermal thread technique is safe and effective. And it can be performed with less energy than existing treatment methods, providing significant advantages to patients.

SUBMISSION TITLE: FDA MAUDE DATABASE REPORTED ADVERSE EVENTS ON ABLATIVE AND NONABLATIVE FRACTIONAL RESURFACING LASERS FROM 2013 TO 2022

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Background: Ablative and nonablative fractional resurfacing lasers represent a rapidly-growing area of laser medicine and surgery, owing at least in part to their range of applications and their efficacy in these areas. They are used for a wide variety and growing number of indications, including scar resurfacing, acne scarring, dyspigmentation, overall improvement texture and tone, and even laser-assisted drug delivery. As these procedures become increasingly prevalent across a growing number of practice settings (including medical spas by nonphysician operators), it is critical for providers to understand potential adverse effects to better counsel patients and select optimal treatment approaches.

Study Design/Materials and Method: We employed the Food and Drug Administration (FDA's) Manufacturer and User Facility Device Experience (MAUDE) database (http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfmaude/search. cfm), which compiles medical device reports (MDRs) for suspected injuries from device use or malfunction, submitted by manufacturers and operators and representing the largest repository of device adverse effects. We focused our query on MDRs related to ablative and nonablative fractional resurfacing lasers over the 10-year period from 2013 to 2022. The query was performed in January 2023 using a comprehensive list of product names and manufacturers.

Results: The initial search yielded 240 MDRs, which were individually reviewed for duplicate records or insufficient data. Ultimately, 165 MDRs were analyzed. Burns were the most commonly-reported issue (59 MDRs), followed by dyspigmentation (28), scarring (23), and postoperative infection (16). Within the 10-year period analyzed, 56% of MDRs occurred between 2016 and 2019, with a disproportionately low percentage of MDRs occurring in 2022 (5%).

Conclusion: Our findings demonstrate rare but potentially serious adverse effects of ablative and nonablative fractional resurfacing lasers. Care must be taken with counseling, patient selection, and treatment settings to optimize safety, informed consent, and patient satisfaction.

SUBMISSION TITLE: FIRST NARRATIVE REPORT OF ADVERSE EVENTS FROM THE CUTANEOUS PROCEDURES ADVERSE EVENTS REPORTING (CAPER) REGISTRY

Authors: Michael Yi; Umer Nadir; Loma Dave; Farhana Ikmal Hisham; Ross Pearlman; Kristin Hellquist; Murad Alam

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Background: The Cutaneous Procedures Adverse Events Reporting (CAPER) Registry is a patient safety database that collects data on adverse events associated

with procedures performed by dermatologists, nondermatologist physicians, and nonphysicians. Included procedures are skin cancer surgery, laser, and cosmetic procedures.

Study Design/Materials and Method: A steering committee composed of board-certified dermatologists, clinicians, and researchers from the American Society for Dermatologic Surgery Association (ASDSA) and the Northwestern Department of Dermatology developed the CAPER Adverse Event Report Form by adapting existing similar data entry forms used in other medical registries.

Results: A total of 54 cases and 83 adverse events (AEs) associated with 18 types of cutaneous procedures were reported from March 2021 to November 2022. The AEs associated with nonphysician-conducted procedures included large, circular, hypopigmented scars; second degree burns; permanent discoloration; and bullae developing into ulcers. The adverse events associated with non-dermatologist physician-conducted procedures included erosion and ulcers, and excessive swelling and bluish discoloration of the tear trough.

Conclusion: Nonphysician-conducted and non-dermatologist physician-conducted procedures were associated with a higher proportion of severe AEs (31.3%) compared to dermatologist-conducted procedures (11.8%).

SUBMISSION TITLE: FRACTIONAL CO_2-LASER VERSUS MICRONEEDLE RADIOFREQUENCY FOR ACNE SCARS: A RANDOMIZED, SINGLE TREATMENT, SPLIT-FACE TRIAL

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Background: Ablative fractional CO_2 laser (AFL) is an established first-line energy-based treatment for acne scars. Microneedle radiofrequency (MNRF) is an emerging treatment, also targeting the skin in fractions. No studies have so far compared AFL with MNRF for acne scars in a direct controlled, side-by-side comparison. In this study, we compared AFL and MNRF treatments for acne scars in a randomized split-face trial with blinded response evaluation, objective measures, and patient-reported outcomes.

Study Design/Materials and Method: Fifteen patients with moderate to severe acne scars were included. At baseline each patient had two similar test areas identified, these were randomized to receive a single treatment with either AFL or MNRF. Standardized multilayer techniques were applied with AFL and MNRF, first targeting the scar base, thereafter the entire scar area. Outcome measures included blinded evaluation of clinical improvement of scar texture (0–10 scale) at 1- and 3-months follow-up, local skin reactions (LSR), pain according to Visual Analogue Scale (VAS), skin integrity quantified by transepidermal water loss, and patient satisfaction.

Results: Fifteen patients completed the study with a median test area size of 24.6 cm^2 (IQR: 14.9–40.6). A single treatment with AFL or MNRF equally resulted in a median 1-point texture improvement after 3 months follow-up ($p < 0.001$). Best responders achieved up to a 3-point improvement ($n = 3$ test areas, 10% of treatment areas). Erythema and loss of skin integrity was more intense after AFL compared with MNRF after 2–4 days ($p < 0.001$). Patients reported MNRF (VAS 7.0) to be significantly more painful than AFL (5.5) ($p = 0.009$). Patients were generally satisfied with the overall outcome on a 10-point scale at median 6 for both treatments (IQR: 5–7).

Conclusion: AFL and MNRF treatments are equally effective at improving texture in skin with acne scars. AFL resulted in more pronounced LSRs whereas MNRF was more painful. Patients were generally satisfied with the overall outcome.

SUBMISSION TITLE: HIGH FREQUENCY NONFOCUSED ULTRASONIC TECHNOLOGY FOR THE TREATMENT OF MILD TO MODERATE ACNE SCARS: RESULTS FROM A ONE-ARM SINGLE CENTER PROSPECTIVE CLINICAL TRIAL

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Background: Acne scars are a common dermatologic complaint and are very difficult to treat. Many energy based technologies have prolonged downtime and require a great number of treatments. In addition, these technologies may not be safe for all skin types. We present a one-arm single center prospective clinical trial that employed high frequency nonfocused ultrasonic technology for the treatment of mild to moderate acne scars in all skin types.

Study Design/Materials and Method: Primary efficacy endpoints were objective reduction in acne scars from baseline on the physician acne scar severity scale (0-3). Secondary endpoints were treatment associated adverse events and procedure tolerability. Patient reported subjective outcomes were also included. Patients with all skin types were recruited and subjected to 3 treatments spaced at 4-week intervals and were followed for 90 days after the last treatment. Objective and subjective data were recorded at screening, during treatment visits and at follow-up visit. Twenty-two subjects were enrolled and 19 completed the trial.

Results: Based on the data, 9 out of 19 had mild scarring and 10 out of 19 had moderate scarring at baseline. At the 3-month follow-up, 15 out of 19 patients had mild scarring and 1 out of 19 had an absence of scarring based on physician evaluation and photography. Also, 7 out of the 10 subjects that had moderate scarring at baseline improved to having mild scarring at the 3-month follow-up. After the first treatment, based on patient satisfaction questionnaires, 68% agreed or strongly agreed that acne scarring improved. At the 3-month follow-up, 90% agreed or strongly agreed acne scarring improved compared to baseline. The most common treatment associated adverse event was transient erythema.

Conclusion: High frequency non-focused ultrasonic technology which has been approved for reduction of fine lines and wrinkles and skin lifting of the eyebrow, submental tissue, and neck is a safe and effective treatment for acne scars on all skin types with transient adverse events. This is the first report for the use of this technology in the treatment of acne scars.

SUBMISSION TITLE: HOW EFFECTIVE IS THE NOVEL TISSUE MICRO-CORING DEVICE AT CORE REMOVAL?

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Background: The tissue microcoring device was recently FDA-cleared for the treatment of moderate-to-severe wrinkles in the mid-to-lower face. This minimally-invasive technology mechanically removes thousands of microexcisions of the skin with hollow needles, and leaves behind skin without clinical or histological evidence of a scar. As a result of excess skin removal, patients exhibit improvement in rhytides and laxity. Parameters of the device (core depth and density) can be altered to intraoperatively customize treatments. Core depth varies from 0 to 4 mm, and can be modified based on skin thickness and proximity to underlying bone/teeth at different sites. Treatment density varies from 1% to 8%, and can be adjusted depending on the aggressiveness of the desired treatment. Optimal coring requires (1) the needle to entirely penetrate the skin and (2) the formed core to be completely removed. The device interface provides a real-time intraoperative expected core count which is based on (1) number of handpiece "strikes" (pulses) and (2) treatment density. However, expected and actual core count may differ. Although the device registers a pulse, this does not guarantee complete core removal. To our knowledge, no studies have evaluated the efficacy of true core removal with this device.

Study Design/Materials and Method: From September 2022 to January 2023, 20 patients who underwent dermal microcoring for moderate-to-severe wrinkles of the mid-to-lower face at the Dermatology Laser & Cosmetic Center at Massachusetts General Hospital were randomly selected to be included in the study. High resolution photos were taken immediately post-operatively of the treatment area. Two independent dermatologists assessed (1) the quantity and quality of strikes and (2) the percentage of cores actually removed at different sites on the face. Strike quality and actual core percentage were assessed on a 0 to 5 point scale (5 = 100%, 4 = 75%–100%, 3 = 50%–75%, 2 = 25%–50%, 1 = 0%–25%, 0 = 0%).

Results: Overall, 20 patients were included in the study (age range: 49–74 years, 100% female, FST II–III). Core depth ranged from 2 to 4 mm and core density ranged from 5% to 7%. The average treatment session removed 5391.4 expected cores. Across all patients, 2452 handpiece strikes (pulses) were analyzed. On average, patients underwent 124.5 visible handpiece strikes. Needles made 100% contact with the skin in 38.1% of cases, 75%–100% of the time in 15.3% of cases, 50%–75% of the time in 10.0% of cases, 25%–50% of the time in 7.0% of cases, 0%–25% of the time in 11.1% of cases, and 0% of the time in 18.4% of cases. The average handpiece strike score is 3.2 (zygoma = 4.8, lateral cheek/preauricular area = 4.6, medial cheek = 1.17, chin/perioral area = 3.42, and mandible = 3.8). Of the 2452 pulses, there were 23 instances of overlap (0.94% of pulses) and no cases of scarring.

Conclusion: To our knowledge, this is the first study to evaluate the efficacy of the novel dermal microcoring device. The coring needles fully penetrated the skin on average 50%–75% of the time. Cores were completely removed at a comparatively lesser rate. There are certain sites where both device contact and coring can be improved, especially the medial cheek. These results provide a new perspective on this technology. Despite suboptimized needle penetration and coring, patients still exhibit significant improvement in wrinkles and laxity, revealing that there is likely profound unlocked potential with future optimization of the technology.

SUBMISSION TITLE: IMPROVED EFFICACY OF SEQUENTIAL 5-FLUOROURACIL AND DAYLIGHT PHOTODYNAMIC THERAPY FOR ACTINIC KERATOSES COMPARED TO DAYLIGHT PHOTODYNAMIC MONOTHERAPY—A RANDOMIZED INTRAINDIVIDUAL CONTROLLED STUDY

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Background: Actinic keratosis (AKs) is the most frequent premalignant skin disease in the white population and is a major public health concern because of its high prevalence, substantial socioeconomic burden, and potential for malignant transformation. Daylight photodynamic therapy (dPDT) and topical 5-fluorouracil (5-FU) are effective treatments of AKs, especially of thin lesions on the face and scalp. However, studies have shown that efficacy is significantly reduced when treating moderate or thick AKs and especially 5-FU treatment can be associated with severe local skin reactions resulting in discontinuation of the treatment.

The aim of this study was to compare the efficacy of sequential 4% 5-FU and daylight PDT (dPDT) with dPDT monotherapy in the treatment of patients with multiple actinic keratoses in the face and scalp.

Study Design/Materials and Method: Fifty-seven patients with multiple AKs were treated in two symmetrical areas of the face or scalp, randomized to 4% 5-FU creme twice daily for 7 days before a single dPDT procedure and dPDT monotherapy. Daylight exposure was performed either with indoor daylight lamps or ambient outdoor light. Primary endpoint was complete lesion response rate at Week 12. Erythema, pain and patient satisfaction were monitored during and after treatment.

Results: Twelve weeks after treatment 88% of all AKs cleared in the 5-FU + dPDT area compared to 75% in the dPDT area ($p < 0.0001$). For thin AKs (Olsen grade I AK), the combination treatment increased the response rate from 78% with dPDT monotherapy to 89% after 5-FU + dPDT ($p < 0.0001$). An even better improvement was seen for moderate thick AK's (Olsen grade II AK) with a complete response rate of 78% after 5-FU + dPDT compared to 55.0% after dPDT monotherapy ($p = 0.0074$). No significant difference in efficacy was found between indoor and outdoor daylight exposure ($p = 0.087$). One week of 5-FU treatment resulted in moderate to severe erythema before dPDT in 50% of the patients. Erythema was more severe 2 days after dPDT in the 5-FU pretreated areas (moderate/severe erythema in 88% of areas) compared to dPDT monotherapy areas (moderate/severe erythema in 41% if areas). Twelve weeks after treatment 75% of the patients were equally very satisfied with both treatments.

Conclusion: Sequential 5-FU and dPDT was more effective than dPDT monotherapy in the treatment of AKs in the face and scalp. Especially moderate thick AKs responded better to the combined treatment. Local skin reactions were more pronounced after combination treatment, but no patients discontinued the treatment. The combination of 5-FU and dPDT is a convenient and effective treatment with high compliance and especially suitable for patients with multiple thin and moderate thick AKs.

SUBMISSION TITLE: IMPROVING UPPER ARM TONE AND STRENGTH WITH APPLICATION OF SIMULTANEOUS HIFEM AND SYNCHRONIZED RF—A PROSPECTIVE MRI STUDY

Authors: Robert Weiss

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Background: Use of simultaneous high-intensity focused electromagnetic field (HIFEM) synchronously with radiofrequency (RF), has previously been used safely and effectively to reduce subcutaneous fat and improve muscle tone in multiple body parts. The objective of this study was to investigate the effect of the HIFEM + RF procedure on muscle toning and adipose tissue on the tricep region of the upper arms.

Study Design/Materials and Method: Thirty-four subjects were enrolled (23–72 years old, average BMI 18.5–33.9 kg/m^2) in this two-site MRI study. Subjects underwent four, 30-minute long, bilateral procedures over the upper arms spaced one week apart, with the device simultaneously delivering HIFEM and RF energies. The changes in fat and m. triceps muscle tissue were measured via magnetic resonance imaging (MRI) carried out at baseline, 1-, and 3-month follow-up visits. Additionally, digital photographs, patient comfort, and satisfaction questionnaires were obtained, and safety was monitored. The study protocol and informed consent form were approved by Advarra IRB and is registered on clinicaltrials.gov (NCT04596241). To be included in the study, subjects were required to be over 21 years of age, were required to not undergo any treatments other than

the study procedure, and maintain a regular diet and exercise regimen.

Results: MRI images showed significant improvement at both follow-up visits. At the 1-month follow-up patients showed 22.3% (-4.0 ± 1.2 mm, $p < 0.01$) decrease in fat tissue on average, with 21.5% ($+8.2 \pm 2.3$ mm, $p < 0.001$) average increase in muscle mass. Twenty-five patients completed the 3-month follow-up visit, with the average decrease in fat tissue by 25.5% (-4.9 ± 1.5 mm, $p < 0.01$) and the average increase in muscle mass by 23.9% ($+8.9 \pm 2.0$ mm, $p < 0.001$). High patient satisfaction was seen in 85%, superior comfort during the treatment (91.2%), and low VAS score (1.6 ± 2.0), indicating a virtually pain free procedure.

Conclusion: Simultaneous HIFEM and RF energies demonstrated improvement in excess adiposity in the upper arm along with shaping and toning of the triceps muscle. A relatively comfortable procedure with MRI measurable results that gradually improve up to 3 months after the last treatment. These findings correspond with the outcomes seen in other body parts. The improvement in muscle mass has medical ramifications for use as a substitute for physical exercise for strengthening arms for patients with reduced range of motion.

SUBMISSION TITLE: IN VIVO REFLECTANCE CONFOCAL MICROSCOPY CRITERIA TO MONITOR TREATMENT RESPONSE FOR BIOPSY-PROVEN BASAL CELL CARCINOMA

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Background: Reflectance confocal microscopy (RCM) criteria for in vivo diagnosis of basal cell carcinoma (BCC) have been established. These include the presence of streaming in the epidermis, dermal tumor islands and/or dark silhouettes, peripheral palisading, peritumoral clefts, highly refractive peritumoral fibrosis, increased and dilated vessels, and inflammatory cells. These criteria have been validated for untreated BCCs, and studies have reported high sensitivity for BCC diagnosis using these RCM criteria. Of note, the majority of clinical studies investigating efficacy of novel treatments for BCC require biopsy-proven BCC as a study inclusion criterion. When monitoring treatment response, some of the RCM BCC features may be impacted by the treatment itself. The objective of this study was to prospectively image biopsy-proven BCC with RCM at baseline and during the posttreatment follow up to determine clearance and identify associated RCM features.

Study Design/Materials and Method: Ten subjects with biopsy-proven BCC were enrolled and completed this IRB approved study. Clinical examination, dermoscopy, and RCM imaging were performed at baseline, before treatment, and at approximately 12 weeks posttreatment of BCC lesions with a 1064 nm Nd-YAG Laser. RCM features of BCC were documented and compared to clinical and histologic determination of treatment response.

Results: For the lesions that had no residual BCC histologically, RCM features that exhibited statistically significant changes at follow up compared to baseline included absence of: hyperreflective tumor islands, dark silhouettes, peripheral palisading, peritumoral clefting, and dermal inflammatory cells. Changes in streaming, fibrosis, and increased and dilated vasculature did not reach significance.

Conclusion: The presence of RCM streaming, fibrosis, and dilated vessels at BCC sites that were otherwise clear posttreatment histologically, could be secondary to scar formation as a part of the healing process. It is likely to observe these during RCM imaging of biopsy-proven BCC at baseline (resulting from healing of biopsy and remaining BCC compressing the overlying epidermis) and posttreatment (resulting from treatment induced healing process and/or presence of residual BCC compressing the overlying epidermis). As such, these three RCM BCC features, although reported to have high association with BCC diagnosis, should be interpreted with caution when used for monitoring treatment response for biopsy-proven BCCs. The results of this pilot study are significant considering an ongoing increased number of BCC clinical trials that require clinical and imaging-based determination for the need of subsequent treatments during the trial, and because of the possible role of artificial intelligence for RCM interpretation in the future. Large-scale studies are needed to further validate these findings.

SUBMISSION TITLE: LASER HAIR REDUCTION IS AN EFFECTIVE TREATMENT OPTION FOR PATIENTS SUFFERING FROM HIDRADENITIS SUPPURATIVA

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Background: Hidradenitis Suppurativa (HS) is a chronic, recurrent, debilitating, inflammatory disease involving the skin folds such as axillary, inguinal, inframammary, perineal and perianal skin of young

and middle-aged adults. This condition is extremely difficult to diagnose and treat and disproportionately affects females (3:1), patients of African American and Hispanic descent, and those of lower socioeconomic status. Patients with this condition suffer from constant pain, foul smelling discharge, scarring and huge expenses in managing this condition leading to both physical and emotional disability and opioid addiction. Patients experience social isolation, depression, failed relationships, and loss of employment. Because of the above-mentioned reasons HS has one of the lowest quality-of-life scores of any skin condition with profound impacts on patients' physical, emotional, and social health. Estimates of the prevalence of HS have varied, ranging from less than 1%–4%. Treatment options include topical, oral, and injectable medical treatments in addition to surgical and laser treatments. Unfortunately, all currently available treatments are inconsistent and only moderately effective. Currently, the single agent that is FDA approved for treatment of patients with HS is a systemic immunosuppressive injectable biologic agent called adalimumab (Humira) that is not only quite complicated to administer because of the need for frequent lab testing due to its immunosuppressive nature, but also extremely expensive for both the patient (copays of $1000/month) and the health care organizations (cost of $75,000 per patient per year). In a phase 3 trial (PIONEER I) that studied the efficacy of adalimumab in treating HS, 41.8% treated patients achieved HiSCR (is defined as a ≥ 50% reduction in inflammatory lesion count abscesses + inflammatory nodules, and no increase in abscesses or draining fistulas) after taking this drug for 3 months of therapy respectively. Since the disease process in HS is centered around the hair follicle and stem cells located in the hair bulb, inflammation of the hair follicles leads to the formation of the sinus tracts and worsening of the disease. There is emerging evidence that permanent reduction of hair and accompanying stem cells using lasers can not only help control this condition, but also induce long term remission. Laser hair reduction (LHR) of involved areas has shown some promise in small studies in controlling mild to moderate HS. Unlike adalimumab, LHR treatment for HS is safe without any risk of immunosuppression or systemic side effects, is remittive, and can be delivered at a fraction of the cost ($1500 per patient per year) of biologic medications. In this study we investigated the effectiveness of LHR in HS for patients of all Hurley Stages.

Study Design/Materials and Method: We conducted a single center, retrospective, cohort study of HS patients treated with LHR to determine the efficacy of LHR in treating HS by determining the percent of patients achieving HiSCR and comparing it to the efficacy of adalimumab for treating HS in previously published studies. Patients in our study were included if they had at least three laser treatments and were allowed to continue with their current treatments while they were being treated with LHR. A combination of electronic data extraction for age, gender, race/ethnicity, BMI, smoking history, location of lesion and stage of disease (Hurley Stage), topical, oral and injectable treatments used, number and spacing of laser treatments and structured chart review for determining the Hidradenitis Suppurativa Clinical Response (HiSCR) score based on clinical pictures to calculate the treatment efficiency after laser treatments. Both multivariable logistic and Cox regression models were run to examine the associations between HiSCR achievement and patient characteristics (age, sex, BMI, Hurley staging, comorbidities). All treatments were mostly done by one RN and the pictures were reviewed by two dermatologists to determine the Hurley Staging before and after laser treatments.

Results: Eighty-two patients met the inclusion criteria and had at least three LHR treatments. The mean age of the patients was 30 years with ages that ranged from 14 to 71 years. Women represented 80% of the cohort. Fifteen patients had Hurley Stage I, 58 patients has Hurley Stage II and nine patients had Hurley Stage III, thus 81% of the patients had moderate to severe disease (Hurley Stage II or III). 26.8% of the patients were White, 20.7% patients were Hispanic, 25.6% of the patients were African American and 19.5% patients were Asian. The number of treatments ranged from 3 to 22 treatments with a mean number of treatments being 6% and 50% of patients had more than six treatments. Based on a review of the before and after pictures, overall 70% of the patients achieved HiSCR: 74% of patients with Hurley Stage I and II and 44.4% of patients with Hurley Stage III achieved HiSCR. 18/82 (22%) of patients were receiving biologics before starting LHR and only 3/82 (4%) patients started biologics after the LHR treatment in addition to the 18 patients who were already on biologics before LHR treatment.

Conclusion: Based on the results of our study, LHR is a very effective modality for treatment of mild to moderate HS when compared to the only FDA approved medical treatment for HS, adalimumab. To the best of our knowledge, this is the largest cohort of patients that showed efficacy of LHR treatment using HiSCR to determine the efficacy of the LHR treatment. Our study also showed that using LHR as a treatment option, we can reduce the usage of biologics in HS. LHR is being recognized as an important treatment option for the treatment of HS and we hope this study will encourage other providers to start using LHR for the treatment of HS, thus avoiding the morbidity and cost burden of biologic medications.

SUBMISSION TITLE: LASER TREATMENT IN THE PROCEDURAL MANAGEMENT OF CONGENITAL MELANOCYTIC NEVI

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Background: Congenital melanocytic nevi (CMN) are benign melanocytic proliferations present at birth at risk for developing into melanoma. Surgical excision has traditionally been the first-line management for CMN removal, but results in scars and may be complicated by disfigurement. Multiple clinical studies have demonstrated the efficacy of laser treatment of CMNs, but data on fair-skinned subjects is lacking. We report effective combination laser treatments for CMN in pediatric patients treated at a major academic hospital in the United States.

Study Design/Materials and Method: A retrospective review was conducted on the medical records of patients under 18 years of age with any size CMN who underwent an operating room procedure at Massachusetts General Hospital from January 1, 2010 to December 31, 2022. Patients whose CMN was treated with laser followed by excision were excluded, except for those who had separate excisions and laser treatments for CMNs at different sites. Laser type and settings were determined by the treating physician. The age, gender, race, Fitzpatrick skin type, size of nevus, area treated, number of treatments, interval between sessions, laser device, response, complications, and follow-up duration were recorded.

Results: One hundred fifty-eight charts were screened and the vast majority of patients underwent excision, partial excision, or biopsy of CMN. Twelve children, including nine females and three males, were treated with laser for further descriptive study. All 12 patients had large to giant CMNs appearing dark brown or black and with facial involvement at baseline presentation. Age at the first laser treatment was under 18 years for all patients, with the youngest case being 11 months old. Most patients were White (75%) with Fitzpatrick skin types I–II. The median number of total treatments was 5.5. All procedures were performed under general anesthesia, given the age of patients and the intensity of laser energy. Patients were generally treated with a combination of Q-switched laser (755 or 1064 nm) and a longer pulsed laser (755 nm or pulsed dye) for pigmentation clearance and hair removal, followed by a fractional ablative carbon dioxide laser or nonablative laser for resurfacing. Additional lasers were applied as needed for enhanced effect or management of complications. Three patients had excisions and two patients underwent suction blister epidermal grafting for repigmentation at other sites of the nevus. Laser treatments achieved pigment reduction in all patients, with no significant scarring, dissatisfying dyspigmentation, or long-term adverse events observed during follow-up visits.

Conclusion: CMNs in pediatric patients with lighter skin types can be safely and effectively treated using a strategic combination of different laser devices, which depends on patient characteristics. Multiple sessions are required to reduce pigmentation and resurface. Our study suggests that laser treatment is a promising alternative for patients who choose not to undergo surgery, those with CMN that are located in visible areas that are poor sites for excision, and CMN that are too large for extensive excision.

SUBMISSION TITLE: LASER TREATMENT OF CUTIS MARMORATA TELANGIECTATICA CONGENITA

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Background: Cutis marmorata telangiectatica congenita (CMTC). It is a rare, congenital, vascular disorder characterized by dilated capillaries and veins, in all layers of the dermis and subcutaneous tissue. Venous lakes can also be observed. It manifests as erythematous-to-violaceous, reticulated, net-like, or marbled-appearing patches on the skin [2, 4, 5, 7, 8]. There are two types of CMTC: isolated and classic. Isolated CMTC is a mild form without any associated syndromes, and the skin lesions tend to fade over time. Classic CMTC is a more severe form that may present with recurrent ulcerations, underlying cutaneous atrophy, and other vascular malformations [2, 4–8]. The etiology of CMTC is unknown, but molecular genetic testing has identified mosaic heterozygous pathogenic variants in the GNA11 gene

[1, 2, 5, 7]. CMTC is most commonly found on the lower limbs, as in the case of the patient in this study. Different vascular lasers including pulsed dye, alexandrite and NdYAG 1064 lasers as well as IPL were proposed for CMTC treatment but reported results were not satisfactory. The purpose of this study is to determine the long-term effectiveness of a 532 and 1064 nm large-spot laser with contact cooling in the treatment of CMTC.

Study Design/Materials and Method: A 45-year-old woman visited the Klinika Ambroziak due to vascular malformations on her right thigh, shank, and foot, which include numerous grave and serpiginous capillaries with a marbled pattern and visible venangiectasias. Discrete ivory white scarring was visible along dilated vessels and was evident in dermoscopic evaluation. Classic type of cutis marmorata telangiectatica congenita was diagnosed. It was treated with the large spot 532 and 1064 nm millisecond laser with contact cooling, as well as the picosecond 1064 nm laser with diffractional lens. The latter was added to treat associated discrete scarring. Patient underwent five laser treatment sessions (532 nm) and one session with a picosecond laser. A topical application of timolol was added after the last session.

Results: Although immediate response after vascular laser was achieved both clinically and dermoscopically, after 5 months, videodermoscopy showed that large capillary loops persisted, and clinical improvement was not satisfactory.

Conclusion: After the initial treatment, the effectiveness of the laser therapy was noticeable. However, over time the results were disappointing. Effective treatment can be difficult due to regeneration of abnormal vessels and natural tendency to scarring.

SUBMISSION TITLE: LINE-FIELD CONFOCAL OPTICAL COHERENCE TOMOGRAPHY FOR VISUALIZATION AND SUBTYPING OF BASAL CELL CARCINOMA IN MOHS MICROGRAPHIC SURGERY: A FEASIBILITY STUDY

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Background: Mohs micrographic surgery (MMS) is an effective and tissue-sparing, yet time-consuming, technique that requires histopathological examinations of multiple tissue layers. Line-field confocal optical coherence tomography (LC-OCT) is a real-time noninvasive imaging device that has been shown to visualize BCC in vivo. In this proof-of-concept study, using a novel image acquisition approach we investigated the feasibility of perioperative visualization and subtyping of BCC tissue layers using LC-OCT for a more rapid examination.

Study Design/Materials and Method: We scanned the subcutaneous surface of six histologically-verified BCC MMS tissue-blocks to visualize deep tumor-borders using three-dimensional images and videos. Localization of BCC in LC-OCT scans were compared to their corresponding localization in the Mohs map. LC-OCT subtyping of tumors was performed blinded using literature-reported image features and confirmed by histology reports.

Results: Using LC-OCT, we were able to visualize the deep BCC tumor borders in all six MMS tissue-blocks and correlate their localization to histology. After assessment of LC-OCT scans for subtyping, we categorized five BCCs (83.3%) as nodular and one as mixed nodular and infiltrative subtype (16.7%). The nodular subtype contained LC-OCT image features of peritumoral hyperreflective outer shell, dark cleft, and millefeuille pattern. The mixed subtype additionally contained dark silhouettes. All findings corresponded to MMS histopathology.

Conclusion: Our results suggest that LC-OCT can visualize and subtype BCC in MMS tissue layers. Real-life evidence is needed to determine if perioperative LC-OCT is a time- and cost-efficient alternative to conventional histology in MMS.

SUBMISSION TITLE: LINE-FIELD CONFOCAL OPTICAL COHERENCE TOMOGRAPHY OF HIGH-RISK SKIN CANCER PATIENTS: RESULTS FROM AN EXPLORATIVE IN VIVO STUDY

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Background: Line-field confocal optical coherence tomography (LC-OCT) is a novel noninvasive laser-based imaging technique, which has been used for the visualization of a broad range of skin disorders, including benign and malignant skin neoplasms. While the use of LC-OCT in the management of skin cancer is emerging, its role in a high-risk skin cancer population with multiple lesions and high morbidity has yet to be investigated. Here, we aimed to explore the potential application of LC-OCT in the

noninvasive characterization of tumor lesions in immunosuppressed skin cancer patients.

Study Design/Materials and Method: Organ transplant recipients (OTR) were enrolled following written informed consent during routine skin cancer screening at a university dermatology practice. Clinically suspicious lesions including actinic keratosis (AK), squamous cell carcinoma (SCC), and basal cell carcinoma (BCC) were scanned before biopsy for routine histology. Lesions were scanned with LC-OCT to acquire three-dimensional images and video recordings for assessment of tumor morphology using predefined dermato-oncological imaging features.

Results: Thirty histologically verified and keratinocyte carcinoma and precursor lesions from 24 OTR patients, comprising AKs $n = 16$ (grade I–III), SCCs $n = 4$ (in situ and invasive lesions) and BCCs $n = 10$ (superficial, nodular, and infiltrative subtypes), were included. We identified a total of 37 different image features that differed in their presence between tumor subtypes. For AK, characteristic features included parakeratosis with epidermal dysplasia and tumor budding at the basal layer. Despite resemblance to its precursor lesions, SCC additionally exhibited an irregular dermal-epidermal junction, with broad strands of tumor tissue in the dermis, and hyperreflective keratin pearls. BCCs presented with distinctively different features including dermal lobules with a characteristic inner millefeuille pattern and peritumoral hyporeflective clefting.

Conclusion: In this explorative study, we have described LC-OCT features in a high-risk skin cancer population. The presented results on high-resolution laser-based imaging for visualization and morphological characterization of keratinocyte carcinomas may improve care for medically complex immunosuppressed patients.

SUBMISSION TITLE: LONG-TERM EFFICACY OF FEEDBACK-CONTROLLED 1726 NM LASER FOR TREATMENT OF MODERATE INFLAMMATORY ACNE VULGARIS

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Background: The concept of selective photothermolysis has recently been applied to the treatment of acne, after lipid absorption bands were found to be maximal at the 1726 nm wavelength. More recently, targeted destruction of sebaceous glands using a novel 1726 nm laser with integrated feedback-controlled cooling and real-time temperature sensing was demonstrated to be safe and effective for improving inflammatory acne. The unique cooling and pulsing mechanisms sufficiently protect the superficial skin from thermal injury, while treating the skin to a temperature-defined endpoint to allow for high levels of reproducibility and safety. This study evaluates the long-term data and durability associated with these treatments.

Study Design/Materials and Method: A novel 1726 nm laser with integrated feedback-controlled cooling and real-time temperature sensing (Accure Acne, Inc.) was used for the treatment of moderate inflammatory acne vulgaris in two multisite trials. Subjects were enrolled to receive up to 4 monthly treatments. For long-term analysis, data was also collected at 12, 26, 39, and 52 weeks following the last treatment.

Results: A total of 35 subjects were enrolled in the trials and had treatment performed. Mean age was 26.0 years (R: 16–48 years), and 71.4% were women. Fitzpatrick skin types II–VI were represented. Of these, 17 subjects had long-term data collected and available. For inflammatory lesion count, median improvement was 79%, 68%, 75%, and 90% at 12, 26, 39, and 52 weeks following the last treatment respectively. For responder status, defined as at least a 50% reduction in inflammatory lesion count, rates were 100%, 83%, 80%, and 88% at 12, 26, 39, and 52 weeks following the last treatment. There were no device-related serious adverse events related to permanent damage or scarring.

Conclusion: A novel 1726 nm laser with integrated feedback-controlled cooling and real-time temperature sensing is safe and effective at offering durable long-term improvement for acne.

SUBMISSION TITLE: LONG-TERM EFFICACY OF MICROWAVE THERMOLYSIS AND BOTULINUM TOXIN A FOR AXILLARY HYPERHIDROSIS – A RANDOMIZED CONTROLLED TRIAL

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Background: Botulinum Toxin A (BTX-A) is a standard treatment for axillary hyperhidrosis that is generally effective but temporary. Microwave Thermolysis (MWT) is a newer energy-based treatment alternative that may offer

a sustained reduction of both sweat and odor. This study aimed to be the first to evaluate and compare long-term patient-reported efficacy outcomes in axillary hyperhidrosis patients treated with BTX-A and MWT.

Study Design/Materials and Method: Thirty adults with moderate-severe axillary hyperhidrosis were included in a prospective, GCP-monitored, randomized, within-patient controlled trial. Patients received one treatment session at baseline, one axilla treated with BTX-A and the contralateral with MWT. Patient Reported Outcome Measures (PROMs) for sweat, odor and quality of life (Hyperhidrosis Disease Severity Scale [HDSS: 1-4], Odor Scale [OS: 1-10], Dermatology Life Quality Index [DLQI: 0-30]) were collected at baseline, 6- and 12-month follow-up (FU). The change in PROMs from baseline to FU was evaluated (p-value) and compared between BTX-A and MWT (Δp-value).

Results: A total of 30 patients completed 6-month FU, 15 patients completed 12-month FU (ongoing). Baseline PROMs for sweat, odor and quality of life were comparable between sides.

Patients reported severe hyperhidrosis in both axillae (HDSS median 3 [IQR: 3–4]) before treatment. At 6-month FU, HDSS was significantly reduced to median 2 (IQR: 2–2, $p < 0.0001$) for both BTX-A and MWT, which sustained at 12-month FU (BTX-A IQR: 2–2, $p = 0.0009$; MWT IQR: 1–2, $p = 0.0010$). No significant difference in HDSS between interventions was detected at 6-month FU ($\Delta p = 0.4142$) nor at 12-month FU ($\Delta p = 0.0833$).

Odor was likewise reported as substantial with OS median 6.5 (IQR: 4–8), bilaterally. Following treatment, OS was significantly reduced at 6-month FU to median 3 (IQR: 2–5, $p = 0.0018$) for BTX-A and median 2.5 (IQR: 2–5, $p = 0.0002$) for MWT. At 12-month FU, odor reduction persisted with OS median 3 (IQR: 2–6, $p = 0.0152$) for BTX-A and median 2 (IQR: 1–4, $p = 0.0007$) for MWT. No difference between the interventions was detected at 6-month FU ($\Delta p = 0.6826$), however, at 12-month FU there was a subtle, but significant, difference in sustained odor reduction favoring MWT ($\Delta p = 0.0497$).

Patients' quality of life was negatively affected by their axillary hyperhidrosis (DLQI median 10 [IQR: 7–14]). At 6-month FU, both treatments had significantly and equally ($\Delta p = 0.0857$) improved DLQI to median 3 (BTX-A IQR: 1–5; MWT IQR: 1–6; $p < 0.0001$ for both), which was corroborated at 12-month FU with DLQI median 2 (BTX-A IQR: 1–5, MWT IQR: 0–5, $p = 0.0006$ for both) with no detectable difference between interventions ($\Delta p = 0.1797$).

Conclusion: This RCT is the first direct comparison of long-term patient-reported efficacy outcomes following BTX-A and MWT for axillary hyperhidrosis. Both interventions effectively improved patients' reported sweat, odor and quality of life. While the treatments' impact was comparable on sweat, a subtle difference in long-term odor reduction was detected in favor of MWT, thus cementing the applicability of energy-based devices in the field.

SUBMISSION TITLE: LOW FLUENCE SINGLE TREATMENT WITH A NOVEL ABLATIVE FRACTIONAL 2,910 NM FIBER LASER FOR PHOTOAGING IN SKIN OF COLOR

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Background: Laser resurfacing in skin of color is challenging due to the increased risk of postinflammatory pigmentary alteration. Side effects in skin of color are often minimized by decreasing both the treatment density and thermal energy. A new mid-infrared fractional ablative laser operating at peak water absorption causes minimal residual thermal damage resulting in potentially fewer side effects, little to no pain and shorter downtime compared to traditional ablative and fractional ablative lasers. In this study, we evaluate a new novel ablative fractional 2910 nm erbium-doped glass fiber laser (UltraClear; Acclaro Medical) for treatment of photoaging in skin of color.

Study Design/Materials and Method: Patients with skin of color (Fitzpatrick skin types IV–VI) presenting for facial photoaging underwent a single treatment session utilizing the superficial mode of the 2910 nm erbium-doped glass fiber laser. Patients were given the option of no numbing or topical benzocaine/lidocaine/tetracaine, which was applied to the face for 45 minutes prior to treatment. The entire face was treated. Photographs were taken at baseline and 6–12 weeks following treatment. Evaluation of pretreatment and posttreatment photos was completed by three physician reviewers. Reviewers were asked to rate the degree of improvement using a 5-point Global Aesthetic Improvement Scale (GAIS) as follows: (0) no improvement, (1) minor improvement, (2) moderate improvement, (3) marked improvement, (4) very significant improvement.

Results: A total of nine patients underwent a single treatment session. All patients were female, FST IV, and an average age of 46.6 years old. Side effects were transient and included erythema, edema, and mild crusting. There were no instances of post-inflammatory pigment alteration. Evaluation of digital images revealed an average GAIS score of 1.93.

Conclusion: Our preliminary results demonstrate that low fluence treatment with a novel ablative fractional

2910 nm erbium-doped glass fiber laser is safe and effective for treating photoaging in skin of color. Further studies, including the role of multiple treatment sessions, are needed to better understand further efficacy, durability, and optimal treatment settings and are currently ongoing at our center.

SUBMISSION TITLE: MAGNETIC MUSCLE STIMULATION AND CRYOLIPOLYSIS FOR INFERIOR GLUTEAL CONTOURING

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Background: Noninvasive body contouring is among the fastest-growing segments of the aesthetic market, with the number of procedures quintupling in the past decade and over 250,000 cryolipolysis treatments performed in 2019 (ASDS Procedure Survey Data). In particular, public interest in gluteal and thigh contouring procedures has increased enormously. A critical characteristic of aesthetic improvement in this area is maintaining a short infragluteal fold (IGF) or crease not extending beyond the medial 2/3 of the posterior thigh (Aboul Fotouh, 2019). A bulge of excess fat in the infragluteal area is commonly called a "banana roll." Body contouring in this area is challenging as it serves as a supporting pillar for the buttocks, and reduction can cause ptosis of the buttock over the IGF (Aiache, 2006; Body Contouring).

Cryolipolysis is an FDA-approved noninvasive alternative to liposuction for subcutaneous fat reduction based on adipocyte apoptosis in response to cold but above-freezing temperatures (Derrick et al., 2015). Electromagnetic muscle stimulation (EMMS) is another FDA-approved body contouring treatment. It depolarizes skeletal muscle motor neurons to stimulate high-intensity supramaximal involuntary muscle contraction and causes long-lasting muscle hypertrophy (Rambhia et al., 2022). The combination of these two modalities has previously been shown to improve abdominal contouring greater than either treatment alone (Kilmer et al., 2020). This study evaluated a multimodal approach combining cryolipolysis and EMMS for contouring the inferior gluteal/banana roll area.

Study Design/Materials and Method: Twenty subjects 22–65 years of age with BMI < 30 were randomized to receive combination therapy with one to two sessions of cryolipolysis to the banana roll and four sessions of EMMS to the buttocks or one to two sessions of cryolipolysis alone. Cryolipolysis was followed by a massage with an acoustic shockwave device. Subjects maintained weight within 5% of baseline. Efficacy was evaluated on the Investigator Global Aesthetic Improvement Scale (IGAIS), Subject Global Aesthetic Improvement Scale (SGAIS), 2D and 3D photography, and Patient Treatment Satisfaction Surveys. Primary endpoints were 6 weeks after the last cryolipolysis session and 4 weeks after the last EMMS session.

Results: Safety was demonstrated for both cohorts with no device- or procedure-related adverse events. The group receiving multimodal therapy was found to have greater mean improvement on IGAIS, 1.2 and 1.4, compared to 1.0 and 1.25, as well as greater mean improvement on SGAIS, 1.8 and 1.8 compared to 1.0 and 1.0, for the right and left buttocks, respectively. Additionally, combination therapy subjects reported greater satisfaction with the appearance of their banana roll: 1.6 and 1.6 compared to 1.5 and 1.25.

Conclusion: These results demonstrate that both cryolipolysis and EMMS improve the appearance of the inferior gluteal area. Both modalities are safe, well-tolerated, and are noninvasive alternatives to liposuction, fat augmentation, biostimulators, and implants for gluteal contouring.

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SUBMISSION TITLE: MICROWAVE ABLATION OF ECCRINE GLANDS AS A TREATMENT FOR RESIDUAL LIMB HYPERHIDROSIS

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Background: Up to 66% of lower limb amputees report residual limb hyperhidrosis with a significant association between sweating and decreased prosthetic function [1]. Current strategies for treatment such as botulinum toxin are focused on temporary relief of this problem. Microwave thermoablation is an effective permanent solution for axillary hyperhidrosis [2]. The purpose of this study was to evaluate the use of microwave thermoablation for the treatment of residual limb hyperhidrosis.

Study Design/Materials and Method: This study was a prospective nonrandomized feasibility trial. Tricare-eligible lower limb amputees with residual limb hyperhidrosis were eligible for this study. Dermatology Life Quality Index (DLQI) scores, Severity of Prosthesis Problem Scale (SPPS) scores, and gravimetric measurements of sweat after 10 minutes of exercise were taken at baseline and 3 months after treatment. Study participants underwent treatment of half of their limbs followed by treatment of the other half 2 weeks later to avoid risk of compartment syndrome. Pretreatment and posttreatment measurements were compared using the Wilcoxon signed-rank test using SPSS (IBM).

Results: A total of nine limbs in eight patients (one double amputee) underwent treatment. There was a statistically significant decrease in DLQI ($Z = -2.136$, $p = 0.033$) and SPPS ($Z = -2.521$, $p = 0.012$) scores indicating improvement in quality of life and increased ease of prosthetic use, respectively. There was a statistically significant decrease gravimetric amount of sweat produced ($Z = -2.032$, $p = 0.042$).

Conclusion: Microwave thermoablation significantly improves quality of life, increases ease of prosthetic use, and decreases amount of sweat produced in lower limb amputees. These effects are expected to be permanent.

SUBMISSION TITLE: NEEDS ASSESSMENT REGARDING THE USE OF CUTANEOUS LASERS AND ENERGY DEVICES IN PATIENTS WITH SKIN OF COLOR

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Background: In patients with skin of color (SOC), the use of light and energy-based devices may need to be adapted for improved effectiveness and safety.

Study Design/Materials and Method: A panel comprised of clinicians with expertise in lasers and treatment of skin of color patients, as well as patients with skin of color, was convened to identify clinical and research needs pertaining to the use of lasers and energy devices in patients with skin of color.

Results: Based on a Delphi process, the following needs were identified: (1) Increased awareness among patients and physicians regarding the heightened risks of adverse events including hyperpigmentation and hypopigmentation; (2) Standards for modification of laser settings for patients of SOC, with development of specific recommended setting ranges for each individual device by manufacturers, given the variation between individual devices; (3) Improved patient education materials that better explain the need for gentle, low energy treatments, and provide appropriate postoperative skin care instructions, including how to identify incipient adverse effects and promptly notify the doctor; (4) Public communications to apprise patients who may be unaware of therapeutic options, or suspicious of the health care system, regarding the availability of laser and cosmetic treatment options for treatment of patients with SOC; (5) Further research and development to invent and optimize nonlight energy based devices, which may be safer in patients with skin of color, and relatively "color blind"; (6) Clinical research, including clinical trials and registry studies, to study the effectiveness and safety of laser and energy device treatments in SOC (when larger studies including diverse populations are undertaken, a significant proportion of the cohort should be skin of color patients); (7) Ongoing dialogue with SOC patients to better

understand their needs, and how these are or are not being met, by current laser treatments and laser practitioners.

Conclusion: Future directions, guided by the needs identified by the Delphi process, could include the education of patients with SOC on outcomes and expectations, and of physicians on adequate treatment protocols.

SUBMISSION TITLE: NON-INVASIVE TREATMENT OF CUTANEOUS NEUROFIBROMAS (CNF): RESULTS OF A PROSPECTIVE, DIRECT COMPARISON OF FOUR METHODS

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Background: Neurofibromatosis type 1 is a neurocutaneous genetic condition in which cutaneous neurofibromas grow slowly for decades causing disfigurement and dysesthesia. We aimed to halt or slow the progression of early cNF with minimally-invasive, well-tolerated, non-scarring and rapid treatment(s).

Study Design/Materials and Method: We compared the safety, tolerability (including pain scores), and efficacy (change in cNF volume/height via 3D imaging and clinical improvement via physician assessment) of four different treatment modalities in 19 adults with an adequate number of small (2–4 mm) cNF (3–10 cNF treated per modality) in a prospective study approved by the MGH Institutional Review Board. The modalities include electrocautery with an insulated radiofrequency needle, 755 nm alexandrite laser with negative pressure (8 mm spot size, 100 J/cm^2 fluence, 3 milliseconds pulse duration), 980 nm diode laser (delivered via 8 mm sapphire skin-contact window) and intratumoral injection of 10 mg/mL deoxycholic acid (KybellaR) at a volume approximately equal to that of the tumor.

Topical anesthetic (5% lidocaine/prilocaine) was applied for 40 minutes before treatment. Tumors were randomized to treatment versus control (no treatment). At baseline, 3, 6, and 12 months after treatment, the pain score, tumor height and volume (via 3D Cherry ImagingR), clinical assessment of tumor clearance, inflammation, pigmentation, and scarring were assessed. Biopsies were obtained from 10 subjects at 3 months after treatment.

Results: Of the 19 participants enrolled (24–70 years old, average age of 48; 4 M/15 F), 17 have completed the 6-month assessment. A total of 307 cNF tumors were treated. No adverse events >grade 2 occurred in any of the treatment groups. All modalities reduced (or eliminated) some cNF by 6 months posttreatment, with large variation between tumors and between participants. When residual neurofibroma tumor was present histologically, its appearance was similar to that of control untreated tumors. There was no evidence of atypia, mitosis or tumor inflammation. Mild fibrosis was present at the sites of prior tumor.

Moderate to severe pain limited the 980 nm laser treatment dose, and this treatment produced no apparent tumor reduction in most participants. The alexandrite laser was only mildly painful and caused immediate gray-blue purpura selective to the tumor, and in some participants led to complete tumor clearance without any scarring or pigment abnormality. The pain associated with the deoxycholate injections was minimal, and the resultant cNF reduction from the injections ranged from none to nearly complete. Pain during insulated-needle radiofrequency coagulation was mild, though more than deoxycholate injections or alexandrite laser. Tumor reduction associated with this modality appeared to correspond to the zone of coagulation. No cNF growth stimulation or recurrence from these treatments has been noted.

Conclusion: Effective, well-tolerated treatment of small cNF without surgery is feasible. All four modalities assessed were safe and demonstrated at least some degree of efficacy. Alexandrite laser assisted by mild suction was the only tumor-selective treatment. Because this laser is widely available and was well tolerated, it is a promising modality for future study. Injection of deoxycholate was surprisingly well tolerated and effective. Its main limitation is skillful placement into the cNF.

This study is still in progress, but we are able to conclude that clearance of small cNF after only one noninvasive local treatment is possible for some cNFs. Our future studies will focus on optimizing the doses and delivery of these promising treatments.

SUBMISSION TITLE: NON-THERMAL (PHYSICAL) PLASMA: AN EFFECTIVE AND WELL TOLERATED TREATMENT FOR WARTS IN CHILDREN

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Background: Treating warts (VV) and molluscum contagiosum (MC) in children is especially challenging, as most of our treatment modalities are painful, difficult to tolerate, yet require strict compliance. Non-thermal physical plasma (NTAP) is an emerging modality, which has been shown to be effective to treat actinic keratosis, likely via inducing apoptosis or cell senescence. Based on our proof-of-principle study demonstrating the efficacy of NTAP for VV treatment in adults, we investigated the use of this novel device in the pediatric patient population.

Study Design/Materials and Method: In a pilot study we enrolled six pediatric patients with VV and MC, who received NTAP treatments at 4-week intervals for a maximum of four treatments. A subsequent, prospective, open-label study randomized pediatric patients 1:1 to receive NTAP or traditional therapy (cryotherapy for VV and cantharidin for MC). Patients were treated at 4-week intervals for a maximum of three treatments. Patients were evaluated for lesion response, adverse effects, and pain 4 weeks after completion of the treatment series.

Results: All the treated lesions in the proof-of concept study have cleared after an average of two treatment sessions for VV and after four sessions for MC. These patients remained clear of VV for at least 6 months and of MC for 2 months. In the prospective randomized study, a total of 150 lesions (32 MC, 118 VV) in 17 patients were enrolled. Patients were a mean of 9.06 [+3.05] years old. Of NTAP treated lesions, 82.67% had complete response, 16.0% partial response, and 1.33% no response, as compared to 80.28% complete response, 8.45% partial response, and 11.27% no response for traditional therapy ($p = 0.023$). Mean pain level during treatment was 1.245 [+1.89] for NTAP lesions and 3.71 [+3.22] for SOC lesions ($p = <0.001$). No significant adverse events occurred.

Conclusion: This study demonstrates that NTAP is an effective and well-tolerated treatment for MC and VV. Its great tolerability makes this emerging technology especially attractive for the treatment of these lesions in the pediatric patient population.

SUBMISSION TITLE: NOVEL TREATMENT OF SUTURE EXTRUSION USING 755 NM PICOSECOND LASER WITH DIFFRACTIVE LENS ARRAY

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Background: Suture extrusion or spitting sutures are a frequent postoperative occurrence in dermatologic surgery, which can prolong healing time, cause patient discomfort and distress, and lead to further complications. Traditional methods include trimming any visible material with forceps or scissors, however complete removal is not always possible.

Study Design/Materials and Method: Ten patients presented at 4–8 weeks following excisions using dermal polyglactin 910 sutures with increasing erythema, edema, and pain. Spitting sutures were noted at the lateral aspects of the surgical sites. Some patients' sutures were not protruding sufficiently to allow removal, and the some patients did not tolerate instrumentation due to discomfort. A picosecond alexandrite laser with a diffractive lens array was utilized to hasten resolution (Cynosure).

Results: Each patient underwent four passes of a picosecond 755 nm laser using a 6 mm diffractive lens array at a fluence of 0.64–0.71 J/cm^2. Treatment was well tolerated, and dissolution of remaining suture material, as well as improvement in symptoms, was noted after one to two treatments.

Conclusion: A 755 nm picosecond laser may be an alternative treatment for spitting sutures in patients who are not amenable to conventional techniques.

SUBMISSION TITLE: OBJECTIVE STRUCTURED ASSESSMENT OF TECHNICAL SKILLS IN LASER PROCEDURES: VASCULAR LASER, ABLATIVE LASER, AND NONABLATIVE LASER

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Background: Objective structured assessment of technical skills (OSATS) have been used across various specialties to ensure resident competency in different procedures required for graduation from residency [1]. This study entailed development of OSATS checklists and global ratings scales for common cutaneous laser procedures.

Study Design/Materials and Method: Two investigators conducted an exhaustive literature review to identify required steps for the following laser procedures: vascular laser, ablative laser, and nonablative laser. A long list of all the possible steps for the procedure was developed and steps were categorized into preprocedure, during procedure, and postprocedure. Once this list was compiled, individual virtual interviews with laser experts were conducted and feedback was elicited regarding whether items should be included, deleted, modified, or added to the list. Items that were recommended for removal by more than one panelist were excluded. Next, stakeholders were identified to participate in the Delphi process. Stakeholders that were published at least five times since 2022, board members of prominent laser or related energy-based societies, lecturers at major conferences (AAD, ASLMS, ASDS) in 2022, or members of the AACD resident education committee and AACD research committee members were included in the Delphi process. Delphi round 1 and round 2 occurred virtually via the utilization of Qualtrics software. A Likert scale (1-9) was used to identify the likelihood of inclusion into final OSATS. Delphi round 2 included all items from round 2 and any new items that may have been added. Stakeholders were presented with their score from round 1 along with the median round 1 score. Each item was provisionally included if at least 70% of Delphi participants rated it between 7 and 9 and no more than 15% of participants rated it between 1 and 3 during the second round. A virtual consensus meeting was conducted where all provisionally included items were discussed. Based on final yes/no voting, items that at least 80% of stakeholders supported were included in the final OSATS.

Results: Three separate checklists were developed for vascular laser, ablative laser, and nonablative laser. These were validated by the initial expert panel. Then, the Delphi process was conducted over the course of 2 months. The final checklists for vascular laser, ablative laser, and nonablative laser contained 13, 15, and 12 items respectively.

Conclusion: OSATS checklists for laser procedures were developed for the evaluation of trainee competence in vascular, ablative, and nonablative laser procedures.

SUBMISSION TITLE: OBJECTIVE STRUCTURED ASSESSMENT OF TECHNICAL SKILLS IN SCLEROTHERAPY PROCEDURES

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Background: Objective structured assessment of technical skills (OSATS) are often used to measure these procedural competencies in the form of a checklist. This study entailed development of OSATS checklists and global ratings scales for sclerotherapy procedures.

Study Design/Materials and Method: A comprehensive literature review was conducted by two investigators to identify required steps for sclerotherapy procedures. A nonoverlapping list of all the possible steps for sclerotherapy was developed. Steps were then categorized into preprocedure, during procedure, and Postprocedure. Individual virtual interviews with sclerotherapy experts were conducted to elicit feedback regarding whether items should be included, deleted, modified, or added to the list. Items that were recommended for removal by more than one expert were excluded. Once an expert approved list of items was compiled, Delphi stakeholders were identified. Criteria for inclusion of Delphi stakeholders included stakeholders that published at least five times since 2022, board members of prominent sclerotherapy or related societies, lecturers at major conferences (AAD, ASLMS, ASDS, AVLS) in 2022, or members of the AACD resident education committee and AACD research committee members. Delphi round 1 and round 2 were conducted using a Likert scale of 1-9 to identify stakeholders' likelihood of inclusion into final OSATS. The virtual Delphi consensus was conducted using Qualtrics software. Delphi round 2 included all items from round 2 and any new items that may have been added. Additionally, each individual stakeholder's score from Delphi round 1 was included in round 2 along with the median round 1 score. Each item was provisionally included if at least 70% of Delphi participants rated it between 7 and 9 and no more than 15% of participants rated it between 1 and 3 during the second round. A virtual consensus meeting was held where final yes/no voting took place for all the provisionally included items. Items for which at least 80% of stakeholders voted in support were included in the final OSATS.

Results: The initial checklist for sclerotherapy procedure after literature review contained nine items. After the review of this checklist by expert panelists, the checklist was lengthened to 12 items to comprehensively cover all steps necessary to perform sclerotherapy. A Delphi process with an expanded group of stakeholders was then conducted over the course of 2 months. The final checklist for sclerotherapy procedures included 12 items.

Conclusion: The OSATS for sclerotherapy was designed for visual sclerotherapy of spider and reticular veins. Ultrasound guided sclerotherapy would require additional steps. Postprocedure management, including management of complications, is also excluded from this OSATS.

SUBMISSION TITLE: OPTICAL COHERENCE TOMOGRAPHY ENDOSCOPE IN EVALUATING VAGINAL HEALTH

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Background: The genitourinary condition of menopause (GSM) could benefit from fractional-pixel CO_2 laser therapy. However, the lack of evaluation of the efficacy and safety of laser treatment impedes its implementation. We previously demonstrated that our optical coherence tomography (OCT) system could obtain the vaginal epithelial thickness (VET) and blood vessel density (BVD) in vivo to assess vaginal health, which records vaginal tissue changes that are from CO_2 laser for a treatment session. In this study, we updated the long-term follow-up results to show the lasting performance of the laser treatment. In addition, the correlation analyses between vaginal health index (VHI), vulvovaginal symptom questionnaire (VSQ), VET, and BVD were conducted to research the relationships under postmenopausal status.

Study Design/Materials and Method: Twenty-five postmenopausal women were enrolled in this study. Participants were enrolled if they had one or more GSM symptoms and were excluded if they had used vaginal estrogen within 3 months. They had four visits within 4–6 weeks intervals. Participants finished the VSQ and had a vaginal exam to record the VHI. Three fractional-pixel CO_2 laser treatments were conducted during the initial three visits. Before the laser treatment on each visit, OCT scans were taken. On the fourth visit, only OCT scans were taken. The OCT imaging was performed at four locations: distal anterior (DA), distal posterior (DP), proximal anterior (PA), and proximal posterior (PP). Five of 25 subjects participated in the long-term

follow-up measurement within the 3-month interval, which only contains OCT scanning and no laser treatment anymore. Statistical analysis was performed using paired Student *t* test for the changes in BVD and VET. Pearson's correlation coefficients between BVD, VHI, and VSQ were calculated.

Results: We enrolled 25 postmenopausal women with a mean age of 62.6 (SD 8.5). The mean length of menopause was 12.8 years (SD 9.1). There was a significant increase in VET (Figure 1) and BVD (Figure 2) in all 4 vaginal locations at the fourth visit ($p < 0.05$). After 7 months of the final laser treatment (third visit), VET recovers to the initial status, which is similar to the result of the first visit. However, BVD remains a 33.7% improvement compared to the first visit. One participant has a 13.3% decrease in VET and an 8.3% increase in BVD compared to the initial visit after 1-year from the fourth visit. The absolute value of the correlation coefficient between VHI and VSQ is 0.5356, and the value of VHI and VET is 0.6805, which could be categorized as highly correlated. All other values could be graded as moderately correlated.

Conclusion: The OCT/OCTA endoscopic system demonstrated a great potential to serve as a noninvasive tool in screening, guiding, and evaluating laser treatment of GSM. The OCT results correlated with clinical results well in postmenopausal cases.

SUBMISSION TITLE: QHREDGS MODIFIED PEPTIDE HYDROGEL IMPROVES RECOVERY AFTER FRACTIONAL MICRONEEDLE RADIOFREQUENCY AND NONABLATIVE FRACTIONAL LASER RESURFACING

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Background: Laser and energy-based devices are commonly used to improve the appearance of aging skin of the face, but usually involve a long recovery time, which is a major concern for many patients. This recovery time, which can take upwards of a week, is marked by pain, erythema, edema, scabbing and dyspigmentation.

This study focuses on a novel posttreatment skin care topical containing a unique peptide, QHREDGS, derived from the fibrinogen domain of Angiopoietin-1. The peptide is obtained by a synthetic route and covalently immobilized to chitosan, via a zero-linker 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide chemistry. A wound healing hydrogel is obtained upon thermal-ionic gelation of the positively charged Q-peptide-chitosan and a negatively charged collagen. In previous studies, in vitro results indicated accelerated keratinocyte migration with Q-peptide hydrogel compared to the peptide-free hydrogel and the tissue culture plastics. When keratinocytes, dermal fibroblasts and macrophages were cultivated on the Q-peptide hydrogel, secretion of pro-regenerative cytokines and inflammation attenuating cytokines was measured along with the increased secretion of scar-preventing TGF-beta3. Accelerated wound healing was observed with Q-peptide hydrogel in a diabetic mouse model ($N = 10$/group), equine model ($N = 10$/group) and a human split skin murine xenograft ($N = 10$/group), in comparison to collagen sponges (ColActive and Primatrix), peptide-free hydrogel and natural healing. Enhanced vascularization was observed in the human split thickness skin murine xenograft model ($N = 4$/group) and the equine model ($N = 10$/group) indicated more elastic regenerated tissue.

For use in clinical dermatology, QHREDGS peptide hydrogel was formulated by covalent immobilization and dilution into a carrier to yield a hydrogel suitable for dermatological application. Following peptide hydrogel application, a thick emollient petrolatum based ointment with soluble QHREDHS peptide is applied to provide a standard of care while maintaining peptide exposure.

Study Design/Materials and Method: Study design: This was an IRB-approved, multisite investigator-blinded, randomized, split-face pilot clinical study comparing the QHREDGS peptide regimen to a standard of care control regimen used postprocedure for fractional microneedle radiofrequency (FMRF) treatment of the face and neck and nonablative fractional laser (NAFL) facial resurfacing. Subjects were assessed with photography at baseline (Visit 1), and postprocedure follow up visits, specifically Visit 2 that took place on Day 2 (±1 day) and Visit 3 that tool place at the end of the study Day 7 (±1 day). Subjects and investigators also completed preprocedure and postprocedure questionnaires at baseline and both follow-up visits.

Twenty healthy subjects with Fitzpatrick skin types I–IV we included in the trial. Written informed consent was obtained from each participant at the time of enrollment. Subjects were randomized using block randomization with block sizes of two for each study site before initiation of the treatment to determine which side of the face was set to receive which treatment.

Participants received both control and experimental posttreatment topical, in identical labelled tubes, according to their randomization. Immediately after the treatment, one side of the face was treated with (1) QHREDGS peptide hydrogel applied first and followed by (2) emollient ointment containing petrolatum and soluble QHREDGS peptide. The control side was treated with the standard of care treatment, consisting of a (1)

the carrier gel and followed by (2) a petrolatum-based cream, specifically CeraVe Healing Ointment. The subjects were instructed to apply the products in identical manner up to four times per day for 7 days.

Subjects were evaluated in the office during the treatment visit immediately postprocedure (Visit 1), and on postprocedure follow up Day 2, ±1 day (Visit 2) and Postprocedure follow Day 7 ±1 day (Visit 3). Profile and portrait photos were taken by the clinician during these clinic visits for image analysis. Participants were asked to take self-photographs everyday post procedure from Day 1 to 7. Photographs were imaged using FIJI (ImageJ; NIH). A macro was written to automate the process and remove bias.

Statistical analysis: Data from 19 subjects were analyzed; one subject was excluded from analysis as the material was applied to hands. Data are presented as mean ± standard deviation. A paired two-tail *t*-test or a Wilcoxon test was performed where indicated. A *p*-value of 0.05 or less was considered significant.

Results: Of the 20 subjects enrolled into the study, one was excluded as they received the study treatment on their dorsal hands. Eight participants received FMRF on the face and neck and 11 participants received nonablative fractional laser treatment on the face. All participants successfully completed the study. There were 18 women, and 2 men. There were no observable differences between baseline characteristics between the participants.

The postprocedure course for both FMRF and NAFL showed an observable visual reduction in redness, irritation, and purpura after treatment with the QHREDGS peptide treatment regiment on Day 2 ± 1 (Visit 2). There were no observable differences in exudation, lentigines, or tone.

Change in skin color and appearance, ΔE^*, from immediately after the procedure to Day 2 ± 1 (Visit 2) was quantified by image analysis. QHREDGS peptide treatment regimen had a greater ΔE^* compared to the comparator regimen, suggesting that this treatment regimen supports a faster recovery in skin color and appearance.

Skin quality was quantified using image analysis and thresholding techniques. Skin texture was quantified by calculating the change in skin texture threshold value between the baseline visit (Visit 1) and Day 2 ± 1 (Visit 2). A lower skin texture threshold value (i.e., closer to 0) denotes a faster recovery to baseline levels of skin texture, as it implies there is little difference between the baseline images, and Day 2 ± 1 (Visit 2). QHREDGS treatment regiment had significantly improved skin texture as demonstrated by a lower skin threshold value. This suggests that the QHREDGS treatment regimen improves skin texture recovery following energy-based dermatological procedures.

In addition to skin texture, change in scabbing and erythema area from the first follow-up visit to baseline was quantified. Again, a lower value denotes a faster recovery in postprocedure eschar formation and erythema as it implies there is little difference between the two timepoints, and the postprocedure skin resembles baseline skin. The QHREDGS treated skin had significantly less eschar and erythema compared to the comparator regimen. Taken together, these data demonstrate that the QHREDGS peptide treatment regimen can improve postprocedure recovery time by reducing postprocedure skin texture abnormality, eschar and erythema by twofold compared to the comparator regimen.

Subjects reported 2× higher satisfaction with the QHREDGS peptide regimen at Visit 2 when asked to report on which side of their face their skin feels better. At Day 2 ± 1 FMRF patients were 600% more likely to report their skin feeling better on the Q-gel side of the face in comparison to control side and 500% more likely to report their skin looking better on the Q-gel side of the face in comparison to control side at the end of the study.

There was a 200% improved clinician rated recovery with QHREDGS peptide regimen over control for all procedures and 300% improved clinician rated recovery for FMRF at Day 2 ± 1. There were no significant adverse events reported.

Conclusion: In this study, the QHREDGS treatment regimen was demonstrated to be a safe skincare regimen that promoted accelerated recovery time and improved skin appearance following NAFL resurfacing and FMNF treatments on the face. The use of this regimen may lead to increased patient satisfaction as a result of a shortened recovery time and self-reported improvement in skin appearance.

SUBMISSION TITLE: RAMAN SPECTROSCOPY OF TOPICAL FINASTERIDE CAN DETERMINE THE POTENTIAL OF LASER-ASSISTED DRUG DELIVERY IN ANDROGENETIC ALOPECIA

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Background: Androgenetic alopecia is a widely prevalent diagnosis in men who suffer from progressive,

terminal hair loss on the anterior, middle, temporal, and vertex areas of the scalp. The pathophysiology of androgenetic alopecia involves a complex interaction between androgens in the setting of genetic predisposition, resulting in follicular miniaturization and reduction in terminal hair density. This condition also carries a significant yet variable psychosocial burden in affected individuals, with some experiencing a reduced quality of life even with clinically imperceptible hair loss. Despite its prevalence, the efficacy of available treatments is limited by various factors, such as patient compliance, topical drug penetration, and the chronic nature of the condition. The advent of laser-assisted drug delivery may help improve topical drug delivery of finasteride, a 5α-reductase inhibitor that slows down the production of dihydrotestosterone and stimulates hair growth. However, penetration and distribution of active pharmaceutical ingredients in tissues after a fractional ablative laser procedure are difficult to determine. Raman spectroscopy (RS) is a promising analytical technique that utilizes a laser beam to illuminate a sample to detect and measure small spectral shifts in scattered light and their corresponding vibrational spectra, providing a chemical 'fingerprint' unique to each molecule in the sample.

Study Design/Materials and Method: Samples were irradiated with a Raman-AFM-SNOM-TERS-Lifetime system (WITec Instruments Corp; Alpha 300 R + confocal Raman imaging spectrometer) at a 488 nm wavelength. Laser power of 18 mW was employed. Irradiated samples included finasteride 98% (HPLC) powder and specialty pharmacy topical finasteride formulation (ChemRx) with its gel vehicle as a control. The powder and gel formulations were placed on silicon wafers affixed to a glass slide to overcome the intrinsic fluorescence from the glass. Two scans at a resolution of 1 μm were acquired for the samples and analyzed using WITec Raman imaging software. The baseline was corrected for any fluorescence background.

Results: Spectroscopic experiments demonstrated numerous peaks for the pure powder of finasteride, ChemRx finasteride formulation, and its vehicle. Of the peaks found in both the powder and the formulation, the peak at 1450 cm^{-1} corresponding to C18H23-25 in-plane deformation was the strongest peak unique to the drug and not found in the vehicle, demonstrating that RS can differentiate formulated finasteride from its vehicle.

Conclusion: RS is a promising analytical method to assess topical finasteride penetration even at low concentrations of the active pharmaceutical ingredient. To monitor and quantify drug distribution in human skin after laser-assisted drug delivery, a number of new Raman-based imaging modalities, such as stimulated Raman spectroscopy and coherent anti-Stokes RS, are being investigated to enable RS of biological samples more effectively.

SUBMISSION TITLE: REDUCING BRUISING CAUSED BY COLLAGENASE CLOSTRIDIUM HISTOLYTICUM (CCH) INJECTIONS BY UTILIZING A NONINVASIVE APPLICATION OF SIMULTANEOUS RADIOFREQUENCY & TARGETED PRESSURE ENERGY

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Background: Cellulite has a high prevalence in postpubertal women [1] and occurs when multiple pathophysiological factors result in altered skin topography characterised by dimpled appearance of the skin surface. Collagenase clostridium histolyticum-aaes (CCH) is indicated as a subcutaneous injection for treatment of cellulite [2], which is associated with significant bruising (ecchymosis) in the injection-site [3]. Women who received CCH-injections on the buttocks had a four-times higher bruising rate than women treated with placebo [4]. The objective of this study is to investigate the effects of CCH combined with a noninvasive anticellulite device that administers simultaneous targeted pressure energy (TPE) and radiofrequency (RF), on cellulite severity in the buttocks and thigh.

Study Design/Materials and Method: Five women suffering from cellulite were enrolled in this pilot study to assess the long-term effects of CCH combined with simultaneous TPE + RF treatment. During a 21 day cycle, subjects received one CCH treatment followed by two TPE + RF treatments on the buttocks. After repeating the cycle twice, patients were evaluated 1-month (Day 81) and 3 months (Day 141) after the last treatment. At baseline anthropometric data was collected, cellulite severity was assessed by Clinician Reported Photonumeric Cellulite Severity Scale (CR-PCSS), and subjects filled a self-assessment questionnaire. At the 1- and 3-month follow-up visits, the investigator evaluated changes in the treatment area based on the Global Aesthetic Improvement Scale (GAIS) and the CR-PCSS. The patients completed the Cellulite assessment and Satisfaction questionnaire. Pretreatment and posttreatment digital photographs of the buttocks and injection sites were taken at all treatments and follow-up visits.

Results: Eighty-three percent (after treatment), 81% (1-month) and 80% (3-month follow-up) of subjects were satisfied with results. At the 1-month follow-up four subjects had GAIS score ≥4, two subjects had ≥1 level of improvement in CR-PCSS score while two remained at their baseline score. However, at the 3-months follow-up, $n = 4$ subjects had GAIS score 4 (improved), $n = 1$ had a score 5 (much improved), and the average score was 4.25.

The average CR-PSS score reduced from baseline of 2.25 (mild) to 1.5 (almost none) at 3 months posttreatment. Photograph evaluation showed that the bruising caused by CCH injections completely dissipated within 14 days following the TPE + RF treatments to the buttocks. No adverse events related to the TPE + RF device were observed.

Conclusion: The noninvasive therapy utilising simultaneous TPE and RF modalities has been proven effective for reducing cellulite and mitigating skin laxity 5–7. Combined TPE + RF offers a pain-free solution to patients with bruising, the most commonly reported adverse event 8. The TPE + RF therapy itself is safe and was not associated with any adverse effects. Moreover, it could motivate patients who seek CCH-buttock-cellulite treatment (or other similar procedures) 9, 10 but are deterred by this injection site bruising. The combined treatment with TPE + RF and CCH modalities resulted in high patient satisfaction and objectively improved the appearance of cellulite. The consecutive application of TPE + RF energies noticeably accelerated the dissipation of bruising post-CCH injection.

SUBMISSION TITLE: RETROSPECTIVE ANALYSIS OF UNITED STATES LITIGATIONS INVOLVING DERMATOLOGISTS FROM 2011 TO 2022

Authors: Young Lim; Ray Jalian; Mathew Avram

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Background: Navigating the legal system is an unfortunate necessity for many practicing physicians. Due to the significant emotional and financial impact of a lawsuit and its potential damage to the clinician's reputation, a growing number of physicians currently resort to defensive medicine, whereby the overcautious provider will order unnecessary diagnostic tests or avoid high-risk procedures and patients with prior complications. Many providers cite fear of malpractice litigation as a primary factor influencing their care delivery, but strategies to tackle medico-legal challenges are rarely taught in medical education. We performed a retrospective analysis of all litigations against practicing dermatologists in the United States between 2011 and 2022, identifying the basis of the malpractice claims, the demographic of the defendant dermatologists, and the claim outcomes. A clear understanding of the characteristics of prior litigations in dermatology will help mitigate similar errors in practice, and promote safer patient care along with reduction in medical liability.

Study Design/Materials and Method: We employed two large legal data repositories: WestlawNext (www.westlaw.com), which houses primary legal sources including both state and federal cases, trial court documents, jury verdicts, and settlements, used routinely by practicing attorneys for legal research and information, and Lexis from LexisNexis (www.lexisnexis.com), which is also a primary database containing more than 60,000 legal, news, and public records, marketed to government, nonprofit, and academic agencies conducting research.

We queried both state and federal cases in which a dermatologist was the defendant. Exclusion criteria included litigation that did not involve patient care (e.g., staff disagreements or business-related lawsuits), cases in which the dermatologist was the plaintiff, and cases in which a dermatologist was involved as a third-party but not as a defendant. Duplicates between the two repositories were also removed.

Results: We identified a total of 54 (43 state and 11 federal) lawsuits between 2011 and 2022 in which a practicing dermatologist or dermatology group practice was the defendant. Of the 54 claims, 35 were involved male dermatologists (64.8%), 23 of which were filed by female plaintiffs (65.7%) and 12 by male plaintiffs (34.3%). Twelve cases involved female dermatologists (22.2%), seven from female plaintiffs (58.3%) and five from male plaintiffs (41.7%). The remaining cases had two or more dermatologists as defendants, or did not specify a gender. Most cases (30, 55.6%) were dismissed prior to trial or judgment made for the physician. Of the 24 cases in which judgment was made for the plaintiff (44.4%), payout information was available for only five cases, and ranged from $15,000 (injury from laser) to $1,950,000 (delayed diagnosis of malignant melanoma). In 49 of the 54 total cases, the defendant dermatologist was in private practice (90.7%).

There were 22 cases filed by patients for delayed or incorrect diagnoses of something malignant as benign (40.7%). In five of these cases, the diagnostic error resulted in death, all secondary to metastases of malignancy (four from metastatic melanoma, one from squamous cell carcinoma). In 16 of the cases, the error led to an unnecessary procedure, including larger excisions or debridement of infected tissue. Five cases of error resulted in limb or digit amputations, and one led to kidney transplantation.

There were 27 cases of accidental injury (50%), where patients sustained an unintended or unexpected injury or postprocedural complication, the majority of which were from elective, cosmetic procedures. Of these 18 cosmetics-related cases, burns from laser procedures were associated with the most lawsuits, followed by burns from chemical peels. Notably, four (16%) cases were due to patients falling off the exam table.

Five cases (9.3%) were from patients claiming that the provider failed to communicate important information. These included a lack of informed consent of a surgical procedure (3), side-effects of isotretinoin (1), and failure

to disclose conflict of interest with a prescribed medication (1).

Conclusion: While lawsuits from patients against dermatologists largely involve injury from elective procedures, clinicians should practice caution regarding missed diagnoses, and ensure critical information is shared with patients to safeguard against easily-avoidable litigation. Being a male provider, in a private solo practice, performing an elective cosmetic procedure on a female patient, bears the highest risk for a malpractice lawsuit.

SUBMISSION TITLE: SAFETY AND EFFICACY OF ELECTRICAL MUSCLE STIMULATION COMBINED WITH 1064 NM DIODE LASER, PULSED ELECTROMAGNETIC FIELD AND VACUUM ASSISTED RADIO FREQUENCY FOR NONINVASIVE BODY CONTOURING AND FAT REDUCTION

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Background: There is a population of patients who are interested in not only reducing subcutaneous fat for body contouring, but also have a desire to tone the underlying musculature. The purpose of this study was to evaluate safety, efficacy and patient satisfaction of 1064 nm diode laser, combined with electrical muscle stimulation (EMS), vacuum assisted radio frequency and pulsed electromagnetic field (RF and PEMF) energies, for noninvasive abdominal fat reduction and body contouring.

Study Design/Materials and Method: Subjects ≥18 years of age, requesting noninvasive EMS treatment and/or lipolysis of the abdomen and flanks were enrolled into a study where they received 3 monthly laser + 5 bi-weekly EMS + RF/PEMF treatments; the EMS + RF/PEMF group received 5 bi-weekly treatments, and the EMS alone group received 6 weekly treatments. Efficacy was assessed by physician Global Aesthetic Improvement Scale (GAIS), abdominal circumferential and skinfold measurement, Body Satisfaction Questionnaire (BSQ) and Subject Satisfaction Survey (SSS). Additionally, adipose and muscle measurements were made from Ultrasound (US) and Magnetic Resonance Imaging (MRI).

Results: Safety was demonstrated for all study arms with no device- or procedure-related adverse events. Abdominal reduction as measured using US and skin calipers showed up to a 30% reduction, with a mean reduction of 11%. Abdominal circumference was reduced by 1.4%. Adipose reduction, as measured by US, Skinfold and Circumference, was statistically significant. All subjects showed improvement as determined by an increase in physician GAIS evaluation. The vast majority (67%) of subjects were dissatisfied with their body before the study; after treatment two-thirds (67%) of subjects were at least "Satisfied," while 25% of all subjects were "Very Satisfied."

Conclusion: Improvement in both objective and subjective endpoints was shown in the combined data of all study Arms. Adipose reduction as measured by US, Skinfold and Circumference was significant. There was a clear overall improvement at follow-up compared to baseline photographs, as evaluated by the study physician. Subjects showed satisfaction with their body appearance after treatment.

SUBMISSION TITLE: SINGLE TREATMENT FACIAL RESURFACING WITH A NOVEL ABLATIVE FRACTIONAL 2910 NM FIBER LASER

Authors: Taryn Murray; Shelby Kubicki; Heather Richmond; Paul Friedman

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Background: Since their introduction, ablative fractional lasers have been considered the gold standard for facial resurfacing. By creating columns of thermal injury, the intervening areas of untreated skin serve as a reservoir for stem cells and fibroblasts to remodel collagen and elastin and ultimately improve the tone, texture and appearance of the skin. These lasers also offer an improved safety profile compared to traditional ablative lasers, though given their fractional nature, they typically require more treatment sessions. In this study, we evaluate a new novel 2,910 nm erbium-doped fluoride fiber laser (UltraClear; Acclaro Medical) for full face resurfacing with a single treatment session.

Study Design/Materials and Method: Patients presenting for facial photoaging and rhytides underwent a single treatment session utilizing the 2910 nm erbium-doped fluoride fiber laser. Topical benzocaine/lidocaine/tetracaine was applied to the face for 45 minutes before treatment. The entire face was treated with one to three

passes using both superficial and deep laser modes. Patients were asked to rate the average level of pain during the treatment on an 11-point scale ranging from 0 (no pain) to 10 (worst possible pain). Photographs were taken at baseline and 6–8 weeks following treatment. Evaluation of pretreatment and posttreatment photos was completed by three physician reviewers. Reviewers were asked to rate the degree of improvement using a 5-point Global Aesthetic Improvement Scale (GAIS) as follows: (0) no improvement, (1) minor improvement, (2) moderate improvement, (3) marked improvement, (4) very significant improvement.

Results: A total of 10 patients underwent treatment. Nine patients were female and one patient was male. The average patient age was 64.5 years old. Fitzpatrick skin types included II ($n = 2$), III ($n = 6$), and IV ($n = 2$). Side effects were transient and included erythema, edema, and crusting. Patients reported an average level of discomfort of 6.2. Evaluation of digital images revealed an average GAIS score of 2.43.

Conclusion: Our preliminary results demonstrate that treatment with a novel 2910 nm erbium doped-fluoride fiber laser is safe and effective in treating photodamage and rhytides. It also offers less discomfort and shorter downtime compared to conventional fractional ablative lasers. Further studies, including the role of multiple treatment sessions, are needed to better understand efficacy, durability and optimal treatment settings and are currently ongoing at our center.

SUBMISSION TITLE: SINGLE TREATMENT SCAR RESURFACING WITH A NOVEL ABLATIVE FRACTIONAL 2,910 NM FIBER LASER

Authors: Taryn Murray; Shelby Kubicki; Emily Guo; Heather Richmond; Paul Friedman

Dermatology & Laser Surgery Center, Houston, TX; UTHealth Science Center at Houston/MD Anderson Cancer Center, Houston, TX; Dermatology & Laser Surgery Center, Houston, TX; Dermatology & Laser Surgery Center, Houston, TX; Dermatology & Laser Surgery Center, Houston, TX; McGovern Medical School, University of Texas MD Anderson Cancer Center, Houston, TX; Weill Cornell Medical College, Houston Methodist Hospital, Houston, TX

Background: Ablative fractional lasers are considered the gold standard for treating many types of scars. These lasers stimulate fibroblasts to remodel collagen and elastin within the dermis, which alters the tone, texture and collagen contraction within scars, ultimately resulting in marked improvement in the appearance. A new mid-infrared fractional ablative laser operating at peak water absorption causes minimal residual thermal damage resulting in potentially fewer side effects, little to no pain and shorter downtime compared to traditional ablative and fractional ablative lasers. In this study, we investigate a new novel 2910 nm erbium–doped fluoride fiber laser (UltraClear; Acclaro Medical) for the improvement of atrophic and hypertrophic scars of various etiologies.

Study Design/Materials and Method: Patients presenting for scars of varying etiologies were treated with a single session of the 2910 nm erbium-doped fluoride fiber laser. Treatment was performed using multiple passes with superficial and deep modes or a single pass with a combination mode. Photographs were taken at baseline and 6–8 weeks following treatment. Evaluation of pretreatment and posttreatment photos was completed by three physician reviewers. Reviewers were asked to rate the degree of improvement using a 5-point Global Aesthetic Improvement Scale (GAIS) as follows: (0) no improvement, (1) minor improvement, (2) moderate improvement, (3) marked improvement, (4) very significant improvement.

Results: A total of 10 patients underwent treatment. Patient ages ranged from 13 to 59 years old. Scar types included atrophic ($n = 5$) and hypertrophic ($n = 5$). The etiologies included surgical scars ($n = 4$), acne scars ($n = 2$) and traumatic scars ($n = 4$). Fitzpatrick skin types included II ($n = 1$), III (n = 5), and IV ($n = 3$). Adverse effects were transient and included erythema, edema and point-point hemorrhage. Evaluation of digital images revealed an average GAIS score of 2.2.

Conclusion: Our preliminary results show that treatment with a novel 2910 nm erbium-doped fluoride fiber laser is safe and effective in treating atrophic and hypertrophic scars of various etiologies. Further studies, including the role of multiple treatment sessions, are needed to better understand efficacy, durability and optimal treatment settings and are currently ongoing at our center.

SUBMISSION TITLE: SOCIAL MEDIA IN AESTHETICS: ANALYSIS OF THE USERS BEHIND THE TOP LASER POSTS

Authors: Patricia Richey; Margaret Funk; Mathew Avram

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Background: Within the aesthetic realm, the influence of social media is quite prominent, with a

growing percentage of patients using this technology to seek out healthcare recommendations and education. To ascertain the most accurate representation of what our patients may encounter on social media, we sought to characterize the top posts on the most popular visually-based social media platform (Instagram).

Study Design/Materials and Method: To determine the most trafficked and viewed Instagram posts, the most reliable and accurate method is to view the "top" hashtags, which are labels that users can attach to their posts. We queried Instagram with variations of hashtags related to lasers and aesthetics to determine which hashtags had the greatest number of posts associated with them. Instagram then automatically selects the "top" posts for a specific hashtag per their algorithm (which reportedly takes into account user engagement, including the number of likes and comments). We analyzed the content of the top 100 posts associated with each of the following hashtags: #laserhairremoval, #lasertattooremoval, #laserresurfacing, #cosmeticdermatology. We excluded duplicate posts and posts in a language other than English. In total, 400 posts were reviewed. We made note of whether the user was a physician (and if so, which specialty) or nonphysician.

Results: The majority (66%) of the 400 posts (100 posts per hashtag) reviewed were posted by nonphysicians or medical spas with nonphysician injectors (Table 1), but this trend was more pronounced in the #lasertattooremoval and #laserhairremoval groups. Of the posts written by physicians or physician groups, the most common specialties featured were Dermatology (104 posts) and Plastic Surgery (26 posts). Two users identified themselves via their Instagram handles as physicians (utilizing "dr" or "doctor") but were not. One nonphysician user's biography included the phrase "ablative laser specialist."

Conclusion: At a time when patients are increasingly turning to social media for healthcare recommendations and education, the vast majority of the "top" content related to lasers is being provided by nonphysicians.

SUBMISSION TITLE: SPLIT-FACE STUDY TO EVALUATE EFFICACY OF CRYOMODULATION FOR REDUCTION OF PAIN AND INFLAMMATION AFTER NONABLATIVE FRACTIONAL RESURFACING

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Background: Nonablative fractional lasers, a common treatment modality for rejuvenation of photoaged skin, are associated with acute posttreatment side effects including pain, erythema, and edema. Cryomodulation, or the delivery of controlled cooling to downregulate inflammatory processes in the skin, has been proposed to mitigate acute side effects following nonablative fractional laser treatment. A new controlled cooling device (Glacial Rx®; R2 Technologies) has been developed to deliver cryomodulation for a range of different indications. In this clinical study, we evaluate the device for reduction of postlaser side effects.

Study Design/Materials and Method: A single-blind, prospective, randomized, split-face study was conducted to assess the efficacy of the controlled dermal cooling device for reduction of pain, edema, and erythema following fractional laser treatment with the 1550 nm erbium-doped fiber laser (EDFL) or a combination of the 1550 nm EDFL and the 1927 nm thulium fiber laser (TFL). Subjects received full-face

Table 1. Breakdown of top social media posts by hashtag and "top" 100 posts associated with the most popular hashtags.

Hashtag	Total posts on Instagram (n)	Posts by nonphysicians (%)	Posts by dermatologists (%)	Posts by plastic surgeons (%)	Posts by other specialties (%)
#lasertattooremoval	272 K	98	1	1	0
#laserhairremoval	2.2 M	91	3	3	3*
#laserresurfacing	64.9 K	44	31	22	3**
#cosmeticdermatology	228 K	31	69	0	0

M = Million

K = Thousand

* Internal Medicine (2), Cardiology (1)

**Internal Medicine (1), Family Medicine (1), Gynecology (1)

nonablative fractional resurfacing treatment, and were randomized to receive a 10-minute controlled cooling treatment to either the left or right side of the face immediately following the laser treatment. Subject pain ratings were recorded immediately postlaser treatment and immediately postcryomodulation treatment. Photos were taken immediately postcryomodulation treatment and at 2-day follow up. At 2-day follow up subjects were also surveyed for reduction of side effects and treatment satisfaction. Blinded review of photographs by two physicians was conducted to assess efficacy based upon correct identification of the cryomodulation-treated side of the face.

Results: Ten female subjects were enrolled at one investigational site; eight subjects were treated using a dual 1550-nm EDFL and 1927-nm TFL, and two subjects were treated using a 1550-nm EDFL. Subject ages ranged from 35 to 66 with Fitzpatrick skin types I–V. The average pain score for subjects immediately postlaser was 5.15 on a scale of 0 to 10 (0 = no discomfort and 10 = very severe discomfort). Immediately following cryomodulation, the average pain score on the side of the face treated with the cooling device was reduced by 69%, to an average of 1.6. The untreated side of the face was reduced by 19%, to an average of 4.2. At the 2-day follow up, 70% of subjects reported a noticeable difference in edema and 50% reported a noticeable difference in erythema between the treatment and control sides of the face. The average subject satisfaction score for the cryomodulation treatment was 4.2 on a scale of 1 to 5 (1 = not satisfied, 2 = slightly satisfied, 3 = somewhat satisfied, 4 = satisfied, 5 = very satisfied). All subjects (100%) indicated that they would elect to undergo the cryomodulation treatment again, and would recommend the treatment to others. Two blinded physician reviewers were successful in identifying which side of the face had received treatment with the cryomodulation device in 70% of subjects' posttreatment photographs.

Conclusion: The results of this split-face study support the efficacy of a cryomodulation device for reduction of pain, edema, and erythema following nonablative fractional laser treatment. Cryomodulation was delivered in a simple 10-minute procedure and yielded high patient satisfaction. Additional clinical studies are underway at our center to evaluate cryomodulation as an adjunct to other common dermatologic procedures, and to assess longer term impact on procedure outcomes.

SUBMISSION TITLE: SURGICAL DEBULKING AND ABLATIVE FRACTIONAL LASERS: A MINIMALLY INVASIVE METHOD FOR TREATMENT OF BASAL CELL CARCINOMA IN GORLIN SYNDROME

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Background: Gorlin syndrome, also known as basal cell nevus syndrome, is a rare genetic disorder that causes patients to develop multiple basal cell carcinomas (BCCs) and other extracutaneous manifestations. The management of BCCs in patients with Gorlin syndrome can be more challenging than in patients with sporadic BCCs due to factors such as extensive disease with numerous BCCs of variable histologic type, treatment selection, lifelong management, treatment resistance, surgical fatigue, the need to decide between curative and palliative approaches and the potential for adverse effects of systemic treatments. Patients with Gorlin syndrome may present with numerous BCCs appearing as early as the first year of life and develop by median age of 20 years, making the standard treatment approach of surgery with clear margins of every lesion impractical due to the potential for morbidity and disfigurement. Additionally, systemic medications such as smoothened inhibitors of the hedgehog pathway may have intolerable toxicities and are contraindicated in patients trying to have children. The BCCs associated with Gorlin syndrome can also cause morbidity, disfigurement, pain, and social and emotional impacts, leading some patients to request removal of particularly painful or bothersome BCCs for quality-of-life reasons. Herein, we propose a new approach of using surgical debulking followed by ablative fractional laser resurfacing for tissue destruction and drug delivery purposes in patients with Gorlin syndrome. This approach may be followed by topical therapies such as imiquimod 5% or 5-fluorouracil 5% cream.

Study Design/Materials and Method: This study employed a treatment protocol for treating BCCs in Gorlin syndrome that met at least one of the following criteria (Table 1) and involved debulking using shave excision, followed by fractional laser ablation using the DEKA SmartXide DOT CO_2 laser (28 W, 1300 microseconds dwell time, 250 μm spacing, 4 pulse stacking) with a dot pitch of 600 μm to minimize demarcation lines. The treated area was curetted after each pass of the laser for a total of 3 passes. Additional treatment with imiquimod and/or 5-fluorouracil was administered. Follow-up visits were scheduled at approximately monthly intervals.

Results: Combination treatment consisting of surgical debulking followed by fractional laser ablation and curettage is a safe, effective and tissue sparing means for treating BCC in Gorlin syndrome patients. The procedure was well-tolerated and resulted in minimal to no pain or adverse effects. Postprocedure, patients received 5-fluorouracil or imiquimod as additional treatment without adverse effect. Follow-up at 45 days showed no evidence of tumor recurrence (Figures 1–3).

Conclusion: Treatment of extensive BCC burden in Gorlin syndrome often requires a multimodal

approach, including surgery, electrodessication and curettage, topical and systemic treatments, laser therapy, and cryosurgery. This treatment modality, which combines debulking shave excision with ablative fractional laser surgery with curettage in-between laser passes, followed by topical treatment, has several advantages. It can be performed in a single office visit, allowing for the treatment of multiple lesions in a single encounter, and may have reduced morbidity compared to more extensive procedures. Ablative fractional laser surgery facilitates destruction, allows for modification of the settings based on clinical assessment of tumors, and enhances drug uptake with prolonged drug deposition in the skin1. However, it is important to note that this method does not guarantee clear margins as assured during Mohs surgery and may not distinguish between indolent and aggressive forms of BCC at the time of the procedure. Overall, this combined approach of surgical debulking and ablative fractional laser with curettage in-between laser passes, followed by topical treatments, can be an effective option even as a "field" therapy for multiple BCCs in Gorlin syndrome.

SUBMISSION TITLE: THE EFFECTS OF LONG-PULSED ALEXANDRITE LASER THERAPY ON FACIAL REDNESS AND SKIN MICROBIOTA COMPOSITIONS IN ROSACEA: A PROSPECTIVE, MULTICENTRE, SINGLE-ARM CLINICAL TRIAL

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Background: Rosacea is a chronic skin disorder characterised by abnormal neurovasculature and inflammation in the central region of the face. The efficacy of pulsed-dye laser and intense pulse light treatments for rosacea have been demonstrated in several clinical trials. However, the efficacy of long-pulsed alexandrite laser (LPAL) therapy alone to relieve facial redness in rosacea has not yet been studied. This study aimed to evaluate the efficacy of LPAL therapy on facial redness in rosacea and assess changes in skin microbiota composition.

Study Design/Materials and Method: Subjects with rosacea ($n = 21$, mean age: 39.2 ± 11.3 years) were recruited from two medical institutions and received monthly LPAL treatments (Clarity II™; Lutronic Corp.) for 3 months. At each visit, clinical photographs were taken, and erythema was measured using a spectrometer. At the initial and final visits, the Dermatology Life Quality Index (DLQI) and Skin Sensitivity Questionnaire (SSQ) were evaluated. Skin swabs were obtained, and facial microbiome composition was analysed using 16S rRNA amplicon sequencing.

Results: After three LPAL treatment sessions, the average facial erythema index, measured using a Mexameter®, decreased significantly, from 360.0 ± 96.7 at baseline to 312.0 ± 94.5 at the final visit ($p < 0.05$). Of the 21 subjects, 16 reported a greater than 50% improvement after treatment. The DLQI and SSQ showed significant improvements in symptoms. Skin microbiome diversity was altered significantly, particularly the representations of the genera *Clostridium*, *Lawsonella*, *Bacteroides*, and *Lactobacillus*.

Conclusion: LPAL therapy alone showed favourable efficacy for the treatment of facial redness in rosacea, with some impacts on the skin microbiota composition.

SUBMISSION TITLE: THE IMPACT OF OPTICAL COHERENCE TOMOGRAPHY ON SURGICAL MARGIN ASSESSMENT AND FOLLOW UP OF BASAL CELL CARCINOMA

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Background: Basal cell carcinoma (BCC) is the most common form of nonmelanoma skin cancer, with increasing incidence worldwide [1]. Of the several therapeutic options, electrodessication and curettage and conventional surgical excision remain the most commonly adopted interventions [2]. However, pulse dye and long pulsed neodymium-doped yttrium aluminum garnet (Nd:YAG) lasers have emerged as promising alternative therapies for the treatment of non-aggressive subtypes of BCC [3]. The determination of accurate tumor margins is critical for any of these procedures to provide a high cure rate. Clinical assessment of preoperative margins remains challenging due to the subtle visual differences between cancerous and normal skin [2]. Thus, any device that might enhance the preoperative delineation of BCC margins is of clinical importance. Noninvasive diagnostic strategies such as

optical coherence tomography (OCT) have been shown to improve the diagnostic accuracy and margin assessment of BCC [4]. The aim of this study is to examine the impact of OCT on margin assessment of BCCs treated with long-pulsed Nd: YAG laser.

Study Design/Materials and Method: Randomized multicenter, open-label trial of patients (aged ≥18 years) with biopsy proven superficial and nodular BCC subtypes were enrolled from March 2, 2021 to September 30, 2022 at two sites in the United States (University of California, Irvine, CA; Henry Ford Health). All patients were treated with the long-pulsed 1064 nm Nd: YAG laser (ScitonTM). Patients were randomized to receive either the "conventional" 120–140 J/cm^2 nonoverlapping scanned pulses or the Controlled Hyperthermic and Monitored Protocol (CHAMP) method using a thermal imaging camera (Teledyne FLIR™). Initial evaluation of tumor borders was based on visual inspection with the naked eye, guided by dermoscopic evaluation for every lesion at each visit. Tumors were marked with a 5 mm margin around the clinical edge of the tumor using a red-inked pen. Imaging was performed using OCT (VivoSight Dx; Michelson Diagnostics). The first scan with OCT was performed in the center of the lesion, which enabled measurement of tumor thickness. Thereafter, the red pen margins were assessed with OCT in at least four different positions relative to lesion center: at 3, 6, 9, and 12 o'clock. Wherever OCT scanning of these margins demonstrated persistence of tumor, an additional red pen margin was added. Tumor clearance following laser treatment was assessed by OCT at follow-up visits at 3–12 months. Residual BCC identified by OCT during follow-up was retreated with laser therapy. Where no tumor was demonstrated by OCT, treatment sites were excised for histological confirmation of tumor clearance.

Results: Seventy-three BCC lesions from 60 patients (32 men [53.3%]; 28 [46.6%] women; mean [SD] age, 66.5 [10.29] years) were evaluated. Four (6.67%) subjects withdrew from the study. BCC subtype distribution was superficial for 56 lesions (76.7%), mixed superficial and nodular for 12 (16.4%), and nodular for 4 (5.5%). The most commonly diagnosed sites were trunk (37/50%) and upper extremities (26/35.6%). Eleven patients had more than one lesion (number of lesion range: 2–3) enrolled in the study. Lesion diameter ranged from 0.5 to 2 cm. All centrally scanned lesions contained BCC features (e.g., epidermal protrusion into dermal layer, disrupted epidermal-dermal junction, ovoid bodies with dark perimeter). During the initial visit, OCT examination identified the presence of BCC at the lateral margins in 10 (13.7%) out of the 73 evaluated lesions. The median change in lesion size was 3.5 mm (LQI-UQI: 2.25–5.75 mm). Of these lesions with modified margins, histologic confirmation is currently available for three, all of which were free of tumor. Of the total number of lesions seen in follow-up, three (3/73), while clinically negative for residual tumor, displayed morphological features of BCC on OCT imaging, resulting in repeat laser treatment. To date, only one of these (33%) lesions has been excised, which demonstrated no histological evidence of BCC.

Conclusion: Use of OCT imaging has been previously proven to diagnose BCC in vivo with high accuracy and specificity [5]. Our preliminary findings demonstrate the utility of OCT as a noninvasive preoperative margin assessment tool in the treatment of BCC for nonsurgical interventions, in this case, Nd: YAG laser. As demonstrated in this interim report, OCT imaging can also aid in the monitoring of treatment outcomes at each visit. As such, OCT could be used to estimate subclinical extension and presurgical margins in regular clinical practice and should improve the detection of residual tumor after any treatment for BCC.

SUBMISSION TITLE: THE IMPROVEMENT OF QUALITY OF LIFE IN FEMALE PATIENTS AFTER CHILDBIRTH BY HIFEM WITH SYNCHRONIZED RADIOFREQUENCY FOR THE STRENGTHENING OF CORE MUSCLES

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Background: Women's bodies undergo many changes and challenges after pregnancy and postpartum. After childbirth, regaining the strength of core muscles is important in preventing incontinence, pelvic floor disorders, and back pain issues. This study investigated the effect of abdominal HIFEM and synchronized RF with consecutive pelvic (standalone HIFEM) treatments for core muscle strengthening and improving quality of life.

Study Design/Materials and Method: Thirty-six female subjects (31–42 years, BMI 22.7–34.5 kg/m^2) were enrolled in this multicentre, single-arm, open-label, interventional study. The treatment schedule consisted of seven visits, four HIFEM + RF abdominal procedures spaced 5–10 days apart, and six standalone HIFEM pelvic floor procedures spaced 2–4 days apart. Both procedures were used consecutively at the first, third, and fifth treatment visits, the HIFEM + RF was applied before HIFEM-only treatment. The follow-up visits were scheduled 1 and 3 months after the treatments. The primary evaluation included measuring the core strength by with a pressure biofeedback device and waist circumference. 5-point Likert scale questionnaires documenting patients' satisfaction and comfort were used, including a 10-point visual analog pain scale (VAS).

Results: $N = 32$ patients completed the 3 months follow-up evaluation. The core muscle strength showed a 25.04%

(+24.07 ± 22.14 mmHg, $p < 0.05$) increase at 1-month follow-up, with a 29.04% (+26.58 ± 28.45 mmHg, $p < 0.05$) increase at 3-month follow-up. The waist circumference was reduced by 3.12 ± 2.99 cm and 4.61 ± 3.48 cm (both $p < 0.001$) at 1 and 3 months follow-up, respectively. Patients found the combined treatment comfortable and painless (VAS = 2.6). According to 5-point Likert-scale satisfaction questionnaires evaluated 3 months post-treatment, 97.1.% of patients reported stronger core muscles (average score 4.3 ± 0.6), 94.1% of subjects felt a stronger pelvic floor (average score 4.20.6), and 88.2% of subjects had improved physical performance during exercise (average score 4.1 ± 0.6). Furthermore, 91.2% of patients reported being more comfortable in their clothes (average score 3.7 ± 0.5), while all patients stated they were able to perform daily routine/activities without issue and spend quality time with their children (average score 4.5 ± 0.5). No adverse events or side effects were observed.

Conclusion: Three-month data analysis outcomes indicated that the treatment regimen of consecutive HIFEM + RF and HIFEM-only effectively improves core and pelvic floor strength, and function, through stimulation of abdominal and pelvic floor muscles. This resulted in improved patients' quality of life along with high satisfaction.

SUBMISSION TITLE: THE QUANTITATIVE ANALYSIS OF LOW CONCENTRATION (2%) ALA-PDT ASSISTED WITH Q-SWITCH 1064 NM FRACTIONAL HAND-PIECE ND: YAG LASER FOR ACNE VULGARIS TREATMENT

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Background: Acne vulgaris is a common, chronic inflammatory disease of the pilosebaceous unit. Conventional 5-Aminolevulinic acid-photodynamic (ALA-PDT) therapy (10%–20%), a noninvasive technique with phototoxicity, has been widely applied for moderate-to-severe and severe acne. But the longer downtime for adverse effects, such as intolerable pain, burning and itching sensation, erythema, edema and postinflammatory hyperpigmentation, can interrupt the patients' daily life. Laser with fractional thermophotolysis can obviously increases the drug permeation. The aim of this study is to investigate the effects of nonablative Q-switched 1064 nm Nd:YAG fractional laser-assisted ALA-PDT with low concentration (2%) on acne vulgaris.

Study Design/Materials and Method: Enrolled patients were randomly assigned to two groups. One group received combined therapy of 2% ALA-PDT and nonablative Q-switched 1064 nm Nd:YAG fractional laser, and the other received only 2% ALA-PDT. Patients in each group had received three-session treatments with 4-week interval (Weeks 0, 4, and 8). Sebum secretion, melanin index, erythema index and transepidermal water loss (TEWL) were assessed at Week 2, 8, 12, and 24. VISIA® skin image system score and global aesthetic improvement scale (GAIS) were also evaluated for clinical improvements.

Results: Twenty-four participants were enrolled, and they were evenly randomized to two groups (12 vs. 12 in each). Significant improvement in sebum secretion was noted in combined therapy group than monotherapy group at Week 12 (37.5% vs. 16.3% of reduction, $p < 0.05$), and the effect would still be noted until Week 24 (18.3% vs. 17.4% of reduction). More adverse effects including melanin index (16.9% vs. 12.5% of increment at Week 12) and erythema index (4.1% vs. 2.7% of increment at Week 24) were noted in combined group than monotherapy group, whereas melanin deposition on whole face average improved eventually at Week 24 (14.6% vs. 18.8% of reduction). As for TWEL, no significant difference was noted during the follow-up. For VISIA® skin analysis, patients in combined group had better percentile ranking for outcomes in porphyrins and red light images. There were no significant differences in GAIS at the end of follow-up between each group, and combined group had higher proportion who experienced satisfaction at Week 2.

Conclusion: With assistance of fractional laser, low concentrations (2%) of 5-ALA can provide effective phototoxic reactions in treating acne vulgaris. The satisfaction of patients is high with acceptable adverse effects.

SUBMISSION TITLE: THE SIMULTANEOUS APPLICATION OF HIFEM WITH SYNCHRONIZED RADIOFREQUENCY FOR THE STRENGTHENING OF CORE MUSCLES AND QUALITY OF LIFE IMPROVEMENT

Authors: David Kent

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Background: The core muscles, such as the abdominal and pelvic floor muscles (PFM), play a significant role in proper posture and protection of the inner organs, with pelvic floor muscles controlling the bladder and bowel, and assisting in sexual function. Deconditioning of core muscles increases the predisposition to injury, incontinence, and sexual dysfunction and worsens the quality of life. As a monotherapy, HIFEM effectively strengthens the PFM and, in synergy with radiofrequency (RF), also the abdominal muscles. Aim of this

study is to investigate the efficiency of the combined use of abdominal and pelvic HIFEM treatments on core muscle strengthening and improving quality of life.

Study Design/Materials and Method: Thirty-nine patients (60–75 years, 19.7–33.9 kg/m^2, skin type I–V) were enrolled. The treatment schedule consisted of four HIFEM + RF abdominal procedures spaced 5–10 days, with six standalone HIFEM procedures on the pelvic floor spaced 2–4 days. Therefore seven ($n = 7$) treatment visits were scheduled, while at the first, third, and fifth treatment visits, both procedures were used consecutively starting with HIFEM + RF. The changes in the core strength were measured by a biofeedback device. The secondary outcomes included waist circumference measurements, a 5-point Likert scale Satisfaction and Therapy comfort questionnaire with a 10-point visual analog pain scale.

Results: The evaluation of the 3-month data ($n = 38$) from the biofeedback device showed an increase in core muscle strength by 36.5% (+30.7 ± 17.0 mmHg). The evaluation of secondary outcomes showed a waist circumference reduction of −3.1 ± 14.7 cm at the 3-month visit, with 89% of patients being able to get up from sedentary positions more easily, 76% were able to perform daily activities better, and 92% were satisfied with the treatments and would recommend the treatment to their family and friends. Additionally, patients found procedures comfortable (4.0 ± 0.8 points on a 5-point Likert scale) and reported only mild pain (2.5 ± 2.1 points on 10-point pain scale). No serious adverse events or side effects occurred.

Conclusion: The evaluation indicates a high efficiency of HIFEM + RF and HIFEM procedures in strengthening of the core muscles after consecutive application to the abdomen and pelvis. The questionnaires revealed high satisfaction with the results and patient comfort during the treatments.

SUBMISSION TITLE: THE TREATMENT OF SARCOPENIA BY CONSECUTIVE APPLICATION OF STANDALONE HIFEM PROCEDURE WITH SIMULTANEOUS HIFEM + RF PROCEDURE

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Background: The gradual loss of muscle mass, known as sarcopenia, contributes to muscle functional decline and reduced mobility, which limits one's independence. The core (abdominal and pelvic floor) muscles are essential for functional movements. To prevent a decline in muscle function and its deconditioning, an effective noninvasive solution for enhancement of muscle strength may be utilized. Therefore, the aim of this study is to evaluate the effect of the combined use of standalone HIFEM procedure for rehabilitation of pelvic floor muscles and HIFEM + RF procedure for strengthening of abdominal muscles on the improvement of sarcopenia symptoms.

Study Design/Materials and Method: Thirty patients (27 women, 3 men, 26–75 years old, BMI of 19.7–33.5 kg/m^2) were enrolled and scheduled for seven treatment visits and two follow-up visits. Four HIFEM + RF abdominal procedures spaced 5–10 days, with six standalone HIFEM procedures on the pelvic floor spaced 2–4 days were applied. Both procedures were used consecutively at the first, third, and fifth treatment visits, starting with HIFEM + RF. The outcomes included the evaluation of maximal and comfortable gait speed, timed up and go test (TUG), balance test, and number of steps test.

Results: All 30 patients underwent scheduled therapies and follow-up visits. At the 3-month follow-up, all assessed outcomes showed significant improvement. On average, the comfortable gait speed increased by +32.9%, with maximal gait speed increasing by +25.9%. The TUG test showed a −21.1% decrease in the time needed to perform the test, with improved balance (by +11.6%) and an increased number of steps done in 2 minutes (by +18.4%). The results were found to be even more profound in patients over 60 years, with +45.6% improvement in comfortable gait speed, +37.5% increase in maximal gait speed, −20.6% decrease in time needed for the TUG test, +30.3% improvement in balance, and +20.9% increase in the number of steps done in 2 minutes.

Conclusion: The evaluation of five functional tests showed significant improvement in the performance of skeletal muscles when pelvic floor muscles were treated with a standalone HIFEM procedure, and abdominal muscles were strengthened by a simultaneous application of HIFEM + RF. The results indicate the possible means of prevention of sarcopenia even in younger patients with more pronounced results and efficacy of sarcopenia treatment in elderly subjects.

SUBMISSION TITLE: TREATMENT OF ACNE VULGARIS-ASSOCIATED POSTINFLAMMATORY DYSCHROMIA WITH COMBINATION NONABLATIVE LASER THERAPY AND TOPICAL ANTIOXIDANTS

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Background: Acne vulgaris is the most common inflammatory dermatosis worldwide. Affecting as many as 95%–100% of men, and 83%–85% of women during puberty [1], acne often extends into adulthood [2], commonly resulting in sequelae such as postinflammatory erythema (PIE) and postinflammatory hyperpigmentation (PIH) in blemish-prone skin. A disease of the

pilosebaceous unit, acne vulgaris is a result of multiple different pathologic processes, ranging from increased sebum production, lipid oxidation, and free radical exacerbation in antioxidant-poor skin [3], to an inflammatory cascade that has been hypothesized to play a subsequent role in PIE and PIH [4,5]. This postinflammatory dyschromia poses a significant psychological burden on acne patients, often accounting for greater distress than acne lesions, and representing a large proportion of the economic burden associated with management and treatment [6].

Energy-based devices (EBDs) are considered first-line treatments for scarring associated with acne vulgaris [1], and multiple nonablative lasers are routinely utilized in the treatment of acne-related PIE and PIH [7]. However, recent observations have implicated aberrant and long-term B-cell mediated inflammation in the development of post-inflammatory dyschromia and scarring following acne [8], suggesting a new potential mechanistic arm for treatment and the role of combination therapy [9].

Given these considerations, there remains an unmet need for an integrated treatment of postinflammatory dyschromia of blemish-prone skin, as well as the inflammation that can perpetuate it. Therefore, the primary objective of this study was to assess the safety and efficacy of nonablative laser therapy followed by the topical application of a Silymarin/Salicylic Acid/L-Ascorbic Acid/Ferulic Acid acne product (SSAF) compared to laser therapy alone in the improvement in oily skin patients with facial PIE and PIH associated with acne lesions.

Study Design/Materials and Method: In this single-center, prospective, IRB-approved, randomized-controlled study, subjects with facial PIE and/or PIH from acne were selected for treatment with nonablative laser therapy followed by the topical application of Silymarin CF™ (0.5% Silymarin/0.5% Salicylic Acid/15% L-Ascorbic Acid/0.5% Ferulic Acid, SSAF) or vehicle control (glycol serum). Ages of the subjects ranged from 21 to 61, and all skin types (Fitzpatrick skin types I–VI) were represented within the cohort, with the majority of patients ($n = 20$) being skin type III–VI.

Over 12 weeks, subjects received three laser treatments at monthly intervals, followed by immediate application either SSAF or control product (glycol serum). Both groups received application of the topical product or control immediately postlaser treatment, and were then instructed to use their assigned product regimen twice daily throughout the entire duration of the study. Either a 595 nm pulsed dye laser (PDL) for treatment of PIE or 1927 nm Thulium Laser for treatment of PIH were chosen on the basis of the subject's lesions and Skin Type.

Finally, improvement of PIE and PIH was evaluated through multiple independent modalities, including Post-Inflammatory Hyperpigmentation Index (PAHPI) and Global Aesthetic Improvement Scale (GAIS) blinded observation scoring, and Mexameter® erythema and melanin index values. Collagen density was assessed through optical coherence tomography (OCT).

Results: Twenty-five female and male adult subjects with facial PIE and/or PIH from acne were selected for treatment with nonablative laser therapy followed by the topical application of SSAF or vehicle control (glycol serum). Ages of the subjects ranged from 21 to 61, and all skin types (Fitzpatrick Skin Types I–VI) were represented within the cohort, with the majority of patients ($n = 20$) being Skin Type III–VI.

Following treatment, subjects were first assessed with PAHPI and GAIS blinded observation scoring by three individual experts, revealing an overall 1.38 average mean decrease in PAHPI score from 3.21 (overall disease severity—moderate dense/diffuse) to 1.83 (slightly noticeable-mild) across all treatment groups. In patients receiving SSAF, there was an average PAHPI decrease from 3.18 to 1.74 (1.44 decrease) when compared to the laser-only group 3.25–1.97 (1.28 decrease), suggesting an improvement trend with SSAF-treated patients. The GAIS score also showed overall improvement across three blinded observers, with an overall mean score of 3.24 (much improved) across all subjects, with a higher improvement score witnessed in patients receiving SSAF (3.35), when compared to laser-only (3.10).

PIH was then assessed with analysis of Mexameter index, and revealed a significantly significant decreased mean level of intralesional melanin in patients treated with SSAF (39.76), when compared to laser only ($p = 0.02781$, paired t-test). This was followed by tests of nonlesional, nontreated skin, which did not reveal a change in melanin levels. PIE was then similarly assessed without witnessed difference between combination therapy and laser-only groups. Finally, OCT analysis demonstrated an increase in intensity at a depth of 0.2 mm in the papillary dermis of patients treated with SSAF and nonablative laser therapy, corresponding to an increase in collagen density.

Conclusion: Overall, the study revealed a statistically-significant decrease in PIH and intralesional melanin in patients treated with combination SSAF and nonablative laser therapy. Additionally, clinical improvement of PIE and PIH was augmented in combination SSAF and laser-treated patients, when compared to the laser-only group, with a concomitant increase in collagen density.

Although patients receiving the control solution also demonstrated improvement of their postinflammatory dyschromia with laser monotherapy, the enhanced clinical response in patients receiving SSAF highlights the benefit of integrated treatment. A compound derived from the milk thistle plant *Silybum Marianum*, Silymarin has been shown to prevent lipid oxidation and scavenge reactive oxygen species (ROS), potentially inhibiting multiple components involved in the pathogenesis of acne vulgaris [10]. In combination with the established antioxidant and anti-inflammatory properties of salicylic acid, L-ascorbic acid, and ferulic acid, the topical

application of Silymarin is believed to slow the inflammatory cascade contributing to the development of postinflammatory dyschromia, potentially resulting in the observed improvement in treated subjects.

Therefore, combination SSAF and nonablative laser therapy could serve as a promising solution for decreasing inflammation, PIE, and PIH, specifically in oily, blemish-prone skin. Additionally, integrated treatment with antioxidants and EBDs was shown safe and efficacious in skin of color, providing a potential and promising treatment modality in patients who are disproportionately affected by PIH [11]. Limitations of this study include small sample size and length of posttreatment monitoring and follow-up. Further large, multicenter studies are required to better characterize and establish the pathophysiology underlying the connection between inflammation and the development of PIH and PIE. Finally, future work will focus on extending long-term follow-up to analyze the potential for scar prevention with initial improvement of postinflammatory dyschromia in acne patients.

SUBMISSION TITLE: TREATMENT OF PORT-WINE STAINS USING 595 NM PULSED DYE LASER VERSUS 532 NM KTP LASER - RESULTS OF A PROSPECTIVE SPLIT-SIDE STUDY

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Background: Firstline therapy of port-wine stains (PWS) consists of early and repeated pulsed dye laser (PDL) treatments. Due to high maintenance costs and instability in technology of PDL systems, alternatives are warranted. Large spot, short subpulsed 532 nm KTP laser is a novel laser technology and was recently introduced to treat various vascular lesions including PWS. The aim of the study is to compare the efficacy and safety of 595 nm PDL versus large spot 532 nm KTP laser in treatment of PWS.

Study Design/Materials and Method: A prospective intraindividual split-side study with one to five treatment sessions with a 595 nm PDL versus large spot 532 nm KTP laser at intervals of 6–8 weeks. Control visit was scheduled 6 weeks after last session. Efficacy and safety were evaluated by using standardized three-dimensional imaging, colorimetry, measurement of changes in area, pain intensity (numeric rating scale) during treatment, tolerability, side effects and patient satisfaction (5-point-scale).

Results: Thirty patients were included in the study. Evaluation of efficacy showed significant lightening in erythema and reduction of area. No significant differences between both lasers were measured. Assessment of pain intensities revealed no significant difference. Both lasers showed good safety profile with transient erythema and oedema. Relevant purpura was seen only in PDL treated regions. No remarkable adverse events were observed. Both lasers indicated high patient satisfaction.

Conclusion: PDL and large spot KTP laser are both effective methods to treat PWS. Due to similar efficacy and safety profile, lower downtime, and more stable technology, KTP laser may act as an alternative to conventional PDL treatment in the near future. Further prospective clinical trials are warranted to evaluate long-term effects and adverse events of large spot 532 nm KTP laser.

SUBMISSION TITLE: TREATMENT OF PORT-WINE STAINS WITH 595-NM PULSED DYE LASER: THE LEBANESE EXPERIENCE

Authors: Remie Chrabieh; Zeina Tannous

Remie Chrabieh, MD, Department of Dermatology, Lebanese American University Medical Center-Rizk Hospital, Beirut, Lebanon; Zeina Tannous, Department of Dermatology, Lebanese American University School of Medicine, Byblos, Lebanon, Zeina Tannous, Department of Dermatology, Wellman center for photomedicine, Massachusetts General Hospital, Harvard Medical School, Boston, MA

Background: Port-wine stains (PWSs) consist of congenital capillary malformations of the skin affecting 0.3%–0.5% of newborns. They can cause major cosmetic deformity as well as psychological suffering for the patients and for the parents. The 595-nm pulsed dye laser (PDL) has been widely used for the management of port-wine stains for many years. However, there is no published data on the Lebanese patients and insufficient studies on the Middle Eastern patients.

This is the first study to assess the efficacy and relevant factors of PDL therapy on PWS in Lebanese patients.

Study Design/Materials and Method: A total of 55 Lebanese patients with PWSs and no previous treatments were seen at the dermatology department of the Lebanese American University Medical Center-Rizk Hospital, Lebanon. A retrospective study was conducted to assess the therapeutic response of PDL treatment for PWS based on treatment numbers, laser settings, lesion location and color, extent of hypertrophy and patient's age, sex, and skin phototype. The results were evaluated by comparing pre

and post photographs taken before and after treatment number 7 by two independent dermatologists who did not participate in the treatment procedures. The degree of clinical improvement was graded as follows: poor improvement: <50%, good improvement: 50%–70% and excellent improvement: >70%.

Results: Forty-nine patients who received at least seven sessions of treatment were considered eligible to be included in the study. The female sex represented 65.3% and the skin phototype was between III (59.2%) and IV (40.8%). The mean age was 16 years old and the youngest age at presentation was 11 days. PWSs occurred mainly on the face (63.3%) with a red color (69.4%) and no hypertrophy (71.4%). The most common laser settings used were: 10 mm spot size, 9 J/cm^2 fluence, and 1.5 milliseconds pulse duration. The majority of the patients had an excellent response (63.3%) while 14.3% had a good response and 22.4% had a poor response after seven treatment sessions. Interestingly, patients who started treatment at less than 1 year of age had a higher percentage of excellent response compared to those who started treatment at more than 1 year of age (73% vs. 59%). Moreover, a higher percentage of poor response was seen in patients who started therapy after 1 year of age (30%) while only 6.7% in patients aged less than 1 year. No significant side effects were reported among these patients so PDL is regarded as a safe therapy for darker skin types.

Conclusion: In conclusion, a total of seven PDL treatment sessions is considered safe and effective as it can achieve more than 70% clinical improvement among Lebanese patients with PWSs even in darker skin types. Furthermore, starting treatment before 1 year of age provides the best possible outcome.

SUBMISSION TITLE: USE OF A HYBRID FRACTIONAL LASER IN THE TREATMENT OF ACNE SCARS

Authors: Edward Ross

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Background: Acne scars have been treated by multiple modalities. We treated a series of patients with a fractional laser with (a) a mixture of 1570 and 10,600 nm, or (b) 1570 nm alone, in a side by side observational series to determine which settings optimized acne scar improvement.

Study Design/Materials and Method: Six patients were treated three times, 3 × 4 weeks apart, over the temples and cheeks where acne scars were observed. Photographs were taken at each visit and final evaluation was 3 months after the final treatment. The laser incorporates microbeams 150 μm in diameter with options for 10,600 or 1570 nm. In this observational series, we performed laser on acne scars on one side with the 1570 nm alone, and the other side with a "hybrid" of 1570 and 10,600 nm. For the hybrid side, 70% of the micro beams were applied with the nonablative wavelength and 30% of the dots were applied with the ablative wavelength. The goal of the series was to determine whether adding a small component of ablative fractional resurfacing would produce superior improvement compared to 1570 nm alone. For the CO_2 part, typical settings were 30 W and 2 milliseconds, or approximately 60 mJ per microbeam. For the 1570 nm, 8 W and 6 milliseconds were applied, or 48 mJ per microbeam. Total cross-sectional skin coverage density was approximately 35% for both sides.

Results: Pain was approximately 4 out of 10. For small regions of scarring, less than 25 cm^2, only cold air was applied. For larger areas, 5% lidocaine cream was applied as well. Reviewing photographs, the side where CO_2 laser was introduced, even though comprising a third of the microbeams, resulted in slightly better improvement than the 1570 nm alone. Overall, there was about 35% improvement with the combination approach, and about 25% with 1570 nm alone.

Conclusion: This hybrid laser allows the operator to mix fractions of ablative and non ablative fractional wavelengths to optimize outcomes for acne scarring. Introducing a small component of ablative fractional resurfacing results in more improvement than nonablative resurfacing alone, with only a slight bit more downtime.

SUBMISSION TITLE: USING LASER CONTRAST SPECKLES FOR NON-INVASIVE IMAGING IN DERMATOLOGY

Authors: Nicholas Strat; Lauren Sattele; Courtney Linkous; Chelsea Shope; Laura Andrews; Tyler Beck; Alan Snyder; Hongming Fan; Manuel Valdebran; Tong Ye; Dirk Elston

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Background: As it remains, biopsy and subsequent histologic examination is the gold standard for the definitive diagnosis of neoplastic or inflammatory skin lesions. Biopsy techniques, however, are invasive procedures with potential complications such as bleeding, scarring, damage to nearby structures, pain, and infection.

Accurate noninvasive imaging techniques would eliminate the need for evaluation of skin by biopsy, and may allow clinicians to circumvent the implicated iatrogenic trauma [1]. Laser speckled imaging (LSI) is a noninvasive

imaging technique that offers the ability to assess the blood flow of skin without damaging the skin's barrier, thereby highlighting patterns that can be characterized to particular diseases, much like visual or tactile patterns are used to avoid the need for biopsy to date.

Laser speckled uses low intensity, near-infrared light to illuminate the skin. This is achieved through LSI's low energy, long wavelength laser being diffused and shined onto the skin at 785 nm. Reflected light is transmitted to the device's sensor which elucidates information about the blood flow over time, which is captured by a rapid sequence imaging camera as a pixel pattern. This pattern is then analyzed by a custom MATLAB program, which can quantity the movement of these pixels which are called speckles. This technology has been successfully utilized in vivo by the principal investigator, Manuel Valdebran, MD without concern or development of adverse events [2]. There are no anticipated discomforts or complications related to the device.

This abstract represents the pilot study to an ongoing split-face imaging, observational, prospective cohort study to use LSI to characterize blood flow patterns of a greater variety of lesions, namely: neoplastic, inflammatory, vascular anomalies, and no pathology. This pilot study represents a small cohort of approved neoplastic lesions to determine whether the LSI device and MATLAB code can detect a difference in blood flow between the lesion and a patient's control skin to further inform the ongoing trial.

Study Design/Materials and Method: The primary aim of this research is to characterize the blood flow patterns for various dermatologic conditions, namely: neoplastic, inflammatory, vascular anomalies, and no pathology. These characterizations will then be analyzed to determine whether or not the data from the LSI can be used to distinguish these conditions from each other and increase a clinician's confidence to choose whether or not a lesion will need a biopsy, hopefully reducing the number of unnecessary biopsies. This will be achieved by acquiring quantitative blood flow maps from the LSI images that uses a light source and CMOS/CCD camera to create maps of tissue blood flow [3, 4]. This technique is given by the ability for the laser speckle to distinguish spatiotemporal changes in blood flow through the epidermis. The movement of blood within the tissues creates a pattern which is computed onto an image. This image is then processed using custom software written in MATLAB to measure the speckle flow index (SFI). The SFI of the lesion compared to the SFI of the control tissue of the same patient will be compared to determine if the LSI device can detect changes in blood flow for the given categories of lesions. This will be achieved by measuring the SFI in the patient's primary location, and then in a similar location with negative clinical pathology. For each patient, the SFI of the pathological lesion will be compared to the SFI of the nonpathological location. Paired differences (pathology vs. no pathology) will be analyzed to see if they are significantly different from each other. Same-day biopsy results will be used to determine what pathology, if any, was creating the observed changed in SFI, if any.

All results will be summarized graphically and descriptively. Pathological and nonpathological lesions will be identified by the physician and research assistant, with preference of which lesional characteristic to classify it in will be decided by the principal investigator. The lesion of interest will be selected by the physician, and must be clinically diagnosed and characterized by the physician before research classification, as is the case with standard-of-care diagnoses before biopsy. Biopsy will then be conducted during this visit and read by a dermatopathologist. Inclusion criteria include: treatment naïve as of the first visit, male and female of any age, study participants or representatives who understand the instructions, patients with definitive or suspected diseases per clinical diagnosis and approved by a physician-researcher. Exclusion criteria include: lesions greater than the diameter of the LSI device (greater than 2 cm in diameter at any location of the lesion, inability or unwillingness of subject or legal guardian to give informed consent, pregnant or possibly pregnant women. Each participant with the target pathology for the study will serve as both an intervention and control group, meaning it is a split-face imaging, observational, prospective cohort.

Results: This pilot study analysis included eight subjects with a total of eight lesions. Biopsy of the lesions revealed that there was one basal cell carcinoma (BCC), two malignant melanomas (MM), one pigmented seborrheic keratosis (PSK), three actinic keratoses (AK), and one epidermolysis bullosa (EB) to use in the analysis. We compared the change in SFI from each lesion compared to the patient's own control and plotted these deltas in SFI against each other. The SFI's were given as averages for the types of diagnoses with multiple lesions to compare, whereas for BCC, PSK, and EB we used the values from the one lesion. Although we did not run tests of significance for these values due to the small sample size and distribution pattern across each pathology type, interesting features were noted that can be further elucidated statistically given a higher number of enrolled lesions. Namely, the delta of spatially-derived SFI values for MM lesions was an order of magnitude larger than that of BCC, PSK, AK, and EPI. Additionally, the delta of temporally-derived SFI values for BCC were multiple orders of magnitude larger than MM, PSK, AK, and EPI. In fact, it was noted that AK's had the smallest difference in spatially derived SFI values compared to their control skin, and even a negative value for temporally derived difference in SFI values comparted to its control skin.

Conclusion: LSI is a novel imaging technique with increasing applications in dermatology, including diagnosis of skin cancers. This study demonstrated that LSI was able to detect increased blood flow within malignant skin lesions (BCC and MM) compared to normal skin using temporally and spatially derived blood flow

metrics, although this difference was not statistically significant. The lack of significance is presumably due to small sample size, which is a known limitation of this pilot study. The preliminary results suggest that with an increased sample size, we can compare the SFI of the lesion to the SFI of the control skin to then obtain a blood flow ratio (BFR). The BFR can then be used to characterize neoplastic, vascular, inflammatory lesions compared to normal skin or even subclassifications of each (i.e., Compare BFR of melanoma to basal cell carcinoma). Although no robust conclusions can be derived from the results of this pilot study, this proof-of-concept series of data validates further enrollment and exploration of the LSI's ability to detect a difference in blood flow of a variety of lesions.

LSI may have utility as a noninvasive method of evaluating potentially malignant skin lesions before a more invasive diagnostic procedure such as tissue biopsy, which carries a risk of complications. In the future, LSI may be useful in minimizing unnecessary skin biopsies in some patients and confirming the need for a biopsy in others. Given the small sample size and pilot nature of this study, further studies investigating the clinical use of LSI in diagnosis of skin cancers are warranted, including evaluation of precancerous or noncancerous lesions in comparison to malignant lesions. LSI is emerging as a potentially invaluable noninvasive tool in the assessment of suspected skin cancers.

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SUBMISSION TITLE: VASCULAR DENSITY CHANGES AFTER TREATMENT WITH A BIPOLAR RADIOFREQUENCY SYSTEM INCORPORATING A NOVEL APPLICATOR WITH 3-IN-1 DEPTH ULTRA-THIN MICRONEEDLE

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Background: There are multiple devices in the market for radiofrequency (RF) microneedling, and prior studies have evaluated changes in vasculature and formation of microchannels with these technologies. This prospective study utilizes both optical coherence tomography (OCT), and a new technology, line-field optical coherence tomography (LC-OCT), to evaluate changes in vascularity and microchannel formation following RF-microneedling treatments.

Study Design/Materials and Method: In a prospective study, healthy adults presenting with wrinkles ($n = 8$), melasma ($n = 2$), and/or acne scars ($n = 1$) received up to three RF microneedling facial treatments, with a novel applicator utilizing ultra-thin microneedles inserted at up to three depths with a single insertion, at 6-week intervals with varying follow-up visits. These patients were scanned and analyzed before and after treatment using dermoscopy, OCT, and/or LC-OCT imaging. In this study, we also included LC-OCT imaging in a subgroup of two patients to further evaluate vascular changes.

Results: Eleven subjects (1 Male/10 Female), aged 55 ± 17 years (range: 25–79) with Fitzpatrick skin types II–V had at minimum one RF microneedling treatment during a 3-month study period. A total of 50 RF microneedling treatments were performed. No dots on enface OCT at 100 μm were seen post RF-microneedling, but they were observed on dermoscopy images, which also visualizes skin at 60–100 μm in depth, immediately posttreatment, 24 hours after and 1 week after RF-microneedling treatment. All patients had minimal downtime and no adverse side effects with treatment.

We observed an overall decrease in vascularity with OCT after treatment with the 3-in-1 ultrathin microneedle applicator. Vascular density was defined as the percentage of a region occupied by blood vessels in the OCT en-face images. Vascular density was measured at depths ranging from 0.05 to 0.5 mm. Greatest reduction in vascularity was seen at the depth of 0.5 mm. The average vascular density, at this depth, reduced from 26.3% at baseline visit to 15.1% at the follow-up visit. The statistically significant mean difference between vascular density before the first treatment and the latest follow-up measurement was −0.112 (−11.2%) ($p = 0.0043$; 95% CI: −0.179, −0.044, using a paired t-test).

We found an overall decrease in vasculature with LC-OCT consistent with the OCT findings. With LC-OCT's increased cellular resolution, we were also able to visualize the vessels and quantify their diameter and overall appearance.

Conclusion: OCT analysis showed (i) patients treated with this new bipolar RF system with 3-in-1 ultrathin microneedles applicator had an overall decrease in vascular density and (ii) like previous studies, no dots on enface OCT at 100 μm were seen post-RF microneedling but were observed on dermoscopy images. We propose the use of both OCT and LC-OCT for vascular changes with RF microneedling treatments in future

studies to not only follow overall trends but also to visualize and quantify the actual vessels in 3-D. We also propose further studies on microchannel formation at increased depths and utilizing better cellular resolution technology, such as reflectance confocal microscopy or LC-OCT (at 100 μm), to further study microchannel structural properties and persistence.

SUBMISSION TITLE: WRINKLE REDUCTION BY NOVEL NONINVASIVE TECHNOLOGY: SIMULTANEOUS APPLICATION OF HIFES AND SYCHRONIZED RADIOFREQUENCY FOR THE TREATMENT OF FACE

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Background: Aging causes soft and connective tissues to lose important mechanical and structural properties of the face, characterized by wrinkles and laxity. To combat those unfavorable changes to overall facial appearance, the simultaneous application of radiofrequency and HIFES energies targets muscle and connective tissue structures at the same time, aiming for a holistic approach to facial treatments. This study evaluates the safety and efficacy of this novel procedure for the treatment of facial wrinkles and rhytids and for the improvement of facial appearance.

Study Design/Materials and Method: This prospective, interventional, single-arm, nonrandomized study was conducted at two sites with 19 enrolled subjects. Therapy consisted of four 20-minute treatments (5–10 days apart) administered on the forehead and both cheeks with simultaneous RF + HIFES energies. Evaluation of outcomes was based on digital photographs taken before, after the last treatment and at 1- and 3-month follow-up visits analyzed by three independent reviewers. The Fitzpatrick Wrinkle Elastosis Scale (FWES) and Global Aesthetic Improvement Scale (GAIS) were used to assess changes in overall facial appearance and skin quality. Therapy safety was monitored during the course of the study. Subject satisfaction was evaluated after the final treatment (including treatment comfort assessment), 1 and 3 months follow-up.

Results: Preliminary data from 17 ($N = 17$) subjects were analyzed. The average Fitzpatrick's wrinkle elastosis score significantly ($p < 0.001$) decreased from a baseline of 5.47 points (moderate) to 3.65 points (mild) at 3 months. The average Global Aesthetic Improvement scale showed a noticeable improvement in facial appearance at a 3-month follow-up within 90% of subjects. Satisfaction questionnaires reported that 87% of subjects felt tighter and lifted skin. All (100%) subjects rated the therapy as comfortable and not painful, with the average VAS score being 0.85 points on 10 point scale. There were no adverse or side effects observed.

Conclusion: Interim data assessed 3-month post-treatment indicates promising evidence that the procedure of simultaneously administering novel HIFES and RF modalities to the face provides satisfactory outcomes regarding the improved appearance of the skin and wrinkles. The procedure may be considered a safe and effective option for noninvasive facial rejuvenation.

Early Career

SUBMISSION TITLE: 5% CYSTEAMINE HYDROCHLORIDE CREAM FOR TREATMENT OF BURN SCAR RELATED DYSPIGMENTATION: A CASE REPORT

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Background: Cysteamine is an antioxidant found in mammalian cells and possesses depigmenting properties. Topical treatment has been challenging due to its foul odor and rapid oxidation. In 2010, stabilization was achieved to formulate a topical 5% cysteamine hydrochloride cream. Some studies suggest that the 5% cysteamine hydrochloride cream has been used to treat melasma, postinflammatory hyperpigmentation, and lentigines, however there are no studies that examine its use to treat burn-related dyspigmentation.

Study Design/Materials and Method: A 42-year-old male with Fitzpatrick skin type (FST) VI presented with dyspigmented burn scars and grafts on the face secondary to a gas explosion. The extensive third degree burns required skin grafting which resulted in severe scarring decades prior. Over the course of 5 years, he underwent two microneedling treatments and six treatments of fractionated CO_2 laser with laser assisted drug delivery of topical triamcinolone acetonide with improvement. To address dyspigmentation of the burn scars, the patient was started on 8% hydroquinone resulting in irritation and dermatitis. Five percent cysteamine hydrochloride cream was then initiated.

Results: In the first 2 months of treatment, the patient tolerated the 5% cysteamine hydrochloride cream well and showed a decrease in dyspigmentation via photographic monitoring.

Conclusion: This case demonstrates that 5% cysteamine hydrochloride cream may be a novel treatment option for dyspigmentation from burn scars in FST VI and may be used as a possible alternative to hydroquinone. Although this case exhibits an improvement with 5% cysteamine hydrochloride cream in a burn patient with dyspigmentation, cost may serve as a barrier.

SUBMISSION TITLE: A CASE OF CLASSIC KAPOSI SARCOMA EFFECTIVELY MANAGED WITH A COMBINATION OF PULSED DYE LASER AND INTRALESIONAL BLEOMYCIN

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Background: Kaposi sarcoma (KS) is a rare angioproliferative disorder thought to arise from infection with human herpesvirus 8 (HHV-8) in the presence of certain risk factors, including genetic predisposition and immunosuppression. Classic Kaposi sarcoma (CKS) typically represents an indolent disease process affecting the cutaneous distal lower extremities of older male patients. Despite its often localized nature, CKS may still contribute to impaired quality of life in patients due to chronic and occasionally recalcitrant skin lesions. While destructive treatment modalities are often employed to treat KS lesions and while pulsed dye laser (PDL) treatment of cutaneous KS was first reported several decades ago, to date there remain very few overall cases described in the literature of KS and especially CKS treated with PDL. This may partially be due to the relative scarcity of these conditions.

Study Design/Materials and Method: We report a case of a 61-year-old male with CKS predominantly of the bilateral lower extremities managed over a 21-month period with a combination of PDL and intralesional bleomycin. He stated XRT had previously been highly effective for his condition; however, he preferred to explore other treatment options given the time commitment and frequency/intensity of XRT. Prior ineffective treatments included topical imiquimod and cryotherapy. Previous evaluations for HIV in addition to visceral involvement of KS were negative. Treatment was started with a topical retinoid in addition to PDL. For his first session of PDL, a homogenous dark red plaque was chosen on his left elbow, divided into marked quadrants, and treated with four different settings of PDL with photo-documentation to help determine effective treatment parameters.

Results: Over 8 months, the patient received seven sessions of PDL with significant improvement and clearance of multiple lesions, including the left elbow. Other lesions, especially of the bilateral feet, remained recalcitrant to PDL and the patient continued to pursue surgical excision of certain lesions. It was then elected to treat these sites with intralesional bleomycin. A dose of 0.5 mL of bleomycin 1 mg/mL was found to be very effective in clearing recalcitrant lesions but was also reported to be noticeably painful despite the use of lidocaine/epinephrine. Therefore, bleomycin has been reserved for lesions without benefit from multiple PDL treatments. He was last seen in November 2022 and received continued PDL (session #11 overall to any lesion) to two purple nodules of the right plantar forefoot and midfoot, which were improved from the prior visit. Settings of spot size 7 mm, pulse duration 1.5 milliseconds, and fluence 10.0 and 10.5 J/cm^2 were employed at that time.

Conclusion: In this case study, PDL was found to be overall effective in treating CKS lesions of various morphologies, including papules, patches, subcutaneous nodules, and thin vascular plaques. Intralesional bleomycin was also found to be effective for lesions recalcitrant to PDL. Both therapies used in conjunction have recently spared our patient from frequent XRT and excisional procedures. We suggest that PDL and intralesional bleomycin be further evaluated for KS, including CKS, especially in controlled trials when possible, given the rarity of these conditions.

SUBMISSION TITLE: CASE REPORT: COMBINATION LASER TREATMENTS AND LASER-ASSISTED DRUG DELIVERY FOR SCAR REVISION AND TRAUMATIC TATTOO REMOVAL FOR A PEDIATRIC PATIENT FOLLOWING MOTOR VEHICLE COLLISION

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Background: Trauma-induced skin disease in pediatric patients can present a challenge for treatment and management, especially if there is extensive scarring with a broad range of morphologies. Laser therapy is a less invasive alternative to a surgical approach but requires consideration of the necessary laser modalities as well as the anticipated number of treatment sessions, which is especially important in pediatric patients.

Study Design/Materials and Method: This is an IRB-exempt retrospective case report of a male 8-year-old patient who presented with extensive scarring and

traumatic tattooing of the face and right upper extremity after a motor vehicle accident 2 years prior. He had previously received one set of intralesional triamcinolone injections to the right upper extremity. His initial physical exam was notable for: atrophic scarring of right forehead; traumatic tattooing of right eyebrow, right upper eyelid, right cheek, and nasal tip; hypertrophic and atrophic scarring of right upper extremity involving right antecubital fossa and right dorsal hand; and erythematous scars of face, right posterior anterior forearm and left anterior forearm.

He was treated under monitored anesthesia care with treatment sessions consisting of multiple laser types: pulsed dye 595 nm laser for erythematous scarring, picosecond 1064 nm laser for traumatic tattoo removal, fractionated nonablative 1550 nm laser for atrophic scarring, and fractionated ablative CO_2 laser for right upper extremity hypertrophic scarring with laser assisted drug delivery with triamcinolone. Intralesional triamcinolone was also injected to hypertrophic areas.

Results: After a total of four treatment sessions, his follow-up physical examination demonstrated clinical improvement in the scars and traumatic tattooing, and this was documented via serial clinical photographs. In addition, the patient and his mother appreciated subjective improvement in appearance and thickening of scars.

Conclusion: In this case, multiple laser modalities were used to treat a wide range of trauma-induced skin disease morphologies in a single pediatric patient, including both atrophic and hypertrophic scarring as well as erythematous scarring and traumatic tattooing. This patient had previously suffered a motor vehicle collision, which left him with disfiguring skin changes that were improved through laser treatments and laser-assisted drug delivery of triamcinolone.

Following significant traumatic injuries, patients can present with several trauma-induced skin diseases which require different treatment modalities. The approach in this case minimized the overall number of visits through use of several lasers in each treatment session, and this is particularly important in the pediatric population. There was evident subjective improvement of his skin disease after four treatment sessions. This case highlights the value of laser and laser-assisted drug delivery for traumatic injuries, an especially promising treatment option for pediatric victims of motor vehicle accidents.

SUBMISSION TITLE: DIVERSITY OF SEXES IN CLINICAL TRIALS FOR LASER HAIR REMOVAL

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Background: Patients who receive gender-affirming care as part of a gender transition may choose to undergo laser hair removal. For those who transition from male to female, it especially becomes relevant that male facial skin has an increase in adnexal structures compared to female facial skin, which may affect outcomes when it comes to laser and light-based procedures. However, it remains unclear if trials evaluating laser hair removal equitably represent a diverse population to help characterize these potential differences. This study aims to characterize the sexes of patients in trials evaluating hair removal by energy-based devices.

Study Design/Materials and Method: A systematic review was performed using PubMed with the search query hair AND laser AND removal AND (dermatology OR skin OR cutaneous). Clinical trials written in English were included if a laser and light-based therapy was being studied as an intervention and if hair reduction was an outcome. The exclusion criteria eliminated studies that did not include the face as a treatment area and laser hair removal for diseases with disproportionate occurrence in females or males, such as polycystic ovarian syndrome or pseudofolliculitis barbae. Assigned sexes were assumed to be sex assigned by participating patients themselves.

Results: The query identified a total of 121 articles, of which 28 met inclusion criteria. There were 3882 patients treated with lasers or intense pulsed light (IPL) for hair removal. Twenty-two of 28 (79%) articles reported on sexes of the trial participants. In studies that reported patient sexes, this included 3104 (88.7%) female, 384 (11.0%) male, and 11 (0.003%) nonbinary identifying patients. No studies evaluated laser hair removal outcomes by sex. Limitations for this study include the absence of reporting on sex in many trials and the exclusion of trials that did not include treatment of the face.

Conclusion: This study demonstrates that male skin is underrepresented in clinical trials evaluating laser hair removal. This limits our full understanding of treatment outcomes in male skin and in particular, in patients who are transitioning. This potentially impedes our understanding and ultimately the advancement of laser hair removal in this particular cohort. Future laser hair removal clinical trials should emphasize inclusivity and include outcomes by sex.

SUBMISSION TITLE: EFFECT OF TOPICAL HUMAN PLATELET EXTRACT FOR FACIAL SKIN RECOVERY FOLLOWING RADIOFREQUENCY MICRONEEDLING – A CASE REPORT ON REGENERATIVE TECHNOLOGY

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Background: Photo aging is a complex biological process that results in skin laxity, rhytides, dyschromia, and roughness. Radiofrequency (RF) microneedling is a minimally invasive intervention for skin rejuvenation in all skin types. This technology creates epidermal perforations that delivers radiofrequency-generated thermal energy into the underlying dermis to stimulate neocollagenesis [1]. It is postulated that the mechanical effects of microneedles on the skin can promote growth factor secretion and allow the adjacent keratinocyte and fibroblast microenvironment for skin remodeling. New regenerative technologies, such as platelet rich plasma, have been evaluated as an adjuvant after fractional radiofrequency microneedling [2] for neck rejuvenation. It is postulated that a combination of topical regenerative cytokines and growth factors can contribute to skin recovery. Herein we report a case of topical human platelet extract (Rion Aesthetics, LLC) following facial radiofrequency microneedling.

Study Design/Materials and Method: Type of study: Case report

Methods: This retrospective case report evaluated a 44-year-old female with Fitzpatrick II skin. VISIA CR device imaging captured baseline, immediately after microneedling, and follow-up Day 1, 2, 3, and 7. Investigator assessment of facial rejuvenation and skin recovery time was recorded. Subject applied twice daily topical application of over-the-counter human platelet extract.

Results: All basic parameters of photoaging (color evenness, luminosity, wrinkles, erythema, and brown spots) were assessed clinically by study investigator. VISIA RBX processing demonstrated significant reduction in redness (>80%) at postprocedure day 1. Color evenness and luminosity improved by Day 7 above baseline. Wrinkles and brown spots appeared unchanged from baseline on each follow-up day. Subject reported overall accelerated reduction in redness and skin recovery compared to prior cosmetic procedures. This patient did not experience any irritation, burning, stinging, itching, or dryness with use of topical platelet extract for 1 week. Zinc oxide sunscreen was also recommended.

Conclusion: This case report highlights a pilot use of over-the-counter topical human platelet extract as a postprocedural adjuvant following radiofrequency microneedling. It is well-known that growth factors released from dense granules of platelets promote platelet aggregation, wound healing, and fibrin formation [3]. Among these factors are platelet derived growth factor (PDGF), transforming growth factor-β (TGF-β), and vascular endothelial growth factor (VEGF) [4]. This is the hypothesized mechanism contributing to decreased redness and increased skin recovery, resulting in improved overall skin evenness and radiance. Future studies can evaluate higher energy settings and/or other skin conditions such as acne scarring in a larger cohort of patients across Fitzpatrick skin phototypes.

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SUBMISSION TITLE: ENERGY-BASED DEVICES FOR THE TREATMENT OF FACIAL SKIN CONDITIONS IN SKIN OF COLOR

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Background: There is a growing demand for cosmetic procedures that are safe and effective for diverse patient populations. The development of energy-based devices such as microfocused ultrasound and fractional radiofrequency, which utilize energies that are not specifically absorbed by melanin and thus function independently of skin color, has revolutionized the landscape of noninvasive treatment options for skin laxity, acne scarring, pigmentary conditions, and rhytids in patients with darker skin types. Still, laser and light-based devices are known to be highly effective for the treatment of these conditions, and recent studies have demonstrated that the use of conservative treatment settings can minimize adverse effects such as postprocedure hyper- or hypopigmentation in patients with Fitzpatrick skin types III–VI.

Study Design/Materials and Method: This review includes studies from 2010 to 2021 focusing on patients with skin phototypes (SPT) III–VI in analyses of the safety and efficacy of energy-based devices for treatment of acne scars and pigmentary conditions, as well as for skin tightening and rejuvenation. The PubMed database

was queried for key terms including "skin of color," "Fitzpatrick skin type," "laser," "radiofrequency," "microfocused ultrasound," "acne scars," "melasma," and "skin tightening." Randomized trials, prospective observational studies, retrospective studies, and case series were included, while individual case reports were excluded.

Results: Forty-three studies on the treatment of acne scars and pigmentary conditions, as well as on skin tightening and skin rejuvenation with energy-based devices in patients with SPT III–VI were included. Most followed a prospective observational cohort design, while only three studies were randomized blinded trials. Fractional ablative and nonablative lasers and radiofrequency (RF) microneedling were all shown to be highly effective in treating acne scars in skin of color, but RF was associated with more transient and lower incidence of postinflammatory hyperpigmentation (PIH). Treatment of melasma in SPT III–VI with low-energy, low-density nonablative lasers yielded rates of improvement greater than 50% with minimal adverse effects, and fewer treatment sessions were required as compared with Q-switched and picosecond laser treatments with conservative settings. Microfocused ultrasound was shown to be safe for the treatment of skin laxity in skin of color across several studies, with adverse effects limited to erythema and mild edema and no reports of PIH. In studies of picosecond and Q-switched Nd:YAG laser treatments for skin rejuvination in SPT III–VI, the use of low fluences allowed for either avoidance of PIH or limited duration of PIH to less than 2 weeks. Significant improvements in rhytids, skin texture, and skin elasticity were noted in clinical and histologic studies of RF microneedling for skin rejuvination, with no resulting dyspigmentation.

Conclusion: There are numerous available studies demonstrating safety and efficacy of laser and energy-based treatments for the treatment of facial skin conditions in skin of color. However, as it is difficult to directly compare the safety and efficacy of such different technologies in the setting of varying study designs and populations, larger meta-analyses are needed to consolidate these data to aid dermatologists in making individualized treatment decisions for their patients.

SUBMISSION TITLE: ERBIUM:YAG LASER RESURFACING FOR TREATMENT OF POST-SURGICAL TRAPDOOR DEFORMITY

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Background: Trapdoor deformity is a recognized complication that can occur after facial flap reconstruction following post-Mohs micrographic surgical defects. It is typical for the bulging scar tissue to occur in the nasal area, which is characterized by curved borders and thick, sebaceous skin. Treatments have revolved around flattening this surgical defect to improve its appearance. This retrospective chart review evaluates the effectiveness and safety of resurfacing with the erbium-doped yttrium aluminum garnet (Erbium:YAG) laser.

Study Design/Materials and Method: A retrospective chart review was performed over a 6.7-year period. Patients had resurfacing with an erbium:YAG laser (BURANE XL; Alma Lasers) for trapdoor deformity and had adequate evaluable photographs available. Effectiveness was assessed with having two independent dermatologic surgeons grading before and after photographs using a 5-point Global Aesthetic Improvement Scale (GAIS) (5: Very much improved; 4: Much improved; 3: Improved; 2: No change; 1: Worsened). Safety was reviewed.

Results: A total of 32 patients were treated with the erbium:YAG laser for postsurgical trapdoor deformity. Of all patients, 71.9% ($n = 23$) were women, and median age was 66.5 years (R: 49–85 years). All (100%) trapdoor deformities occurred following flap reconstruction of post-Mohs surgical defects. Trapdoor deformities were located on the nasal ala for 56.3% ($n = 18$), nasal tip for 25.0% ($n = 8$), nasal sidewall for 9.4% ($n = 3$), and upper cutaneous lip for 9.4% ($n = 3$). Median time from flap reconstruction to laser treatment was 2 months (R: 1–45 months). Median number of treatments needed to achieve optimal results was one treatment (R: 1–3 treatments). Median follow-up time was 3 months (R: 1-12 months).

Appearance of the trapdoor deformity improved for the vast majority (78%). Of all patients, 31% were rated to be "Very much improved," 41% were "Much improved," 22% were "Improved," and 6% had "No change." No patients worsened. Median GAIS was 4 out of 5, which correlated to "Much improved." There were demonstrated reductions in thickness, elevation, and nodularity, and there were no cases of infection. No patients reported recurrence or requested surgical

correction following laser treatment. No severe adverse events were documented.

Conclusion: Resurfacing with the Erbium:YAG laser is an effective and safe treatment option for postsurgical trapdoor deformity.

SUBMISSION TITLE: ERGONOMICS IN DERMATOLOGIC LASER PROCEDURES

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Background: Ergonomics is a subject of growing interest for dermatologists to prevent musculoskeletal injury (MSI). Mindful working postures and patient positioning for dermatologic surgical procedures have previously been described, however no studies have addressed the ergonomics of cutaneous laser procedures. Furthermore, while articles from the urology and otolaryngology literature have evaluated ergonomic designs of invasive laser devices, there are no comparable dermatologic studies. Here we strive to educate and draw attention to the importance of proper ergonomics during dermatologic laser procedures to reduce MSI in laser operators.

Study Design/Materials and Method: To highlight the importance of ergonomics in laser procedures, we reviewed the medical literature regarding ergonomics for laser practices. Furthermore, laser experts in the field of dermatology provided insight regarding the ergonomic challenges of laser therapy.

Results: Important considerations include: (1) operating room layout and organization, (2) instrumentation and workflow, (3) patient positioning, and (4) physician mechanics and posture.

Operating Room: Devices can be large, making transferring between rooms is a physical challenge. Furthermore, many treatment plans include combinations of multiple devices. Keeping several devices within one room can be beneficial, though this requires communication between dermatologists within one practice to avoid scheduling conflicts.

Instrumentation: The ergonomic design challenges of laser devices are well known to dermatologists, with heavy fiber tracts that cannot be bent, articulation arms without enough joints, and foot pedals that must be moved mid-procedure. Desired features included consoles that are small and lightweight. Laser arms should be long with multiple articulations to accommodate contours. Hand pieces should also be comfortable to reduce fatigue and improve accuracy [2]. The ergonomic designs of laser protective equipment should also not be overlooked. Heavy goggles can cause forward strain on the cervical spine and impair performance. Laser operators should individualize goggle design choice when possible or use adjustable behind-the-head straps.

Patient positioning: Patient position is dictated by the treatment location, lesion type, and device utilized. For instance, vascular lesions often require Trendelenburg positioning for lesions of the head and neck, a strong argument for examination chairs with this capability. For widespread or circumferential limb treatments, frequent patient repositioning for optimal access is preferred over physician bending and twisting. In cases involving general anesthesia, multiple assistants are necessary for patient turning and the operating table should be high, or the physician should be seated.

Physician Mechanics: The necessity of keeping the laser handpiece at 90° to the skin's surface for cryogen and light field overlap creates a temptation to bend at the back and crane the neck when treating widespread lesions over contoured skin. Laser operators must make a conscious effort to frequently adjust the patient's position while maintaining a neutral spine to prevent MSI.

Conclusion: Ergonomic considerations specific to laser therapy heavily rely on device and equipment design. Further studies are needed within the dermatologic literature to describe the current challenges and provide feedback to improve designs. Nevertheless, there are immediately available organizational, patient positioning, and teamwork strategies to reduce the risk of MSI.

SUBMISSION TITLE: EVALUATING PREDICTORS OF MOHS MICROGRAPHIC SURGERY IN MELANOMA IN SITU OF THE HEAD AND NECK

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Background: Melanoma in situ (MIS) is an early, noninvasive local form of the tumor confined to the epidermis which is typically resected using wide local excision (WLE). Due to the atypical nature of melanoma cells, their difficulty to be viewed under a microscope, and the increased risk of missing microscopic cells, WLE has typically been preferred over Mohs micrographic surgery (MMS) for MIS. However, WLE of tumors of the head and neck (HN) often leads considerable cosmetic and functional co-morbidity. We sought to evaluate predictors of MMS for MIS of the head and neck (MISHN).

Study Design/Materials and Method: The 2004–2019 National Cancer Database was queried for cases of stage 0 MISHN. Demographic characteristics and clinical details including type of surgery received and histology of melanoma were collected. Multivariable logistic regression analysis was performed to control for confounders to assess independent predictors of MMS for MISHN patients.

Results: We identified 85,900 patients with MISHN. Most patients were 60–79 years old (56.6%) with only 2.89% under 40 years old and 21.51% 80 years and older. There were 60,062 men (69.9%) and 25,838 (30.1%) women included in the study; patients were predominantly White (99.1%) with few patients identifying as Black (0.2%) or other races (0.7%). The most common histologic subtypes of melanoma identified were nonspecified malignant melanoma (58.0%), lentigo maligna (36.6%), superficial spreading (3.8%), and nodular (0.9%). Only 1308 (1.5%) patients did not receive surgery; of patients who did receive surgery, the majority received WLE (33.8%) or biopsy followed by gross excision (31.8%); 16,851 patients received MMS (19.63%). MISHN patients were typically healthy with 87.5% of patients having a CDCC score of 0. On multivariable logistic regression, males (OR: 0.91), Black patients (OR: 0.38), patients with CDCC score of 1 (OR: 0.75) were less likely to receive MMS ($p < 0.01$). Individuals in the second and third income-quartiles had a significantly greater odds (OR: 1.23 and 1.22, respectively) of MMS receipt than individuals in the bottom quartile. When compared to unspecified malignant melanoma, desmoplastic/spindle (OR: 0.53) and superficial spreading (OR: 0.18) had a lower likelihood of MMS whereas nodular melanoma (OR: 1.64) had a greater likelihood of MMS receipt ($p < 0.05$).

Conclusion: We conclude that MISHN tends to affect older, White, male patients typically in nonspecified malignant melanoma, lentigo maligna, or superficial spreading fashion. While WLE remains the most common surgical treatment, a considerable proportion of patients receive MMS, with MMS being more likely for nodular and less likely for superficial spreading and desmoplastic melanoma. While higher income individuals with private insurance are more likely to receive MMS, Black patients and males were less likely to receive MMS.

SUBMISSION TITLE: FACIAL ACANTHOSIS NIGRICANS SUCCESSFULLY TREATED WITH NOVEL 1927 NONABLATIVE LASER THERAPY

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Background: Acanthosis Nigricans is a common dermatologic disorder that is difficult to treat. Different methods of photothermolysis have been reported to improve this condition. Case reports and various head-to-head trial studies suggest use of 1550 nm laser for treatment of the hyperpigmentation and abnormal texture. Here we present a case of acanthosis nigricans successfully treated with 1927 nm nonablative fractionated laser.

A 26-year-old male with a past medical history significant for type 2 diabetes mellitus presented for hyperpigmentation around the areas of the forehead, and malar region bilaterally. On exam there were velvety, hyperpigmented, papillomatous plaques seen on the forehead the bilateral infraorbital regions, and the neck. The patient had used 4% hydroquinone twice a day for 6 months without improvement. Following the failure of the treatment, he completed four treatments of trichloroacetic acid (TCA) peels at 15% with a second pass of 25% to the forehead and 15% to the infraorbital areas. Three months following the last treatment, the patient reported no improvement of the hyperpigmented areas and received further evaluation for laser treatment to improve the hyperpigmented areas.

Study Design/Materials and Method: Case Report; Patient recieved two treatments with 1927 nm nonablative fractionated lasers, with the follow settings: 20 mJ, treatment level 7, passes 4 (8 passes to central forehead), 4 to peripheral forehead, and 4 passes to periocular, 1.23 kJ.

Results: Given the anatomic complexity and the failure of previous treatments, the decision was made to begin treatment with a 1927 nm nonablative fractionated treatment. Following initaial treatment, patient noted slight improvement of darkened and rough textured areas. One month following second treatment, patient continued note significant lightening to the area with overall improvement to skin texture, and further treatments are planned.

Conclusion: Acanthosis nigricans is a very common cutaneous disease that is typically seen on the neck and in intertriginous areas. Facial presentation of acanthosis nigricans is very rare but has been reported in various case reports over the years [1–3]. Treatment of this cutaneous disease is difficult, and a definitive therapy of choice has not been established. Lasers have been a popular treatment modality for hyperpigmentation disorders with head-to-head studies showing them to being as effective or superior in resolution of disease as glycolic acid, 20% TCA, and 0.05% tretinoin cream [4–6], though most studies were performed using 1550 nm nonablative or CO_2 ablative lasers. No studies exist to date on evaluating the efficacy of 1927 nm nonablative laser treatment. This case illustrates the utility of 1927 nm nonablative fractionated laser in the treatment of facial acanthosis nigricans.

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SUBMISSION TITLE: IMPROVEMENT OF LICHEN PLANUS PIGMENTOSUS-LIKE DRUG REACTION UTILIZING A COMBINATION OF THE FRACTIONATED 1,550-NM ERBIUM-DOPED FIBER LASER AND TOPICAL CYSTEAMINE CREAM

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Background: Lichen planus pigmentosus (LPP) is an uncommon variant of lichenoid dermatitis characterized by irregularly shaped gray-brown patches distributed symmetrically on sun-exposed areas. Histologic findings include epidermal atrophy, lichenoid infiltrate at the dermal-epidermal junction, and marked dermal pigment incontinence, while the presence of an eosinophilic infiltrate is rare and suggests a drug-induced etiology. LPP and associated hyperpigmentation are notoriously difficult to treat.

Study Design/Materials and Method: A 70-year old female (Fitzpatrick skin type V) with biopsy proven drug-induced LPP was treated with a combination of a fractionated 1550-nm erbium-doped fiber laser and topical cysteamine cream. The patient underwent five treatment sessions at 6-week intervals followed by two treatment sessions at 3- to 6-month intervals. The entire face and neck were treated with eight passes at each session. The patient was also treated with cysteamine 5% cream once daily to the affected areas for 6 months followed by maintenance therapy two times weekly.

Results: Continual improvement with each treatment session was noted. At 3-month follow up after six treatments the patient had greater than 80% improvement of the hyperpigmentation.

Conclusion: Our novel case highlights the successful treatment of an LPP-like drug reaction with a fractionated 1550-nm erbium-doped fiber laser in conjunction with topical cysteamine. Further studies are needed to better understand efficacy, durability and optimal treatment settings for the treatment of lichen planus pigmentosus and lichenoid drug reaction by fractional photothermolysis as well as the role of topical cysteamine for these indications.

SUBMISSION TITLE: LASER REVISION OF SCARRING FOLLOWING MASCULINIZING CHEST SURGERY

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Background: Masculinizing chest surgery (top surgery) involves the removal of breast tissue and nipple repositioning/reshaping to achieve a masculine chest appearance in transgender men and other transmasculine individuals. The most common techniques are the double-incision mastectomy (DM) and the circumareolar approach. Regardless of the approach, postmastectomy patients are left with scarring. Studies examining laser management are lacking. Herein, we describe two cases of postoperative mastectomy transgender patients presenting to dermatology for scar assessment and the laser treatment outcomes of two.

Study Design/Materials and Method: Case:

The first case is a transgender man in his mid 20s who underwent DM with nipple grafts. He presented for

hypertrophic scarring and dyspigmentation 12 months following the procedure. His chest was treated with three pulsed-dye-laser (PDL) (595 nm) and three combination PDL/fractional CO_2 laser (10,600 nm) sessions. Four treatments were followed by intralesional triamcinolone acetonide (TAC) and one was followed by laser assisted drug delivery of TAC. Treatments were performed every 4–8 week and global photography was obtained.

The second case is also a transgender man in his mid 20s who presented for treatment following a bilateral mastectomy with subsequent bilateral nipple areolar revision due to areolar complex widening. He presented 10 months following his revision with complaints of hypertrophic periareolar scars. The bilateral periareolar area was treated with 23 PDL, five of which were combination CO_2 sessions. The patient and clinician reported improvement in scar thickness, dyspigmentation and appearance.

Results: Discussion:

PDL, CO_2, and the combination have been successfully used in the revision of postsurgical and burn scars. Chest masculinization is imperative to gender affirmation. Our novel cases highlight that laser therapy may be an effective option to treat scarring and dyspigmentation following masculinizing chest surgery.

Conclusion:.

SUBMISSION TITLE: LASER THERAPY IN PATIENTS WITH CUTANEOUS CONNECTIVE TISSUE DISEASE: A CASE SERIES

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Background: Autoimmune connective tissue diseases like systemic sclerosis (SS) and systemic lupus erythematosus (SLE) can affect all major organ systems leading to functional impairment and cosmetic deficits. Although the number of cosmetic treatments performed in the United States continues to rise, the dermatologic literature for performing cosmetic treatments in patients with autoimmune connective tissue diseases remains sparse. In this case series, we document three cases of subjective aesthetic improvement, without complications, following laser therapy in patients with autoimmune connective tissue disease.

Study Design/Materials and Method: Case series

Results: Cases:

(1) A 47-year-old woman Fitzpatrick skin type (FPST) II with a complex rheumatologic history including relapsing polychondritis, rheumatoid arthritis, Sjogren's syndrome, undifferentiated connective tissue disease, and systemic lupus erythematosus (SLE) was referred to cosmetic clinic from her primary dermatologist. On exam, the patient had persistent erythema, dyspigmentation, and mixed atrophic and hypertrophic scarring secondary to prior cutaneous erythematous annular plaques in sun-exposed areas on her trunk and upper extremities. Profractional erbium yag laser therapy (2940 nm with a depth of 110 μm) was recommended for the chest and upper extremities. As of now, she has tolerated a complete round of laser therapy with promising results and plans for future sessions spaced 3 months apart.

(2) A 53-year-old female FSPT II with a 10-year history of Raynaud's disease and SS complicated by cutaneous calcinosis presented to cosmetic clinic for treatment of telangiectasias on the face and chest. On presentation, matted telangiectasias were present on neck, chest, and face with left sided facial volume loss and progressive restrictive opening of the oral cavity. The patient underwent three rounds of pulsed dye laser (PDL) (595 nm wavelength) therapy spaced 3 months apart resulting in reduced erythema at the treated sites. She plans to continue PDL treatment for her face and chest. She will consider future filler injection and hyaluronidase treatment if her volume loss and microstomia progress further.

(3) A 30-year-old woman FSPT VI with a 17-year history of SLE with significant skin involvement including Rowell syndrome and scarring alopecia initially presented to dermatology with depigmented and hyperpigmented plaques on scalp, ears, and face with background erythema. She also had patchy areas of erythema surrounding her mouth and complete loss of eyebrow hair secondary to inflammation. She was referred to cosmetic clinic for progressive postinflammatory hyperpigmentation, depigmentation, and scarring secondary to her disease. For the next 7 years, the patient received PDL (595 nm wavelength) treatment of the face and chest every several months with marked evidence of reduced scarring and re-pigmentation at treatment sites. Her disease course continues to be difficult with periodic cutaneous flares and new systemic involvement.

Conclusion: Best-evidence recommendations for performing cosmetic treatments in patients with autoimmune connective tissue diseases remains limited as there is a lack of clear safety guidelines or information regarding risk of disease reactivation secondary to postprocedural inflammation. In this case series, we document three instances of laser therapy providing subjective cosmetic benefits to patients with autoimmune connective tissue diseases without treatment-related complications. Further studies regarding best cosmetic practices and treatment benefits for patients suffering with autoimmune connective tissue disease are needed.

SUBMISSION TITLE: LASERS IN COMPLEX MEDICAL-DERMATOLOGIC DISEASE TREATMENT

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Background: The use of pulsed dye laser (PDL) to treat complex medical-dermatologic diseases, including CREST (calcinosis, Raynaud phenomenon, esophageal dysmotility, sclerodactyly, and telangiectasia), lupus, and dermatomyositis, has been documented. In this report, we describe two cases from a single academic medical center in which PDL was successfully utilized to treat cutaneous manifestations of complex medical-dermatologic diseases.

Connective tissue diseases with cutaneous manifestations are frequently resistant to first-line treatments including topical and systemic medications, though recent studies have shown that laser therapy is an effective treatment modality. In SLE specifically, telangiectasias are a common cutaneous manifestation for which PDL, with a wavelength of 585–595 nm, has been demonstrated as highly effective (LaRosa, 2017). In a study highlighting eight cases of morphea, associated facial telangiectasias were successfully treated with PDL for up to 2 years after treatment (Tursen, 2018). PDL has also found to be effective in trials for patients with dermatomyositis and sclerosis, both systemic and localized (LaRosa, 2017). Further, a 2013 study suggested that PDL in combination with fractional resurfacing lasers effectively treated the cutaneous manifestations of lupus pernio (Emer, 2013).

Study Design/Materials and Method: We present two cases from a single academic medical center of individuals with complex medical-dermatologic disease treated with PDL.

Results: Case 1:

A 42-year-old male with history of sarcoidosis presented for treatment of an erythematous lesion on the nose with PDL. The lesion had been present for 1 year. He had previously treated it with mupirocin and triamcinolone. The lesion was biopsied, and results showed granulomatous inflammation. There was no associated pain with the lesion, and there were no other lesions or rashes elsewhere.

On exam, he had an erythematous to violaceous, edematous thin plaque involving the nasal tip, nasal ala, and columella. He had been using clobetasol 0.05% ointment and tacrolimus and had no previous laser treatment.

Lesions on the nasal tip, nasal ala, and columella were treated using a 595 nm wavelength laser over the course of the three PDL treatments.

Case 2:

A 53-year-old female with a history of CREST syndrome presented for treatment of symptomatic matted telangiectasias on the cheeks, forehead, and temples with PDL.

Pertinent examination findings included matted telangiectasias of face and chest, microstomia with restricted oral aperture, volume loss of left mid cheek, and sclerosis of the digits with small ulcerations and erosions.

Lesions on the cheeks, forehead, and temples were treated using a 595 nm wavelength laser over the course of five rounds of PDL treatment.

Conclusion: These two cases of PDL successfully treating complex medical-dermatologic diseases bolster the existing literature demonstrating that PDL may be an effective treatment option for these patients. A wavelength of 595 nm was effective in reducing the erythema at each site with relatively few treatments. These cases underscore the broad range of patients who may benefit from laser therapy, not least of which are patients with significant medical-dermatologic conditions such as those with sarcoidosis and connective tissue diseases.

SUBMISSION TITLE: LOW-POWER, LOW-DENSITY, 1927 NM LASER FOR ABLATIVE RESURFACING ASSOCIATED POSTINFLAMMATORY HYPERPIGMENTATION IN SKIN OF COLOR

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Background: Ablative resurfacing, both traditional and fractional, is widely used for the treatment of various skin conditions, including scarring. However, given the higher incidence of postinflammatory hyperpigmentation (PIH) in darker skin types, this treatment has been avoided by many physicians. More recently, laser resurfacing using low-power, low-density 1927 nm lasers have been shown to safely and effectively improve PIH. This study reviews the utility of this treatment modality for PIH associated with ablative resurfacing in skin of color.

Study Design/Materials and Method: A retrospective chart review was performed over a 2.8-year period. Patients had ablative resurfacing, developed PIH from this treatment, and then were treated with a low-power, low-density 1927 nm laser (LaseMD, Ultra, Lutronic, South Korea; Clear+Brilliant; Solta). Patients with Fitzpatrick Skin Type (FST) IV–VI were included. Overall improvement was assessed with 5-point Global Aesthetic Improvement Scale (GAIS) using photographs.

Only those with adequate evaluable photographs were included.

Results: Twelve patients with FST IV ($n = 6$; 50%), V ($n = 4$; 33%), and VI ($n = 2$; 17%) received ablative resurfacing with a fractional ablative CO_2 laser ($n = 10$; 83%) or fully ablative erbium laser ($n = 2$; 17%) for acne scars ($n = 7$; 58%), traumatic or surgical scars ($n = 4$; 33%), and xanthoma ($n = 1$; 8%). Patients had a mean 2.25 ablative resurfacing treatments (R: 1–5), and all cases involved the face. For treatment of the ablative resurfacing associated PIH, there was a mean 2.75 (R: 1–8) treatments with a low-power, low-density 1927 nm laser. Treatments were typically initiated 4–6 weeks after ablative resurfacing, with repeat treatment every 2–4 weeks. Immediately following treatment, topical tranexamic acid and/or a novel lightening topical compound (A-Luminate; Alastin) were applied. All patients had marked improvement denoted by GAIS scores of either 1 ("Very much improved") ($n = 6$; 50%) or 2 ("Much improved") ($n = 6$; 50%).

Conclusion: Low-power, low-density 1927 nm laser resurfacing is effective in the treatment of PIH associated with ablative resurfacing in skin of color.

SUBMISSION TITLE: PATIENT-REPORTED LEVELS OF PAIN IN HYPERTROPHIC SCAR BEFORE AND AFTER FRACTIONAL ABLATIVE LASER TREATMENT

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Background: The focus of this study was on the use of fractional ablative lasers (FLSR) to treat HTSs. It was hypothesized that patient-reported levels of pain associated with HTS would decrease between pre-op and post laser treatment evaluation. It was also hypothesized that demographic or injury characteristics would be able to predict patients who responded to treatment versus those that did not.

Study Design/Materials and Method: A retrospective chart review was performed. The focus of this study was to analyze data from the pre-op visit and the first six laser session follow-ups. Patients rated their pain using a Patient Scar Assessment Scale (POSAS). One hundred and ten patients were included in the analysis. A score of one indicated a low pain level while a score of 10 was high. A difference between pre-op pain score and final laser session of ≥3 qualified as a "responder" ($n = 46$) while a difference of ≤2 or worse score during final session qualified as a "nonresponder" ($n = 62$).

Results: FLSR led to decreased pain scores in all patients. There was a significant decrease at all post-op laser sessions 1–6 (pre-op, sessions 1, 2, 3, 4, 5, $6 = 5.95 \pm 0.24$, 4.10 ± 0.27, 4.49 ± 0.30, 4.20 ± 0.33, 4.48 ± 0.42, 3.86 ± 0.42, 4.29 ± 0.53, $p < 0.05$).

Patients in the responder group had significantly decreased pain scores after laser at all post-op sessions compared to pre-op (pre-op, sessions 1, 2, 3, 4, 5, $6 = 7.40 \pm 0.27$, 3.46 ± 0.36, 4.00 ± 0.49, 3.39 ± 0.45, 3.32 ± 0.53, 2.72 ± 0.37, 3.75 ± 0.61, $p < 0.0001$). The most significant drop in scores occurred after the first treatment, after which the scores remained similar through six sessions. There were no significant differences in the nonresponder group for pain scores.

Responders had significantly higher pre-op pain scores compared to the nonresponders (7.40 ± 0.27 vs. 4.82 ± 0.32, $p < 0.0001$). However, there was no significant difference between responder and nonresponder with the type of drug delivered during laser treatment ($p = 0.3268$). Additionally, there was no significant difference between responder and nonresponder for gender ($p = 0.7002$), Fitzpatrick skin type ($p = 0.2051$), race ($p = 0.6747$), age of scar ($p = 0.0988$), or age of patient ($p = 0.2449$).

Conclusion: Forty-two percent of patients were classified as responders and 56% as nonresponders within the pain score group, indicating that pain was not improved in a higher percentage of patients in response to laser treatment. Patients that were responders had higher pain levels pretreatment than nonresponders. The largest drop in pain scores was seen after the first treatment after which there were not many changes. No demographic or injury variables were able to predict responder grouping.

SUBMISSION TITLE: PERIORAL FACIAL HAIR REFRACTORY TO LASER HAIR REMOVAL IN TRANSGENDER PATIENTS: A REPORT OF 3 CASES

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Background: Laser hair removal (LHR) is one of the most common gender-affirming procedures sought by transgender and gender diverse (TGD) patients. Hair removal has been associated with increased quality-of-life and decreased anxiety in TGD patients. We describe two cases of facial hair refractory to LHR in TGD patients.

Study Design/Materials and Method: Cases: A white transgender woman assigned male at birth (AMAB) in her 20's on oral spironolactone, estradiol, and progesterone for 20 months was treated with LHR using a 755 nm long-pulsed alexandrite laser along the jawline and perioral region. She underwent six treatments over 8 months (15 mm spot-size, 27 J/cm^2 energy, 3 milliseconds pulse duration, and 40/30 dynamic cooling), but hair on the upper lip and chin was refractory to treatment). In our second case, white transgender woman AMAB in her 30's on oral spironolactone and intramuscular estradiol for 24 months sought LHR with the same device for the upper lip, jawline, and neck. She received eight treatments over 12 months (15 mm spot-size, 30 J/cm^2 energy, 3 milliseconds pulse duration, and 40/40 dynamic cooling) with hair on the perioral region refractory to treatment. The final patient is a white transgender woman in her early 30s on intramuscular estradiol. She received LHR on the face and neck using the same device. She received nine treatments over 13 months (15 mm spot-size, 30 J/cm^2 energy, 3 milliseconds pulse duration, and 40/40 dynamic cooling).

Results: LHR is an important intervention for TGD patients, but our findings suggest that perioral hair may be more refractory to LHR.

Conclusion: Limitations include the small number of cases and limited number of treatment sessions completed. Further studies are needed to better identify if there are sites more refractory to LHR and if so, effective methods to improve LHR efficacy in these areas.

SUBMISSION TITLE: POPULARITY OF FAR-INFRARED SAUNAS AND POTENTIAL DERMATOLOGIC RISKS: A GOOGLE TRENDS ANALYSIS

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Background: In the past decade, far-infrared saunas (FIS) have emerged as an alternative to traditional warmed air saunas. In contrast to traditional saunas, FIS utilize infrared wavelengths to improve user tolerability by penetrating deeper into body tissues and increasing perspiration despite being at a lower temperature. However, as a result, FIS exposes users to a greater amount of irradiation, calling into question any potential safety risks.

Study Design/Materials and Method: We performed an analysis of Google Trends to review the interest of infrared saunas from 2004 to present day (2022). We also performed searches for infrared sauna in Google search engine in the invisible "Incognito" mode to examine what types of claims on FIS exist without obscuring Google Trends data. Investigation of the current literature on dermatologic risks associated with FIS was performed through PubMed querying. We used MeSH and non-MeSH keywords of "far-infrared sauna(s)" and "infrared sauna(s)" to search for current literature on FIS. We further explored the current literature on far-infrared light effects on the skin using MeSH and non-MeSH keywords such as "far-infrared light" and "skin" on PubMed.

Results: Google Trends analysis revealed that between 2014 and 2017, the search volume for FIS nearly doubled and has continued to increase since. This growth likely correlated with FIS being a topic of interest in popular media around 2016. The onset of the pandemic in 2019 also brought up interest in FIS as a means of prevention and/or therapy for COVID-19, which may have also contributed to the continued upward trend of interest. Our initial search for FIS on PubMed garnered 65 results with only 16 being clinical trials or randomized controlled trials. Among these studies, there were none that investigated FIS in relation to skin health specifically, or the dermatologic risks of FIS. There was only one study that reported on the dermatologic use of FIS for treatment of refractory foot ulcers in a patient with systemic sclerosis. When searching for articles on far-infrared light effects on the skin, only 17 results were found. Improved blood circulation and wound healing were the most commonly suggested potential benefits of far-infrared light on skin. An initial query of "infrared sauna" on Google search engine yielded over 9 million results, while "infrared sauna+benefits+dangers" yielded over 400,000 results. Numerous supposed benefits of FIS were frequently listed in the top search results, including but not limited to, detoxification, musculoskeletal pain relief, increased sleep quality and overall relaxation. Major dermatologic claims regarding FIS included antiaging benefits through increased collagen and elastin production, enhanced circulation for cell turnover, improved skin clarity and purification of skin.

Conclusion: Given the growing interest and popularity of FIS for a variety of uses, there is a need to bridge the disconnect between scientific evidence and discussions from mainstream media. There are frequent skin claims about FIS that arise through basic querying on Google search engine, such as antiaging and detoxification benefits. Whether or not FIS is being utilized for dermatologic purposes, it is critical to further investigate potential harmful effects or reactions to the skin. Dermatologists thus have an opportunity to play an invaluable role in rigorously evaluating the safety and utility of FIS.

SUBMISSION TITLE: PULSED DYE LASER AND ADJUVANT TOPICAL THERAPIES FOR THE TREATMENT OF PORT-WINE STAINS: A SYSTEMATIC REVIEW

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Background: Port-wine stains (PWS) are congenital vascular malformations with an incidence of 0.3% [1,2]. The gold standard treatment is pulsed dye laser (PDL); however, complete resolution is often difficult to achieve [3]. Neoangiogenesis could contribute to treatment failure, suggesting antiangiogenic topical therapies as a potential adjunct modality for improving PDL treatment efficacy [4,5]. This study aims to assess the effectiveness of various adjuvant topical therapies in conjunction with PDL for the treatment of PWS via a systematic review of the literature.

Study Design/Materials and Method: Following PRISMA guidelines, a systematic review was performed from inception to December 4, 2022 using PubMed, Embase, Web of Science, and clinicaltrials.gov with the following search queries: "port-wine stain," "nevus flammeus," "capillary malformation," "sturge weber," and "pulsed dye laser". A research librarian was consulted for this systematic search. Articles were included if they (1) were a randomized controlled trial (RCT); (2) studied patients with PWS; and (3) investigated topical adjuvant therapies with PDL. Non-English language studies were excluded. Two reviewers (MC and MK) independently screened titles and abstracts of identified articles, followed by the full text of publications considered potentially eligible. Data were extracted onto an electronic form and the following metrics were reviewed: first author's name, year of publication, number of participants, number of lost participants, study design, average age, gender, location and type of PWS, PDL treatment protocols, topical treatment regimen, follow-up time, outcomes, and adverse events. The primary outcome studied was change in appearance of PWS in patients who received topical adjuvant therapies. An attempt to elucidate missing or unclear data was done by reaching out to all principal investigators of the studies included in this review. Risk of bias was assessed using the Critical Appraisal Skills Programme (CASP) Randomised Controlled Trial Standard Checklist.

Results: Through the search, 1835 studies were identified. After screening for duplicates and applying the above-stated criteria, six studies met the standard for full-text review, all of which were ultimately included. Study quality was low in one study, moderate in three, and high in two. The total number of patients studied was 103 (range: 9–23), with 8- to 36-week follow-up. Four studies were split-face, and three were double-blind. The average age ranged from 11 to 33.5 years old; one study included only pediatric patients [9]. Three studies examined adjuvant topical sirolimus ($n = 52$, 0.2% cream, 1% cream, or 1 mg/mL solution) daily [6–8], two examined timolol ($n = 29$, 0.1% or 0.5% gel) twice daily [9,10], and one studied adjuvant imiquimod ($n = 22$, 5% cream) three times weekly [11]. Outcomes using sirolimus as adjuvant topical treatment are mixed: one RCT did not report improvement in PWS through colorimetric analysis [8], another demonstrated significant improvement through Investigator Global Assessment (IGA) [6], and another study showed significant improvement through digital photographic image (DPI) scoring [7]. Both studies examining topical timolol reported no change in PWS appearance compared to placebo. Addition of 5% adjuvant imiquimod cream did lead to significant improvement in PWS appearance, which was confirmed using colorimetric analysis. A variety of outcome measures were reported, including ΔE (difference between PWS and normal skin) divided into lateral and medial sites or of the whole lesion, quantitative and qualitative IGA scoring, a blanching rate derived from ΔE, and a multicomponent DPI score. In terms of adverse events, only imiquimod and sirolimus led to transient mild cutaneous side effects, which included mild skin irritation, pruritus, and stinging.

Conclusion: Overall, the efficacy of adjuvant topical therapy was unclear. Limitations included variation in concentration and duration of adjuvant therapies, differences in follow-up time, and inconsistent outcome measure reporting. Regardless, given their potential clinical promise, additional studies examining topical adjuvant therapies should be considered moving forward.

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SUBMISSION TITLE: RACIAL DISTRIBUTION IN LASER AND ENERGY-BASED CLINICAL TRIALS IN THE UNITED STATES

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Background: In modern dermatology, there are many types of lasers and energy-based devices that are commonly used for a wide range of cutaneous conditions, including the treatment of vascular and pigmented lesions in addition to cosmetic applications. With the overall racial and ethnic diversity of the country increasing, patients of skin of color and different backgrounds are actively seeking medical and cosmetic treatments in the office and home settings. However, lasers have widely been tested in skin types 1–3, with limited studies conducted on darker skin types. With the significant increase in skin of color patients, there needs to be an increase in clinical trials and literature addressing safe and effective laser and energy-based therapies for pigmented skin. Our objective is to review the racial and ethnic distribution in laser and energy-based clinical trials in the United States.

Study Design/Materials and Method: Authors searched clinicaltrials.gov database in December 2022 for eligible trials focused on laser treatments or energy-based devices for any dermatologic condition in which participant recruitment took place solely in the United States (US). All studies were searched with the following filters: Condition: dermatologic disease, Other terms: Laser, Country: United States, With Results. We included trials that focused on laser treatments or energy-based devices. Trials were excluded if there was no reported race or ethnicity data of participants.

Results: Of the 179 identified clinical trials, 39 trials met inclusion criteria with a total of 1445 patients. Out of the trials that included race, there were 1267 patients including 89% White patients, 6% African American patients, 3% Asian patients, and 2% Other or Unknown. Of those that included ethnicity, from a total of 897 patients, there were 11% Hispanic patients, 88%

Not-Hispanic patients, and 0.6% Unknown. Fourteen trials reported Fitzpatrick type with 416 patients total, demonstrating Fitzpatrick Type I (4.09%), Fitzpatrick Type II (37.26%), Fitzpatrick Type III (36.06%), Fitzpatrick Type IV (13.94%), Fitzpatrick Type V (7.21%), and Fitzpatrick Type VI (1.44%). Twenty-six trials were industry-funded, and the remaining 13 trials were funded by individuals/universities/organizations. The top conditions treated were acne/acne scars and skin laxity. Some of the devices used in the trials included Q-switched Nd:YAG laser, fractionated carbon dioxide laser, pulsed dye laser, as well as devices with ultrasound energy or radiofrequency.

Conclusion: The findings in our study provide preliminary evidence that African Americans, Asians, and Hispanics may be underrepresented in laser or energy-based therapies in US clinical trials. It also emphasizes the need to implement a more consistent reporting of race and ethnicity across all types of clinical trials. Adequate representation will contribute to enhanced knowledge of device use in underrepresented patients of diverse backgrounds and improve health disparities in procedural and aesthetic dermatology. It is imperative to address barriers to access to care and advocate for racial diversity to obtain equitable representation in clinical trials.

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SUBMISSION TITLE: RESOLUTION OF HYDROXYCHLOROQUINE-INDUCED HYPERPIGMENTATION OVER THE UPPER AND LOWER EXTREMITIES AFTER SINGLE TREATMENT WITH 532 NM-750 PICOSECOND LASER

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Background: Antimalarials such as quinacrine, chloroquine and hydroxychloroquine (HCQ) can induce tissue pigmentation in various organs including skin, mucosa, joint tissue, trachea, and cartilage in the nose and ears. The incidence of cutaneous hyperpigmentation in patients with systemic lupus erythematosus treated with antimalarials is reported to be as high as 10%–25%. Skin lesions tend to resemble ecchymoses and hyperpigmented patches that fail to resolve, and the theorized mechanism has been drug extravasation with binding to melanin. No therapy exists to treat this condition. We aimed to explore the efficacy of 532 nm-750 picosecond laser in resolving the hyperpigmentation associated with long-term HCQ use in a woman with Fitzpatrick skin type II.

Study Design/Materials and Method: This retrospective case report evaluated a 71-year-old female with Fitzpatrick skin type II who presented with bluish-gray and brown discoloration involving the bilateral forearms and shins. Her medical history was significant for mixed connective tissue disease with fatigue, morning stiffness, joint pain, Raynaud's phenomenon, and positive ANA and U1RNP. Oral HCQ at 200 mg twice daily was started approximately 17 years prior. She developed easy bruising and erythematous, pruritic patches over the bilateral forearms and anterior shins that darkened into brown patches over 8 years prior. Biopsies showed lichenoid dermatitis suspected to be secondary to HCQ, which was subsequently discontinued. Her skin discoloration was not reversible with drug cessation. Failed topical treatments included betamethasone dipropionate 0.05% cream, triamcinolone 0.1% cream, and tacrolimus 0.1% ointment.

Treatment with picosecond laser was recommended. Following an initial test spot, the bilateral posterior forearms and bilateral mid-shins were treated using with 532 nm-750 picosecond laser with 0.5 J/cm^2 fluence, 8 mm spot size, and 2 Hz with trace overlap to an endpoint of confluent, hazy whitening. Patient declined anesthesia and tolerated the treatments well. Ice packs and topical steroid were applied postprocedure.

Results: The patient reported 85% resolution of her hyperpigmentation following a single treatment. No adverse effects or recurrences were evident at 3- and 6-week follow-up.

Conclusion: The incidence of antimalarial-induced hyperpigmentation has been reported to occur without association to cumulative dose or treatment duration. It predominantly presents over the anterior legs and over the posterior arms, but it can also involve the face and mucosal surfaces. Often, there is preceding ecchymoses that is hypothesized to trigger the hyperpigmentation through increased hemosiderin content inducing melanocyte activation.

HCQ is overall well-tolerated without leading to significant immunosuppression. As such, it is often a first-line treatment option for several connective tissue diseases and other autoinflammatory and autoimmune conditions. The hyperpigmentation side effect may lead patients and providers to discontinue the medication despite adequate management of connective tissue disease symptoms, as occurred in our patient. Prior reports have suggested that development of hyperpigmentation was also not associated with duration nor cumulative dose of HCQ. As such, it may represent an idiosyncratic event with potential unidentified triggers or risk factors. Given the larger surface area that can be involved, topical treatment options are often not feasible, effective, nor cost-effective.

Picosecond laser was found to be a safe and effective treatment for HCQ-induced hyperpigmentation in our patient within one treatment session. The patient is continuing HCQ and may require additional sessions in the future. Picosecond laser uses photoacoustics to deliver energy in short pulse durations with minimal thermal heat, which reduces risk of further hyperpigmentation, especially in patients with skin of color compared to other lasers that generate more heat during treatment. Recognition of safe and efficacious treatment options like picosecond laser to address the adverse effect of hyperpigmentation could help with maintaining patients on HCQ. Furthermore, picosecond lasers may have wider applicability to treating other causes of hyperpigmentation.

SUBMISSION TITLE: SOCIAL MEDIA INFLUENCE ON LASER PROCEDURES AT AN ACADEMIC INSTITUTION

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Background: The demand for cosmetic procedures continues to increase in the United States. Literature suggests that 95% of patients who consider a cosmetic procedure consulted an online source, including social media. While there is literature published on factors influencing the selection of procedures and practitioners, there is little information on the reasons for pursuit for cosmetic procedures at an academic institution.

Study Design/Materials and Method: A cross-sectional study was performed on participants who received cosmetic laser procedures from a cosmetic fellowship trained dermatologist at an academic institution. Participants answered survey questions regarding the inspiration to pursue laser treatment and whether social media played a part in the decision.

Results: Fifty-four participants completed the survey (age range 21–77 years old, 44 females, 10 males) with an average age of 52 years old. Thirty-nine participants pursued laser treatment on a personal choice, 22 on a physician recommendation, and 4 by influence of friends or family. Zero participants felt primarily influenced by social media or celebrities/influencers. Although, when asked directly if social media was an influence on their decision, one participant said "Yes" by Instagram specifically.

Conclusion: Based on our small study, patients who decide to pursue laser cosmetic treatments at an academic institution may not be as influenced by social media. This result may be due to our patient population's age as social media tends to influence younger generations. Little to no data exists on the factors influencing patient choice to pursue cosmetic treatments at an academic institution. Further, it is unclear what the role is for social media in the pursuit of cosmetics procedures at an academic institution compared to private practice. This study is limited by data containing only patients who received laser therapy. Future studies should include other cosmetic procedures such as injectables.

SUBMISSION TITLE: THE DUALITY OF DEVICES: RADIOFREQUENCY IN HAIR

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Background: Radiofrequency (RF) devices are being increasingly used for dermatology applications. Recent studies have reported an apparent dualistic nature of RF devices for hair, causing either removal or growth depending on the modality of RF. This dichotomy makes RF an intriguing therapeutic option in a spectrum of hair conditions.

Study Design/Materials and Method: This study sought to provide a systematic review of the role of RF devices in human hair and to discern potential mechanisms of action. PubMed/MEDLINE and Web of

Science searches were conducted in July 2022 according to PRISMA guidelines for studies discussing the use of RF technology in hair applications. Only full-text articles that directly evaluated the use of RF in human hair growth or reduction were included ($n = 19$).

Results: The majority of studies described the utility of RF devices in the removal of unwanted hair ($n = 15$). The use of monopolar RF (mRF) devices to remove eyelashes in patients with trichiasis was successfully documented in three separate clinical studies (total $n = 147$ patients). Combining bipolar RF (biRF) with intense pulsed light laser (IPL) proved superior in body hair reduction compared to IPL monotherapy (5%–8% greater hair reduction, $p < 0.05$). Hair clearance was also better sustained after maintenance biRF/IPL treatment sessions compared to IPL monotherapy (15% greater hair reduction, $p < 0.05$). Combined therapy demonstrated efficacy in lighter colored hairs, with evidence of augmentation after pretreatment with aminolevulinic acid (48% vs. 36% improvement after pretreatment).

Fractional RF was used in four reports as a successful adjunct treatment for assisted drug delivery of topical triamcinolone and minoxidil in alopecia areata (AA) and androgenic alopecia (AGA) patients, increasing both mean hair counts (66% vs. 37% increase, $p < 0.05$) and hair thickness (34% vs. 27% increase, $p < 0.05$). Similarly, nonablative RF as monotherapy stimulated hair density (31.6% increase), hair thickness (18% increase), and hair count (22.8% increase) in AGA patients.

No serious adverse events were reported. Minor side effects included transient erythema, edema, burning, hyperpigmentation, and pain during treatment.

Conclusion: Bipolar RF has been used in combination with IPL for effective long-term removal of body and facial hair. Due to their chromophore-independent method of energy delivery, RF is a viable add-on therapy for treating lighter colored hair and darker Fitzpatrick skin types, which have traditionally posed challenges to light and laser based therapies. Monopolar RF has shown promise in eyelash removal in patients with trichiasis, particularly with disposable electrode tips inserted directly into individual eyelash follicles. Conversely, fractional RF has been used to stimulate hair growth in patients with AA and AGA, either alone or in conjunction with topical treatments through transepidermal assisted drug delivery.

In essence, preliminary evidence supports the use of biRF and mRF devices for hair removal, while fractional RF appears to be an emerging technology for hair growth. All modalities have shown good safety profiles and long term efficacy in hair removal. While these therapies are promising, additional large scale studies are needed to further investigate their efficacy, mechanisms, and parameters for various hair applications.

SUBMISSION TITLE: THE RESIDENT COSMETIC CLINIC: A RETROSPECTIVE ANALYSIS COMPARING VOLUME AND PREDOMINANT TYPE OF LASER AND LIGHT BASED PROCEDURES IN THE PRE AND POST COVID-19 PANDEMIC PERIOD

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Background: The consequences of government enforced restrictions in light of the COVID-19 pandemic have heavily impacted all sectors of the healthcare industry, including the field of minimally invasive nonsurgical cosmetic procedures which involves close physical contact with patients [1,2]. Our study aims to compare the volume and predominant type of laser procedures and light based energy device procedures in the Loma Linda Dermatology Resident Cosmetic Clinic (RCC) pre (2016–2019) and post (2020–2022) the COVID-19 pandemic. Data will be analyzed to elucidate the impact of the COVID-19 pandemic on patient's differential preferences for elective cosmetic procedures during this time.

Study Design/Materials and Method: Deidentified data were collected from a retrospective chart review of patients scheduled in the RCC which typically occurs on a monthly basis. This study was determined to be IRB exempt. The total number of resident performed procedures were recorded in Microsoft Excel and defined by: ablative laser, nonablative laser, hair removal laser, vascular laser and intense pulse light (IPL). Microsoft SPSS and/or Microsoft Excel were utilized for standard data analysis which included simple summary statistics, pivot tables, linear regression and Student's t test. The goal of data analysis was to determine yearly trends.

Results: All recorded procedures reached their nadir in 2020. IPL, the most popular recorded procedure, showed a 75% decrease between 2019 and 2020, while the volume of hair removal laser, vascular laser, and nonablative laser dropped by 100%, 86% and 78%, respectively during the same time period. The ablative laser volume remained unchanged; there were no recorded ablative laser procedures from 2016 to 2020. IPL remained the most common procedure performed after 2020. In 2022, IPL and hair removal laser procedures surpassed prepandemic 2019 volumes. With the exception of ablative laser, after 2020, all recorded procedures showed a statistically significant increase in interest.

Conclusion: All recorded procedures reached their lowest volumes in 2020, aligning with the 10-month peak period of the pandemic spanning from March to December 2020 when stay at home statewide mandates were implemented. Though results of this study are from the microcosm of the Loma Linda Dermatology RCC,

our findings corroborate current nationwide trends and help elucidate future nationwide trends within the realm of laser and light based procedures.

SUBMISSION TITLE: THE ROLE OF LASER AND ENERGY ASSISTED DRUG DELIVERY IN THE TREATMENT OF ALOPECIA

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Background: Although previously only used as monotherapy, it has been recently established that laser treatment can be combined with topical or intralesional medications to enhance the delivery of drugs and improve overall results in a variety of different dermatological disorders. This treatment is often referred to as laser-assisted drug delivery (LADD). However, there are other devices that can be used to enhance drug delivery like radiofrequency microneedling(RFMN). We propose a new term—Laser and Energy Assisted Drug Delivery (LEADD)—to include other forms of energy-based devices not included in LADD.

Objective: The aim of this review is to evaluate the use of LEADD for the treatment of alopecia with a specific focus on ablative lasers, nonablative lasers, and RFMN.

Study Design/Materials and Method: A comprehensive PubMed search was performed in December 2022 for "laser assisted drug delivery" as well as "laser" and "alopecia." Articles were then screened for eligibility with the inclusion criteria as the article focused on LEADD for alopecia treatment, focused on human subjects, and was in English. Results were further refined to only include articles involving ablative lasers, nonablative lasers, and RFMN. Review articles were excluded. Ultimately 18 articles were included in this review spanning from 2018 to 2022. Articles were evaluated for laser type and setting, drug, study design, selected outcomes, and study type. Randomized controlled trials (RCTs) were assessed for quality by the Jadad scale which addresses randomization, blinding, and accounting for all subjects including dropouts.

Results: Currently, the evidence regarding LEADD for alopecia treatment is limited to two specific alopecia subtypes: Alopecia Areata (AA) and Androgenetic Alopecia (AGA)/Pattern Hair Loss (PHL). LEADD with minoxidil and platelet rich plasma (PRP) were evaluated for efficacy in both the treatment of AA and AGA. LEADD with topical corticosteroids and intralesional methotrexate were studied for the treatment of AA, while LEADD with growth factors and stem cells were studied for the treatment of AGA.

Multiple RCTs evaluated LEADD for triamcinolone acetonide (TAC) with ablative fractional lasers for the treatment of AA. There is evidence in the literature that supports the use of topical minoxidil in combination with nonablative lasers for the treatment of AGA/PHL. All of the reviewed studies show a positive treatment effect with LADD; however, some trials did not find LEADD to be superior to monotherapy or microneedling assisted drug delivery. Of note, 50% of the studies reviewed were published in 2022 reflecting a rapidly growing interest in treating alopecia with LEADD techniques.

Limitations: There is a lack of large, high-quality RCTs relating to LEADD treatment of alopecia which is evident by the low Jadad scores ascribed to most of the RCTs evaluated. It is difficult to conduct double-blinded studies as it would be challenging to use a sham laser device. Only one of the articles utilized a topical placebo.

Conclusion:LEADD is a rapidly emerging treatment modality for the treatment of AGA and AA. Traditional drug modalities can be combined with laser treatments for an augmented effect. Larger, well-designed studies are needed to draw more definitive conclusions.

SUBMISSION TITLE: THERAPEUTIC AND WARNING ENDPOINTS FOR LASERS AND ENERGY-BASED DEVICES: AN UPDATE

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Background: Therapeutic endpoints are immediate device-tissue reactions that provide a reliable indicator of treatment response, and help guide the delivery of safe and effective treatments. A nuanced understanding of the size and chromophore of the target, lesion histology, and unique device parameters enables the proceduralist to assess in real-time the efficacy of a

treatment and modify parameters accordingly based on feedback, rather than rely on "preset" device settings. Therapeutic and warning endpoints for the most common indications and devices have been described previously by our group. Here, we expand upon these clinical endpoints as well as describe new ones for additional indications and devices, with an emphasis on device-tissue interactions in skin of color.

Study Design/Materials and Method: Based on literature review and clinical experience, we demonstrate a step-wise approach to identifying therapeutic endpoints, compare complete versus incomplete responses, and illustrate therapeutic and warning endpoints across a spectrum of skin tones. Moreover, we expand upon previously established endpoints as well as describe new ones that rely not only on our sense of "sight," but "sound" as well.

Results: We discuss the mechanism of action of device-tissue interactions and the subsequent histological and clinical responses for new visual, auditory, and subjective endpoints. Subtle purpura serves as an endpoint for scars and pinpoint bleeding/rhytid smoothening serve as indicators/endpoints for ablative fractional lasers. Moreover, we describe endpoints that we can hear such as the unique sounds created by the picosecond laser's photoacoustic effect on pigmented lesions/tattoos, the 1927nm nonablative fractional laser's cavitation and dissection of the dermal-epidermal junction, or the 1064 nm Nd:YAG's destruction of periorbital veins and venous lakes. We discuss the importance of changes in color, with emphasis on "gray" as both as an indicator of success or poor outcome. For devices without visual or auditory endpoints, we discuss the importance of subjective prognostic indicators such as pain. In addition, we discuss device-tissue interactions which are misperceived as predictors of efficacy, such as the singeing of hair during laser hair removal. We also describe endpoints for new technologies such as tissue microcoring, a novel skin tightening device FDA-cleared for moderate-to-severe wrinkles of the mid-to-lower face. The device functions by scarlessly removing thousands of tiny cores which results in tissue tightening. The therapeutic endpoint is complete separation of the "core" from the surrounding epidermis/dermis and underlying adipose, such that no residual epidermis/dermis remains in the newly formed hole. Finally, we photographically and descriptively demonstrate endpoints for hair and tattoo removal, vascular lesions, and pigmented lesions in patients of color.

Conclusion: It is imperative that therapeutic endpoints be accurately characterized for specific device-tissue interactions, so that treatments can be tailored to the patient and optimized in real-time. Our review provides an update to well-established therapeutic and warning endpoints, as well as describes novel ones, with a special emphasis on skin of color.

SUBMISSION TITLE: TREATMENT OF INJECTION NECROSIS RELATED COMPLEX SCARRING WITH ER:YAG FRACTIONAL RESURFACING LASER-ASSISTED DELIVERY OF TRIAMCINOLONE AND INTRALESIONAL TRIAMCINOLONE INJECTIONS

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Background: Injection necrosis after soft tissue augmentation is a rare yet dangerous complication of dermal fillers. Previous authors have reported that nearly 72% of necrosis cases are attributable to the use of hyaluronic acid fillers with nearly 20% of cases resulting in disfiguring scars. Injections by nondermatologists make up the majority of cases [1]. We report a case of injection necrosis related scarring after soft tissue augmentation successfully treated with a combination of ablative fractional Erbium:Yag laser assisted drug delivery of triamcinolone as well as intralesional triamcinolone injections.

Study Design/Materials and Method: A 38 year old female (Fitzpatrick skin type III–IV) presented to our dermatology clinic 2 weeks after soft tissue augmentation of her lips with hyaluronic acid filler in Colombia by a nurse injector. Her tissue augmentation was complicated by intravascular injection of hyaluronic acid into the superior labial artery (SLA) and its tributaries and she experienced near immediate pain and blue dusky discoloration.

She was seen by her injector the following day for filler dissolution and was recommended to use scar creams with no further follow up.

Upon presentation to our clinic, the patient was noted to have atrophic scarring of the upper cutaneous lip mixed with focal thick yellow eschar, few small active superficial ulcerations, surrounding dusky violaceous mottling of upper cutaneous lip; focal crusting of right melolabial fold without vascular anomalies; focal erosion left upper mucosal lip and bilateral inferior nasal sill region. The vermillion border was obscured on the upper lip. Her lower lip was augmented however otherwise unremarkable. Our exam suggested ongoing occlusion of portions of the SLA and/or contributory vessels, in addition to early atrophic scarring.

Initial treatment with 0.8 cc of hyaluronidase (Hylenex) injected into upper cutaneous and vermillion lip was performed with subsequent mild swelling with focal improvement of duskiness. Additional injection

volumes were limited by patient pain. We instructed the patient to take aspirin 325 mg daily as well as to apply mupirocin to her open wounds. The patient was followed closely and although she exhibited complete resolution of necrosis, she developed complex scarring involving the upper cutaneous lip, white roll, philtrum and right alar crease.

Approximately 4 months after her occlusive event, we initiated scar treatment using a combination of laser assisted delivery of triamcinolone cream and intralesional triamcinolone injections. Pretreatment with topical analgesia (using compounded Benzocaine, Lidocaine, and Tetracaine cream) was performed before any procedure.

Every 4–6 weeks, the affected areas were treated with an Erbium:Yag fractional ablative laser (Profractional, Sciton) followed by application of topical triamcinolone cream 0.1% for a total of three sessions. At the first session, the settings of 100 µm, 5.5% density, single pass to the upper lip were used as focal treatment to cribriform scars with the settings of 50 µm and 0 coagulation. At her remaining two sessions, the settings were 200 µm, 11% density, single pass to the upper lip. Additionally at her remaining two sessions, intralesional triamcinolone 10 mg/mL (0.05 and 0.09cc, respectively) was injected for focal hypertrophic scarring.

Results: Overall, our patient had a phenomenal response to laser resurfacing and intralesional triamcinolone for complex scarring. No adverse effects were observed during our therapeutic process. Our patient was satisfied with her results and opted to forgo further treatments.

Conclusion: Necrosis due to injection of filler into the vasculature is one of the most feared complications of soft tissue augmentation. Resultant scarring can be complex and disfiguring to patients. Here we have shown promising results using a combination of laser assisted delivery of triamcinolone and intralesional triamcinolone injections for scar revision.

1. Rentfro K, Clarey D, Glenn EJ, Sulewski R, Wysong A. Soft tissue dermal filler—associated necrosis and impending necrosis: a systematic review of the literature. Dermatol Surg. 2022;48(10):1051–6.

SUBMISSION TITLE: UTILITY OF LASER REMOVAL FOR EYEBROW AND EYELINER TATTOOS

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Background: Eyebrow and eyeliner tattoos have recently become more common, especially with the rising popularity of microblading. Although microblading is supposed to deposit pigment more superficially in the dermis for a semi-permanent solution, they can still persist for months to years, and many patients desire removal. This study reviews the utility of laser removal for eyebrow and eyeliner tattoos and also describes relevant treatment pearls.

Study Design/Materials and Method: A retrospective chart review was performed over a 5.8-year period. Patients had laser removal of eyebrow and/or eyeliner tattoos. Documented treatment information, including safety and adverse events, was reviewed.

Results: A total of 76 patients with eyebrow and eyeliner tattoos were treated for laser removal. Mean age was 47 years (R: 22–75 years), and 98.7% were women. Fitzpatrick Skin Types I–VI were represented. Of these cases, 55.3% ($n = 42$) were eyebrow tattoos, 43.4% ($n = 33$) were eyelid tattoos, and 1.3% ($n = 1$) involved both the eyelids and eyebrows. There was a mean of 2.8 (R: 1–12) treatment sessions. Colors treated included black only (73.7%), black and other colors (19.7%), red only (3.9%), green only (1.3%), and blue only (1.3%). Tattoos were treated with 755 nm picosecond laser (50%) (PicoSure; Cynosure), high-power 532/1064 nm picosecond laser (PicoPlus; Lutronic) (28.9%), or combination of these (18.4%), while single cases were treated with either fractional CO_2 laser or 1064 nm nanosecond laser. Of cases treated with high-power 532/1064 nm picosecond laser, 30.6% were treated with both wavelengths due to color unmasking. There were no documented adverse events related to permanent scarring, hair loss, necrosis, or prolonged erythema or dyspigmentation.

Conclusion: Laser removal of eyebrow and eyeliner tattoos can be safe and effective. There should be consideration for proper eye protection which may include metal intraocular eye shields, pain control with topical and local anesthesia, and pigment unmasking especially with various inks blended for microblading.

SUBMISSION TITLE: VIRTUAL REALITY FOR IMPROVEMENT OF PATIENT EXPERIENCE DURING OUTPATIENT ENDOVENOUS LASER ABLATION: A PILOT STUDY

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Background: Proof of concept utilizing virtual reality (VR) to alleviate anxiety and pain associated with medical procedures has been demonstrated in numerous settings, including wound care, venipuncture, dental procedures and routine medical procedures. In the field of dermatology, VR experiences utilized during Mohs micrographic surgery showed improvement in anxiety, pain and general stress levels [1]. Patients undergoing outpatient endovenous laser ablation (EVLA) may experience pain or anxiety related to the procedure. If EVLAs are not performed by a board-certified dermatologist using tumescent anesthesia, they are often done in the operating room under general anesthesia, which poses a greater risk to the patient and increases the healthcare costs associated with the procedure. Successful methods to reduce the pain and anxiety experienced by patients undergoing this procedure are therefore desirable to minimize costs and health risks and allow the procedure to be performed outpatient with minimal discomfort to the patient.

Study Design/Materials and Method: Patients undergoing an outpatient EVLA procedure under tumescent anesthesia in the dermatology department comprehensive vein clinic at one academic institution from September to December 2022 were recruited to complete two surveys before and after a short playlist of 360° scenic videos suited for a VR headset. An ND:Yag laser, the Alma Vasculife, was used in all EVLA procedures. The VR headset utilized was the Google Daydream, and the videos were selected for their relaxing nature. The VR headset was placed on the patient after the surgical time out, and the videos played from the start of the procedure (ultrasound guided vein access and endovenous placement of the laser fiber) until after the vein was tumesced with local anesthesia using a Kline pump, after which the headset was removed to apply proper eye protection for laser activation. Study data were collected and managed using REDCap (Research Electronic Data Capture) tools hosted at University of Nebraska Medical Center [2,3]. The pre-VR survey included questions rating overall health and patient's confidence and satisfaction with the health care they have received, in addition to the Beck Anxiety Inventory (BAI) to assess anxiety severity and self-reported pain level. The post-VR survey included the same presurvey questions, along with additional questions specific to their immersion in the VR experience and perception of how it affected their procedure. The primary endpoint was change in level of anxiety as measured by BAI score from presurvey to postsurvey, with post-survey overall satisfaction and change in reported pain level from pre-to-post survey as secondary endpoints.

Results: Eight patients were enrolled in this study. The mean age of respondents was 41. Most patients reported this was their first laser ablation procedure (7; 87.5%). The majority of subjects reported no previous history of anxiety (6; 75%), and most subjects self-reported their current health as very good (5; 62.5%). The mean of subjects' pre-VR BAI values was 1.13 on a scale of 63, with a mean post-VR BAI value of 1.07 for a reduction of 0.06 ($p = 0.19$). Several survey items, including but not limited to "feeling of choking" and "fear of dying," had both a pre-VR and post-VR response of 0 for all subjects. In focusing on the seven survey items with at least one nonzero response, the mean pre-VR BAI value was 1.29 and the post-VR value was 1.13 for a reduction of 0.16 ($p = 0.135$). In addition, 87.5% of subjects reported the VR experience at least somewhat improved any procedural day anxiety they may have experienced, while 75% of patients reported the VR experience at least somewhat improved any procedural pain. 87.5% reported that the VR experience improved their overall satisfaction with the day.

Conclusion: Preliminary results of this pilot study suggest participation in a VR experience during endovenous laser ablation and administration of tumescent anesthesia used for outpatient procedures is a promising method for improving procedural anxiety and pain and increasing patient satisfaction. Overall anxiety levels appear to be low at baseline for EVLA, which further supports the desirability to perform this procedure under local rather than general anesthesia. This study is limited by its small sample size. In addition, it was noted that several patients were unable to see the entirety of the 360 VR video due to reclined positioning for the procedure, which may have limited the effectiveness of the intervention. Enrollment in this study is ongoing and as the sample size increases, we anticipate the results will show a statistically significant improvement in BAI scores after the VR experience. Future studies could include a control group to verify the results.

Non-CME

SUBMISSION TITLE: A CLINICAL AND HISTOLOGIC EXAMINATION OF A NEW, HIGH PEAK POWER ND:YAG LASER WITH MICROSECOND TO MILLISECOND PULSE DURATIONS AND UNIQUE SUB PULSE STRUCTURES

Authors: Emil Tanghetti

Center for Dermatology and Laser Surgery

Background: A new solid state high peak power Nd:YAG laser with microsecond to millisecond(s) pulse durations has been developed to treat vascular lesions. The high-peak power PDL with its microsecond to millisecond pulse duration, has been felt to be a safer and more effective treatment for vascular lesions compared to

Nd:YAG lasers making it difficult to replace. Our aim was to obtain a better understanding of this device and it different pulse structures by examining its effect on normal, normal skin and some complex vascular problems. By treating normal skin we are able to understand how the laser affects various size blood vessels at different depths and maximize the safety of the surrounding tissue when treating pigmentary and vascular lesions.

Study Design/Materials and Method: A high peak power Nd:YAG was developed with wavelengths at 532 and 1064 nm. Pulse durations are available from 300 microseconds to 40 or 60 milliseconds with maximum energy of 13.5 or 100 J for 532 and 1064 nm, respectively. The laser features three pulsing formats: a single uniform pulse, submillisecond pulses of 1.5 milliseconds, and submicrosecond pulses at 300 microseconds. Skin cooling is accomplished by cryogen spray cooling both before and after laser pulses. To better understand the effects on normal and abnormal vasculature, we treated four volunteers on the back with the 532 nm wavelength from 0.3 to 40 milliseconds using the three pulse structures at various settings. Patients were observed with photographs up to 1 week posttreatment with biopsies collected 24 hours posttreatment and stained for hematoxylin and eosin. The skin reaction profile on the normal skin was examined by adjusting pulse durations and fluence and then cooling settings to characterize the threshold for erythema, swelling and purpura. Results were used to model the 532 nm profile and compare to traditional PDL to maximize effectiveness while minimizing unwanted skin reactions. Clinical treatments using the 40ms pulse structure in five patients with unresponsive port wine stains and challenging facial telangiectasia on the nose.

Results: Erythema and an urticarial response was observed immediately after treatment at fluences around 9 J/cm^2 for the submilli pulse format, 9–10 J/cm^2 for the submicro pulse format, and for fluences of 6 J/cm^2 with a 1 millisecond pulse duration. Purpura was seen 1 day posttreatment but resolved within 3 days following treatment but the laser setting that gave these skin responses were not typical for standard clinical treatments. Biopsies revealed damage from the superficial to the deep vascular plexus with more intense perivascular inflammation and slight hemorrhage at the submicrosecond pulse durations and format. Treatments on patients with unresponsive PWS and facial telangiectasia revealed significant improvement with the 40ms pulse duration at both unique pulse formats.

Conclusion: This study demonstrated that depending on the pulse duration, pulse structure, and cooling configuration we can damage a wide variety of vessels at multiple depths while simultaneously protecting the epidermis and limiting side effects It was also found at 40 milliseconds pulse duration with the two unique pulse formats has demonstrated significant clinical improvement in hard to treat lesions and vessels.

SUBMISSION TITLE: A NEW 532 NM, VARIABLE-PULSE-STRUCTURE, DUAL WAVELENGTH, KTP LASER WITH CRYOGEN SPRAY COOLING EFFECTIVELY TREATS ROSACEA

Authors: Eric Bernstein

Main Line Center for Laser Surgery

Background: A new dual wavelength, solid-state laser incorporating both 532 and 1064 nm wavelengths was developed with cryogen spray cooling and the unique ability to deliver single pulses or pulses composed of subpulses in the submillisecond or submicrosecond domain. We investigate the efficacy of this laser using all three pulse-structures and the 532 nm wavelength for treating rosacea.

Study Design/Materials and Method: Twenty-one subjects were enrolled in this IRB-approved study. A total of up to three treatments were administered at monthly intervals. Each treatment consisted of a first pass tracing linear vessels with a 40 milliseconds pulse-duration immediately followed by a second pass using a 5 milliseconds pulse, using all three available pulse-structures. Assessment cross-polarized digital images by blinded physician observers compared baseline and 3-month follow-up visits.

Results: Blinded observers correctly identify the posttreatment images 89% of the time, in 17 of 19 subjects completing the study, with an overall improvement rating of 39%. Side effects were limited to short-term erythema and edema.

Conclusion: This study demonstrates that this new, variable-pulse-structure, dual wavelength, solid state, KTP laser with dynamic cooling is a safe and effective for treating rosacea.

SUBMISSION TITLE: BLINDNESS AND SKIN NECROSIS FOLLOWING FILLER: NEW PARADIGMS FOR PREVENTION, DIAGNOSIS, & TREATMENT

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Background: The incidence of soft tissue necrosis, and specifically blindness, from vascular occlusion due to hyaluronic acid filler is on the rise. Recent studies have shown an average of 1:6500 cases of filler injections lead to a vascular occlusion when performed with needle and 1:40,000 when performed with cannula (Alam et al.,

2020; Beleznay et al., 2015; Schelke et al., 2020, Alam et al 2020). Furthermore, most aesthetic injectors are not formally trained on appropriate diagnosis and treatment protocols for vascular occlusion which presents a major patient safety issue.

Study Design/Materials and Method: A literature review of over 25 recent articles as well as expert opinion was collated to develop a novel prevention, diagnosis, and treatment protocol. Specifically, a hyaluronidase protocol with specific timing, dose, and frequency of administration was adapted from work by Lee et al (2020) that demonstrated in an experimental rabbit ear graft model that a hyaluronidase dose of 125 units every 25 minutes × 4 led to superior graft survival compared to other frequency and dose protocols. This together with work from DeLorenzi 2014 which showed that cross-linked HA is susceptible to hydrolysis by hyaluronidase when contained within intact facial artery in a cadaver model and therefore intra-arterial injection of hyaluronidase is likely not necessary to help restore the circulation of ischemic tissues. If, however, the perfusion is not restored, utilization of ultrasound should be employed to find the occlusion and attempt to target it under visualization. Other agents including sildenafil, chewable aspirin, dexamethasone, nifedipine, and acetazolamide also have a role in restoration of perfusion and prevention of tissue necrosis and ischemia–reperfusion injury. The treatment protocol for blindness remains controversial, however, with the rates of blindness on the rise globally, it is imperative that aesthetic providers be familiar with the treatment of this dreaded complication since irreversible retinal ischemia occurs in 15 minutes (Tobalem et al., 2018). Briefly, after assessing for visual acuity loss and relative afferent pupillary defect treatment should be initiated. This consists of eye drops and oral medicines to decrease intraocular pressure and a specific hyaluronidase protocol to reverse ischemia, followed by retrobulbar injection technique if unsuccessful.

Results: The treatment paradigm for tissue necrosis from filler induced vascular occlusion is evolving and newer agents are showing promise in minimizing necrosis and ischemia–reperfusion injury. All injectors should be familiar with these protocols and medicines as the injector is the first line of defense and ultimately responsible for the safety and wellbeing of their patient. Specifically for filler-induced blindness, not all treated patients showed improvement; however, all recovered cases—whether full or partial recovery—received some sort of treatment. Furthemore, the role of ultrasound both during treatment planning to delineate vessels in high risk zones, and during management of vascular occlusion to visualize the occlusion to specifically deliver hyaluronidase cannot be understated.

Conclusion: As the number of new filler injectors entering the aesthetic industry continues to rise, with current estimates as high as 15,000 new injectors per year, it is imperative that all injectors familiarize themselves with diagnosis and management of vascular occlusion. Although most training programs—both in academia and private training programs—teach injectors how to achieve good aesthetic outcomes, most do not specifically address best treatment practices for the dose, frequency, timing, and visualization strategies for hyaluronidase nor do they incorporate emerging treatment agents into a robust management protocol to help keep patients safe from harm, which represents a growing patient safety issue in the aesthetic industry.

SUBMISSION TITLE: CLINICAL EVALUATION OF TISSUE MICRO-CORING, A NOVEL TECHNOLOGY FOR TREATING RHYTIDES OF THE SKIN

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Connecticut Skin Institute, Stamford, CT; MGH, Harvard Medical School, Boston, MA

Background: Tissue micocoring technology was recently Food and Drug Administration (FDA) cleared for the treatment of moderate to severe wrinkles of the mid and lower face. Here,we report an observational case series of this novel technology in an outpatient dermatologic surgery setting.

Study Design/Materials and Method: Observational case series of tissue microcoring system for the mechanical removal of skin to treat moderate to severe wrinkles of the mid and lower face.

Results: We describe the workflow,setup,and procedural approach to the tissue microcoring system.

A complete patient history and physical including other procedures or treatments that could have an impact on outcomes are important when setting expectations. The number of procedures required to achieve the patient's goals may vary from patient to patient and should be discussed up front. The use of injectable local buffered lidocaine with epinephrine achieves minimal procedural discomfort for the patient while also providing hemostasis.

The ability to adjust needle depth settings from 0.0 to 4.0 mm in 0.5 mm increments and to set the percentage of skin removal from 1%, 3%, 5%, 7%, and 8% provides a customized experience for each patient. The higher the percentage of skin removal,the more aggressive the treatment and assessing the patient's skin will guide treatment parameters.

Before and after images and patient reported outcome scores are currently being collected and analyzed and will be presented for consideration.

Conclusion: Tissue microcoring system is a novel method for mechanically removing skin in a scarless fashion. Early commercial experience shows several advantages to this method for treating lower face rhytides with high patient satisfaction.

SUBMISSION TITLE: CLINICAL TASK PERFORMANCE COMPARISON OF EYE PROTECTION FOR PULSED-DYE LASER APPLICATIONS IN DERMATOLOGY

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Background: The pulsed-dye laser (PDL) is one of the class IV medical lasers that has applications in cosmetic dermatology. Its mechanism of action is based on the principal of selective photothermolysis in which oxyhemoglobin absorbs the energy of the PDL light and converts it to heat. The heat causes the collapse of blood vessel walls which reduces convective blood flow to treated areas. This action mutes the pigmented appearance of superficial vascular lesions such as skin erythema and telangiectasia. Studies have documented clinical success of PDL therapy for treating superficial vascular lesions present in patients affected by rosacea, infantile hemangiomas, acne v., and port wine stains.

Study Design/Materials and Method: A multiquestion survey was designed to compare the task performance of PDL LEP filters. The survey was provided to the Gold Skin Care Center clinical team. Two sets of LEP were compared, a set with blue colored filters (Innovative Optics, C740 frame Pi7 filter) and a set with amber colored filters (Innovative Optics, C740 frame Gi2 filter). The principal investigator at the Gold Skin Care Center provided the laser technicians with each set of LEP, asked them to wear them during their PDL procedures, and collected their responses to the survey afterward. Data visualization and analysis were completed using the base packages of the statistical software R. One chi-squared test of proportions and multiple Wilcoxon rank sum tests were used to evaluate the survey data for statistical significance.

Results: The wavelengths of the lasers used while testing each set of LEP ranged from 589 to 595 nm. The quantitative data collected from the survey responses were visualized using color coordinated histograms. The results from the statistical tests were presented using tables with the appropriate descriptive statistics, confidence intervals, and probability values. The data indicated that the laser technicians ($n = 10$) were less likely to remove the amber LEP during a procedure compared to the blue LEP (Chi-squared, $p < 0.001$). The amber LEP enabled more precise identification of red and blue objects/lesions compared to the blue LEP (Wilcoxon rank sum, $p < 0.001$). The color of the amber LEP was found to be, statistically, less fatiguing, bothersome, or annoying than the blue LEP (Wilcoxon rank sum, $p < 0.005$). The fatigue caused by the weight of the two sets of LEP was not found to be significantly different between them (Wilcoxon rank sum, p-value > 0.6).

Conclusion: Our results showed that, for PDL therapies, the amber LEP (Innovative Optics, C740 frame Gi2 filter) performed better for PDL procedures in several ways when compared to the blue LEP. For example, this study documented a clear difference in how well technicians were able to precisely identify red and blue vascular lesions. The difference in task performance between the LEP was further expressed by the differences in reported fatigue caused by the color of the filters. Also, the entire group of laser technicians would have liked to remove the blue LEP during the procedure to see more clearly compared to one in ten when wearing the amber LEP. If a technician were to remove their LEP during a PDL procedure, then permanent visual damage would be more likely to occur. It was concluded that the LEP with amber filters, which have a novel chemical composition, are more effective and safer than LEP with blue filters for use by technicians when undertaking PDL procedures. Further research into other types of LEP that cause color-confusing effects will lead to safer and more effective protective eyewear which will benefit laser technicians, patients, and healthcare institutions overall.

SUBMISSION TITLE: DUAL-WAVELENGTH LASER WITH ADJUSTABLE PULSE FORMAT FOR THE TREATMENT OF VASCULAR AND PIGMENTED LESIONS IN ADULT AND PEDIATRIC PATIENTS

Authors: suzanne kilmer; Kathy Keys

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Background: Microbotox has demonstrated efficacy in improving skin texture and rhytides through the targeting of sebaceous glands and the superficial musculature immediately underlying the dermis.[1] Accomplished through numerous injections of botulinum toxin microdroplets into both the dermis and the interface between the dermis and underlying musculature, the injections are often performed with dilute toxin and have ranged in number on the face from 4 to 9992. This prospective, split-face study aims to assess the efficacy of microchannel delivery of botulinum toxin in the treatment of periocular wrinkles, and determine effective dosing of toxin in periocular skin.

Study Design/Materials and Method: Nineteen patients aged 25 to 55 y.o. were selected for this prospective, split-face study to receive one treatment of dilute botulinum toxin delivered with a microchannel device to the chosen periocular region. The regimen consisted of dilute botulinum toxin (either onabotulinumtoxinA ranging from 10 to 15 units or incobotulinumtoxin A at 10 units), a Vitamin C complex, and a Vitamin E complex. Units of toxin were

chosen based on each subject's musculature and rhytide burden. Utilizing a microchannel device made of surgical-grade stainless steel (SUS 316 L) plated with 24 K Gold, 8 or 5 mL of the dilute toxin were injected as approximately 600 microdoses into the chosen treatment area with 20 0.6 mm × 0.12 mm microchannels. Patients were evaluated 7 days following treatment.

Results: Improvement was assessed through patient survey, as well as photographs taken 7 days following treatment. All treated patients endorsed clinical and subjective improvement of skin texture, as well as a reduction in periocular wrinkles in treated skin, particularly when compared to the untreated side. No adverse effects were reported and the procedure was well-tolerated.

Conclusion: The use of botulinum toxin delivered with a microchannel device was found to produce clinical, visual improvement in mild to moderate periocular rhytides and wrinkles in this split-face study 7 days following injection, particularly compared to untreated skin. Additionally, patients reported subjective improvement in skin texture and appearance on treated peri-ocular skin, without any reported adverse effects. The treatment was well-tolerated, and may represent an efficacious and painless mesotherapy alterative for the improvement of skin texture, and reduction of periocular wrinkles.

SUBMISSION TITLE: ENERGY-BASED SKIN TIGHTENING IN COMBINATION WITH A PERCUTANEOUS SUTURE SUSPENSION SYSTEM FOR JAWLINE CONTOURING

Authors: Barry DiBernardo; David Turer; Matthew Trovato; GREGORY MUELLER; Jason Pozner; Jonathan Cook

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Background: In recent years, aesthetic procedures used to enhance the appearance of the lower face, jawline, and neck have been on the rise. Aging of the skin is characterized by a loss of collagen and elastin resulting in reduced skin elasticity and is common in the jawline and neck area. This is often accompanied by platysma muscle laxity and a banding appearance. Often this worsens with age and is seen concurrently with drooping of the submandibular glands and an increase in appearance of submental fat.

Historically, procedures such as threadlifts and percutaneous suspension sutures have been used to address this loss of neck contours. More recently, a light-guided single-suture suspension system was developed to be placed under the mandibular border, divide, and support the platysma thus improving the cervicomental angle and jawline. However, this system alone does not address skin laxity. This procedure is often accompanied with either laser or radiofrequency-based skin tightening and submental liposuction to optimize outcomes. The surgeon can deliver the chosen method of energy-based skin tightening through a series of small punctures below the mandibular border before placement of the suture system.

Study Design/Materials and Method: This subset analysis of an IRB-approved, multicenter, retrospective study included 391 consecutive meeting inclusion criteria who underwent a light-guided percutaneous suture suspension procedure. The safety and efficacy of those having undergone the procedure in combination with either laser or radiofrequency-based skin tightening energy-based procedures was evaluated. The patients were treated between January 2018 and May 2022 and the medical records were retrospectively reviewed. Patients with mild to moderate neck laxity and a desire to improve their neck contour were included while those having undergone >5 mm skin incision were excluded. Outcome measures included complication rates and revision rates.

Results: Of the 391 cases reviewed, 348 patients (89%) received an energy-based treatment targeting subcutaneous tissues before the suture system placement. Of the 348 combination patients, 300 (86%) received bipolar radiofrequency, 45 (12.9%) received 1440 nm laser in subcutaneous space, and 3 (0.9%) received treatment via helium plasma device. The average patient age was 52.4 with 81% being female. The majority (71%) of the procedures were performed under local anesthesia as an in-office procedure while the remaining 29% were performed under general anesthesia or IV sedation in an outpatient setting. The most common adverse event was recurrent platysmal banding in 16 patients (4.6%). Two patients having undergone bipolar radiofrequency had an adverse event of seroma. Three infections occurred (1%) with one return to OR for suture removal, a rate consistent with other studies of subcutaneous sutures. There were no bleeding complications or hematomas. The use of concurrent energy-based skin tightening did not significantly impact occurrence of adverse events. The average follow up time reported by subjects was 240 days, and subjects were predominantly satisfied with outcomes with only 5% of patients requiring revision.

Conclusion: Although this percutaneous suture suspension system procedure can be performed as a stand-alone intervention, it was found to be safe, effective, and preferred when combined with energy-based skin tightening. Surgeons and patients selected the combination procedure, with 89% choosing to perform or undergo both percutaneous suture system placement along with energy-based skin-tightening treatment on the same day.

Further studies to examine the optimal energy-based concurrent treatments in combination with minimally invasive neck procedures are warranted to further optimize outcomes.

SUBMISSION TITLE: EPIDEMIOLOGY OF PDL AND CO2 TREATMENTS IN THE PEDIATRIC PLASTIC SURGERY AND BURN CENTER IN 2 YEARS PERIOD

Authors: Lidija Barcot; Zoran Barcot

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Background: In Children's Hospital Zagreb at the Pediatric and Burn center, we treat children from 0 to 18 years of age with keloid and hypertrophic burn scars, trauma scars, postoperative scars, and various vascular lesions like infantile hemangiomas and vascular malformations. The two most common types of vascular birthmarks, hemangiomas, and vascular malformations may appear to be very similar but their course and treatment are different. Laser therapy nowadays has become indispensable in the management of superficial pediatric vascular lesions. With a proper balance of wavelength, energy density, and pulse duration, the laser energy could be molded to effectively manage different lesions. As a result, we can now provide optimal selective treatment with minimal collateral damage. Hypertrophic and keloid scars have an impact on children's and their parent's life so they are both interested in laser treatments expecting better cosmetic and aesthetic appearance.

Study Design/Materials and Method: We collected data for the 2-year period/01.01.2021.–31.12.2022./. In that period we have 661 patients from 1 month to 18 years of age, 238 males and 418 females: 281 with different vascular malformations, 111 with infantile hemangiomas, 208 with keloid or hypertrophic scars, 7 with angiofibroma, 6 with rosacea, and 48 with other cutaneous lesions. We did 389 PDL laser treatments, 49 CO_2 fractional ablative laser treatments, 168 common PDL + CO_2 laser treatments, 18 electrocoagulation, and 37 excisions. We put the data into interactions: (a) comparison of types of diagnoses and methods of treatment, (b) distribution of diagnoses according to gender, (c) distribution of diagnoses according to age groups, and (d) distribution of the patients according to the age of life.

Results: With just a few complications due to the application of an excessive dose of laser treatment, children, their parents as well as the medical staff are more than satisfied with the results of laser treatment with PDL and CO_2 laser.

Conclusion: PDL and CO_2 fractional ablative laser treatment for keloid and hypertrophic burn scars, trauma scars, and postoperative scars, as well as PDL laser treatment for various vascular lesions in childhood like infantile hemangiomas and vascular malformations, are safe and effective therapeutic procedures in children of all age groups and as such are an important part of a modern modular approach to treatment.

SUBMISSION TITLE: EVALUATE LOWER FACE LIFTING AND CONTOURING EFFECT OF LONG PULSE WIDTH ND: YAG 1064 LASER EQUIPPED WITH DCD DYNAMIC SKIN COOLING SYSTEM

Authors: Xiaoning Li

Distinct Healthcare Clinic, Beijing, China

Background: The use of laser and energy-based devices (LEBD) has grown exponentially in recent years, and variations in common practices exist. Our study sought to evaluate the current practice paradigms of leaders in the field of LEBD with regard to antimicrobial prophylaxis, adjuvant topical treatments, use of laser procedures in pregnancy, and combination of procedures.

Study Design/Materials and Method: Anonymous surveys were distributed to leading dermatologists in American Society for Laser Medicine & Surgery (ASLMS) via email.

Results: Surveys were distributed to 65 ASLMS members; 37 submitted responses. Routine antiviral prophylaxis is used by 76% for fractional ablative procedures of the face, but only 27% for fractional nonablative procedures. Routine antifungal prophylaxis was used by a minority (16%) for ablative procedures, whereas antibacterial prophylaxis was used by 68%, with varying antibiotics. Wide variations exist in skin preparation and topicals used post-laser treatment. Most respondents feel comfortable combining same-day LEBD and botulinum toxin injections, specifically vascular or Q-switched/picosecond lasers. Most respondents avoid performing LEBD during pregnancy.

Conclusion: Expert consensus in a rapidly growing field sheds light on common, reliable practices. However, even at the expert level, variations exist. Further high-quality research is needed to standardize and update guidelines.

SUBMISSION TITLE: EVALUATION OF HOLMIUM LASER LITHOTRIPSY WITH MULTIPLE PULSES

Authors: Youngseok Seo; Joo Beom Eom; You-rim Park; Jun-Young Moon; Kyung Duk Chu

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Background: Lithotripsy with a holmium laser is painless compared to an extracorporeal shock wave procedure because it uses an optical fiber catheter in the urinary tract. This study shows that precise lithotripsy is possible by multiple Holmium laser pulses.

Study Design/Materials and Method: We have consisted of a realistic in vitro environment to evaluate the performance of the Holmium laser lithotripsy for urinary stones. A phantom model of a urinary stone made with plaster powder with distilled water in a ratio of 1:5 has an irregular surface.

Results: We compared whether the urinary stones phantom model was pushed out by the energy in a transparent tube imitating the urinary tract from multiple Holmium laser pulses. A video clip of the lithotripsy of the urinary stone phantom was obtained using a high-speed camera and visually evaluated the lithotripsy results.

Conclusion: The effectiveness of lithotripsy for urolithiasis was verified by successfully performing a phantom test using multiple pulses of the newly implemented Holmium laser without sacrificing animals.

SUBMISSION TITLE: FDA ADVISORY PANEL MEMBERS RECOMMEND PROCESS IMPROVEMENTS

Authors: Umer Nadir; Michael Yi; Loma Dave; Farhana Ikmal Hisham; Amanda Maisel-Campbell; Brienne Cressey; Alexandra Weil; Angela Lee; Emily Poon; Murad Alam

Northwestern University, Chicago, IL; Northwestern University, Chicago, IL; Northwestern University, Chicago, IL; Northwestern University, Chicago, Illinois, USA; Northwestern University, Chicago, IL; Northeast Dermatology, Portsmouth, NH, USA; Northwestern University, Chicago, IL; Marketing Department, Kellogg School of Management, Chicago, IL; Northwestern University, Chicago, IL; Department of Dermatology, Feinberg School of Medicine, Northwestern University, Chicago, IL, Department of Otolaryngology, Feinberg School of Medicine, Northwestern University, Chicago, IL, Department of Surgery, Feinberg School of Medicine, Northwestern University, Chicago, IL

Background: The purpose of this study was to survey FDA advisory panel members on their knowledge of the Panel process, its strengths and its weaknesses.

Study Design/Materials and Method: Thirty-six questions elicited opinions of members of all 18 FDA device panels with a view to suggesting improvements.

Results: Of 131 eligible, 71 (54.2%) returned surveys. Seven surveys were excluded due to incomplete responses. Panel service averaged 6.8 years (range: 1–22) with 3.9 meetings attended (range: 0–19). Panel member opinions differed based on gender ($p = 0.02$) and level of experience ($p = 0.01$). Overall, respondents valued information presented by FDA and considered this unbiased. Respondents tended to weigh safety and effectiveness equally, or to consider safety more important ($n = 34$ and 19; 57.6% and 31.0%, respectively). They were likely to recommend approval after approval in another country or for another indication ($n = 43$, 62.9%). Fewer than half believed that pivotal trials were frequently well-designed ($n = 28$, 45.9%), with the vast majority suggesting the FDA consult Panel members preemptively regarding trial design and the package insert ($n = 55$ and 54; 88.7% and 84.4%, respectively). Public comments were not deemed valuable. A large majority ($n = 52$, 86.6%) thought a Panel member-only "Executive Session" would allow more clarity and honesty in deliberations. Most (55.9%) also believed a ¾ majority vote appropriate for recommending approval.

Conclusion: Respondents wanted improved study designs, greater protections for patients and physicians, more relevant clinical data including that from other countries, and enhanced opportunity for frank discussion during Panel meetings.

SUBMISSION TITLE: FRACTIONATED, PICOSECOND-DOMAIN, 1,064 NM LASER TREATMENT IMPROVES FACIAL MELASMA

Authors: Eric Bernstein

Main Line Center for Laser Surgery

Background: This study evaluated efficacy of a 1064 nm, fractionated picosecond-domain laser, for the treatment of facial melasma.

Study Design/Materials and Method: Twenty subjects received four monthly 1064-nm picosecond laser treatments delivered through a fractionated 10×10 mm containing 101 microbeams 150 μm in diameter, delivered in 2 passes per treatment. Digital images were taken before and 3 and 8 months posttreatment with the final treatment ending exactly 1 year after intial photographs. Blinded evaluation of digital images was performed by three physician evaluators comparing baseline and 3- and 8-month posttreatment images.

Results: Blinded reviewers correctly identified the posttreatment image in 16 of the 20 image sets (80%) at both timepoints, and improvement was statistically significant. The mean pigment clearance score using an 11-point scale revealed a 40% and 30% average clearance for the 3- and 8-month follow-up periods, respectively. Discomfort was mild and posttreatment effects consisted of mild to moderate edema, erythema, and petechiae.

Conclusion: The fractionated, 1064 nm picosecond laser is effective at improving the appearanch of melasma. Further studies evaluating this device in combination with other treatment modalities should follow.

SUBMISSION TITLE: HISTOLOGIC EVALUATION OF A NOVEL FRACTIONATED 2,910 NM FIBER LASER ON EX-VIVO BLEPHAROPLASTY SKIN SPECIMENS

Authors: Eric Bernstein; Brian Biesman; James MD; Sanzo

Main Line Center for Laser Surgery; Clinical Assistant Professor at Vanderbilt University Medical Center, Nashville, TN; Main Line Center for Laser Surgery

Background: A new 2910 nm fiber laser with unique pulse characteristics has been shown to be effective at improving photodamaged skin with unique histologic changes.

Study Design/Materials and Method: Three specimens were harvested after lower eyelid blepharoplasty surgery and treated with a 2919 nm fiber laser to a depth of 300 μm using deep and superficial mode. Ablation pit depths and zones of thermal damage were measured.

Results: The average pit depth was 378.9 μm from the top of the epidermis to the bottom of the pit, while depth within the dermis alone was very close to the 300 μm predicted depth. Pits averaged 54.7 μm wide on fixed tissue, and the mean thickness of residual thermal damage was 43.3 + 5.6 μm.

Conclusion: The pits were quite uniform and measured depths corresponded very well to the predicted 300 μm, while the zone of thermal damage was highly. These parameters correspond to very rapid healing with minimal discomfort without topical anesthetic.

SUBMISSION TITLE: LIFTING AND CONTOURING OF SOFT FACIAL TISSUE INDUCED BY SIMULTANEOUS APPLICATION OF HIFES AND MONOPOLAR RF

Authors: Brian Kinney

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Background: Large segmental hemangiomas are hemangiomas that covers a specific cutaneous territory, and their presence warrants evaluation for PHACE syndrome.

Study Design/Materials and Method: We present a case of a ulcerated segmental facial hemangioma as the primary symptom in a patient with PHACE syndrome, being treated with a unique combination of triple therapy that includes Propranolol, Prednisone, and Pulsed Dye Laser.

Results: A 1-month-old female presented with a 9 × 7 cm irregular, vascular beefy red plaque extending from the right lateral frontal scalp to the mid upper vermillion border covering the right forehead, right nasal dorsum and part of the right cheek (V1&V2 trigeminal nerve distribution). In addition, there was ulceration of the mid upper vermillion lip resulting in feeding difficulties. Ultrasound of the lesion revealed a high flow malformation consistent with a segmental Infantile Hemangioma (IH) > 5 cm. Therefore, further workup for PHACE syndrome was done. Neurological evaluation showed normal milestones for age and MRA revealed vascular abnormalities of the polygon of willis characterized by hypoplasia and stenosis affecting the carotid, sylvian and cerebral posterior endings. Opthalmologic exam showed bilateral optic nerve "morning glory" anomaly more severe on the contralateral side of the IH, involving the optic disk and retinal vessels. This was seen as a left intraocular "rope-like structure" in the posterior segment on MRA consistent with retinal vascular malformation. Cardiac and ENT evaluation included ECG, echocardiography, & Laryngoscopy were normal.

The patient fulfilled the diagnostic criteria for definite PHACE syndrome [1].

The patient had an hemangioma severity scale (HSS) of 28 which is considered severe and warrants treatment [2,3]. The treatment of large ulcerated IH in patients with PHACE syndrome and arterial abnormalities is critical and controversial with no clear guidelines about the best approach. Propranol, Prednisone and pulsed dye laser (PDL) were among the treatments used for IH. Steroids was long considered the first line treatment for ulcerated IH but in 2014 propranolol became the first line FDA approved treatment of IH. However, Propranolol should be used cautiously in PHACE syndrome due to increased risk of stroke in patients with arterial anomalies and increased risk of hemangioma ulceration [4,5]. Therefore, we ought to start our patient with prednisone (0.5 mg/kg/day) for 1 week before initiating propranolol to avoid risk of ulceration. After that, Propranolol was initiated at 0.5 mg/kg/day and increased gradually along with prednisone over 1 month to reach 2 mg/kg/day for both. Lip ulceration resolved 1 month after being on the full dose of combination therapy with normal feeding and growth. PDL therapy was started after 3 months totalling three sessions, separated by a 2-month interval. Impressive improvement in color and involvement of the IH was seen with a decrease in HSS score by more than 12 points.

Conclusion: This is the first reported case of successful treatment of ulcerated IH in PHACE syndrome using a combination of propranolol, prednisone, and PDL therapy.

SUBMISSION TITLE: MINIMALLY INVASIVE UPPER LIP LIFT USING MECHANICAL DERMAL MICRO-CORING TECHNOLOGY: CASE STUDY RESULTS AFTER A SINGLE TREATMENT

Authors: John Layke
Cytrellis Biosystems

Background: Mechanical Dermal Micro-Coring™ Technology (MCT) mechanically removes micro-cores of skin in the mid-to-lower face without surgery or the use of thermal energy. It is currently cleared for the treatment of moderate to severe wrinkles in the mid to lower face for adults aged 22 and older with Fitzpatrick skin types I–IV. While on-label treatment with MCT currently includes the perioral region, it has not been specifically studied as an alternative to surgical lip lift techniques.

Study Design/Materials and Method: During screening, assessments of the perioral area were made by the treating physician, which included baseline measurements of the length of the philtral columns (right and left) determined by calipers. Patients were included or excluded for treatment based on the current labeling for MCT. Patients were excluded from treatment if they had previous Injections of dermal fillers, fat or botulinum toxin, as well as any other procedure, within the study treatment areas, within the past 6 months (i.e., dermabrasion, laser, RF, chemical and mechanical peels).

The procedure settings available for MCT include skin removal percentage ranging from 1% to 8% within a 10×10 mm window in a triple-needle cartridge. Needle depth settings are adjustable and can be set from 0.0 to 4.0 mm in 0.5 mm increments. A core is the column of skin removed by each needle and is comprised of epidermal and dermal tissue. Considerations for treatment depth are made based on skin thickness, texture of skin, and the specific anatomical area to be treated. In the pivotal study, the most commonly used settings for the perioral area were between 2 and 3 mm, with % skin removal between 7% and 8%. For the initial treatment session in this case series, all patients were treated at the 3 mm depth with 8% skin removal in the perioral area. After the first treatment session, based on the discretion of the treating physician, adjustments to percent skin removal and settings were permitted. Both 2D and 3D photography and physical measurement of the philtral columns are to be conducted at each treatment visit, spaced approximately 6 weeks apart.

In addition to quantitative assessment of change in philtral column length, both treating physician and a trained independent observer compare baseline 2D photographs to postprocedure photographs to assess global improvement in the treated areas. 3D Canfield Vectra analysis is also employed to assess volumetric change in the treated areas. Assessments are completed 6 weeks post each procedure, with a final assessment completed at 6 weeks post the last MCT treatment. Overall patient satisfaction with the aesthetic appearance of the treated area is measured by comparing baseline to 6 weeks post final treatment using the subject satisfaction scale.

Results: Ten patients completed an initial session and returned for follow up assessments. At the 8% skin removal setting, the average core removal count was 2430 micro-cores as measured by the device. After one treatment, all patients showed a decrease in their phitral columns as measured by calipers. In addition, clinical photography assessments showed an overall aesthetic improvement in the perioral area. Patients will continue follow up and up to two additional treatments, with follow up at 6 weeks post their final treatment.

Conclusion: Perioral rejuvenation and specifically, the upper lip lift, continues to be a high demand procedure among patients of all ages. There are a variety of surgical techniques used in clinical practices, but drawbacks exist for each. Preliminary results are encouraging for the use of MCT as a scar-less approach to perioral rejuvenation. Further, MCT allows for customization of treatment based on each patient's specific needs and anatomy. Further studies in a more diverse patient population are needed to fully evaluate safety and efficacy.

SUBMISSION TITLE: MODELING THE ACTIVATION OF MOTONEURONS BY AN ELECTROMAGNETIC MUSCLE STIMULATION DEVICE

Authors: Joel Jimenez Lozano
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Background: Introduction: Electromagnetic muscle stimulation (EMMS) is an emerging noninvasive technique for inducing muscle contractions in aesthetic medicine. The mechanism by which EMMS activates motoneurons to stimulate involuntary muscle contractions is not yet fully understood. In this study,a novel computational model is presented that combines, (1) Maxwell's equations to predict the induced electric and magnetic field in tissue by an EMMS device and (2) Hodgkin-Huxley membrane bioelectricity equations and a cable equation to investigate the activation of motoneurons.

Study Design/Materials and Method: The multiphysics model was solved using a commercially available finite element analysis software. The electromagnetics module to solve Maxwell's equations and the equation-based module for the motoneuron modeling were employed. The effect of the induced electric field in motoneuron activation was examined. Spatial location and influence of the fat layer thickness in triggering the action potential was investigated.

Results: Magnetic and electric field maps were computed. The motoneuron model permitted to calculate

the required electric field threshold per pulse to trigger an action potential for the parameters of the EMMS device. By exploring the spatial distribution of motoneurons,regions of activation were identified and found that the thickness of the fat layer notably affects the reach of the device and its ability to trigger an action potential.

Conclusion: This computational model provides a better understanding of the mechanisms underlying EMMS. The model can be used to predict the effects of the parameters of the EMMS device on motoneuron activation and as an aid to optimize the design of EMMS devices. Clinical characterization of activation zones to target specific muscle groups could improve treatments.

SUBMISSION TITLE: NOVEL DUAL-APPLICATOR CRYOLIPOLYSIS SYSTEM: EVALUATION OF PATIENT-REPORTED SATISFACTION, PSYCHOSOCIAL IMPACT, AND PROCEDURAL ASSESSMENT IN A PROSPECTIVE MULTI-COUNTRY POSTMARKETING STUDY

Authors: Mitchel Goldman, Suzanne Kilmer, Sabrina Fabi, Roy Geronemus, Jordan Wang, Jens Altmann, Jean Michel Mazer, Ulf Samuelson, Terence Tan, Yi Li, Julia K. Garcia, Meetu Bhogal, Alda Karic, Jack McKenna

Cosmetic Laser Dermatology: A West Dermatology Company, San Diego, CA; The Laser & Skin Surgery Medical Group, Sacramento, CA; Cosmetic Laser Dermatology: A West Dermatology Company, San Diego, CA; Laser & Skin Surgery Center of New York, New York, NY; Laser & Skin Surgery Center of New York, New York, NY; BodenseeKLINIK, Lindau, Germany; Centre Laser International de la Peau de Paris, Paris, France; Akademikliniken, Stockholm, Sweden; Halley Body Slimming Clinic, Singapore; Allergan Aesthetics, an AbbVie Company, Irvine, CA; Allergan Aesthetics, an AbbVie Company, Irvine, CA; AbbVie, Toronto, ON, Canada; Allergan Aesthetics, an AbbVie Company, Irvine, CA; Open Health Group, Parsippany, NJ

Background: Cryolipolysis is a clinically proven,-noninvasive subcutaneous fat reduction treatment. An FDA-cleared dual-applicator cryolipolysis system (Allergan Aesthetics, an AbbVie Company) allows for simultaneous treatment of >1 body area. A prospective multicenter clinical study (NCT04897867) with the dual-applicator cryolipolysis system demonstrated high patient satisfaction, safety, and effectiveness at 4 weeks after initial treatment and 12 weeks after the final treatment session. Here, we report additional exploratory analyses of patient-reported outcomes (PROs) from that study,including patient-reported psychosocial impact following treatment with a dual-applicator cryolipolysis system and evaluation of the procedure.

Study Design/Materials and Method: This prospective, multicountry, open-label, postmarketing, phase IV study enrolled healthy participants aged 22–65 years seeking subcutaneous fat reduction treatment of the abdomen and flanks (midsection). Participants had the option to be evaluated and treated in additional body areas, including the upper arms, inner thighs, outer thighs, and/or submental area. Participants could receive up to two treatment sessions with a dual-applicator cryolipolysis system to each of the designated body areas. Treatment plans, including the number of treatment cycles delivered at each session, were designed at the investigator's discretion. Endpoints were assessed at the final follow-up visit, which occurred 12 weeks after the final treatment session.

The primary effectiveness endpoint was participant-reported satisfaction with midsection results per the Cryolipolysis Satisfaction Questionnaire (CSQ)-Midsection (measured on a 5-point scale from "very satisfied" to "very dissatisfied"). Participants were evaluable for the primary endpoint if they completed their cryolipolysis treatment plan and CSQ-Midsection Item 1, which measured overall participant satisfaction with the results of the fat reduction procedure of the treated area.

Exploratory endpoints were participant-reported psychosocial impact of treatment on the 5-item Cryolipolysis Psychosocial Impact Questionnaire (CPIQ) and participant evaluation of the procedure on the 5-item Cryolipolysis General Procedure Questionnaire (CGPQ).

Items on the CPIQ assessed how participants felt about the treated body area with regard to 5 psychosocial attributes: self-conscious (measured on a 5-point scale from "not at all" to "extremely self-conscious"), happy (measured on a 5-point scale from "very happy" to "very unhappy"), anxious (measured on a 5-point scale from "not at all" to "extremely anxious"), bothered (measured on a 5-point scale from "not at all" to "extremely bothered"), and how often participants avoided certain places or situations (measured on a 4-point scale from "never" to "most of the time"). The CPIQ total score was the sum of all item scores. All individual CPIQ items and the CPIQ total score were transformed to a scale of 0 (no impact) to 100 (highest negative impact) points. A negative change from baseline indicated a positive improvement in the psychosocial attributes.

Items on the CGPQ assessed participant comfort with the fat reduction procedure (measured on a 4-point scale from "very comfortable" to "very uncomfortable"), likelihood of having the fat reduction procedure performed on a different part of the body (measured on a 4-point scale from "very likely" to "very unlikely"), willingness to recommend the fat reduction procedure to

a friend (possible responses were "Yes, I would recommend the procedure" or "No, I would not recommend the procedure"), and participant satisfaction with the length of time it took to complete the fat reduction procedure and time to achieve visible results (measured on a 5-point scale from "very satisfied" to "very dissatisfied").

Safety was assessed throughout the study.

Results: Overall, 110 participants were treated in this study; the mean (SD) age was 43.0 (12.1) years, 74.5% of participants were female,and mean (SD) body mass index was 25.1 (2.7) kg/m^2. In total, 5.5% of treated participants had Fitzpatrick skin type (FST) I, 40.9% of participants had FST II, 42.7% of participants had FST III, 9.1% of participants had FST IV, and 1.8% of participants had FST V. Of the treated participants, 96 participants were evaluable for the primary endpoint on the midsection. In addition, 61 of the treated participants were also evaluable for 1 or more of the additional body areas (upper arms, inner thighs, outer thighs, and submental area). Of evaluable midsection participants, the majority of participants (97.9%; 94/96) received the prescribed treatment plan over two treatment sessions. A mean (SD) of 13.1 (3.43) treatment cycles were delivered to the midsection as part of the treatment plan.

The study met its primary endpoint,with 83.3% (80/96) of participants treated in the midsection reporting that they were "satisfied" or "very satisfied" with their results on the CSQ-Midsection at 12 weeks after the final treatment session.

The evaluable participants reported psychosocial improvement after treatment with a dual-applicator cryolipolysis system as assessed by the CPIQ. The mean (SD) CPIQ total score improvement from baseline to 12 weeks postfinal treatment was –28.9 (19.2) ($p < 0.0001$). Furthermore, participant scores demonstrated a significant ($p < 0.0001$) improvement from baseline for each individual item on the CPIQ related to the appearance of the treated body areas, including self-consciousness (mean [SD] change from baseline of –24.7 [28.7]), happiness (mean [SD] change from baseline of –40.1 [27.5]), anxiousness (mean [SD] change from baseline of –21.6 [30.3]), how bothered they were (mean [SD] change from baseline of –30.7 [24.2]), and avoidance of certain places (mean [SD] change from baseline of –26.1 [32.9]).

On the CGPQ administered at 12 weeks postfinal treatment session, 53.1% (51/96) of evaluable participants reported that the fat reduction procedure was "comfortable" or "very comfortable"; 85.4% (82/96) reported that,if needed,they would have this fat reduction procedure performed on a different body area; 89.6% (86/96) would recommend this procedure to a friend; 86.5% (83/96) were "satisfied" or "very satisfied" with the length of time to complete the fat reduction procedure session; and 78.1% (75/96) were "satisfied" or "very satisfied" with the time it took to achieve visible results.

Five participants reported seven device-related treatment-emergent adverse events. All were mild and resolved by the end of the study; none were unanticipated or serious.

Conclusion: Following treatment with a dual-applicator cryolipolysis system,participants reported significant psychosocial improvements and a favorable assessment of the procedure. No new safety signals were identified. Overall,this is the largest study to date demonstrating high participant satisfaction,effectiveness,and safety with the dual-applicator cryolipolysis system and the capability of simultaneous treatment to midsection and additional body areas. This study builds on prior cryolipolysis studies,demonstrating improvement from the patient perspective on various outcomes,and highlights the importance of PRO instruments to evaluate patient impact following body contouring procedures to help improve patient care.

SUBMISSION TITLE: OPTIMIZING CLINICAL BENEFIT AND PATIENT EXPERIENCE WITH COMBINATION DEEP TISSUE RADIOFREQUENCY MICRONEEDLE TREATMENT FOLLOWED BY SHALLOW 1927 THULIUM LASER

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Lutronic, Billerica, MA

Background: Patients in today's aesthetic market are primarily seeking ways to look more youthful by combating the natural skin aging process. Most clinically relevant improvements when receiving treatments do not have an immediate return, as the body requires additional time to repair damaged tissue from laser and radiofrequency treatments Traditionally, improvements can be noted in between 1 and 3 months, but can be longer or shorter depending on the treatment modality and device chosen for treatment. By utilizing a two-device treatment technique with radiofrequency microneedling (RFMN) to target dermal tissue and then following with a nonablative fraction 1927 nm thulium laser to target epidermal concerns, all natural signs of aging can effectively be addressed in one patient appointment.

Study Design/Materials and Method: Patients most common complaints are wrinkles, skin laxity, epidermal pigment, and textural concerns. The combination of RFMN and 1927 nm laser can often address many of these concerns. Patients are first treated with the RFMN device. Before treatment patients are numbed with 23% Lidocaine/7% Tetracaine for 60 minutes. The midface, lower face, and neck are the primary areas for RFMN treatment. For the midface, the device is typically set to 25–40 mj/pin. For the lower face parameters for the device are typically set to 40–75 mj/pin. For treatment of the neck, settings typically ranged from 25 to 40mj/pin. Following the completion of

the RFMN, patients were immediately treated with a 1927 nm Thulium Laser over the entire face. Laser settings could be adjusted based on patient skin type and patient comfort but a majority are treated with 10–20 mj and 6–8 passes. Patients were monitored for posttreatment side effects and then returned in 4–12 week intervals for three to five total treatments.

Results: Overall, patients had a high satisfaction rate with the combination procedure. There were no adverse events from the treatments and there are no serious side effects from the combination of the two devices. Most patients exhibited mild edema, and mild erythema for 1–2 days postprocedure due to the RFMN treatment. For the 1927 nm Thulium laser there were only instances of mild erythema which most often resolved within a day. Upon patient's first follow-up, standardized photography revealed the patient's skin had an overall more even texture and decreased pigmentation. As the treatment series progressed, subject skin laxity and wrinkles improved with most patients exhibiting an approximate 75% improvement. Patient comments often included an immediate difference in all areas treated with the 1927 nm laser with more significant improvement noted in wrinkles and skin laxity to the lower face and neck treated with the RFMN.

Conclusion: The use of a radiofrequency microneedling device immediately followed by a fractional nonablative 1927 nm thulium laser provided excellent benefits for all patients. The use of the 1927 nm laser provided an immediate short term benefit for all patients providing them with a posttreatment glow while the RFMN spent a longer time rebuilding collagen in the dermis to provide the background structure for volumized, healthy skin. The overall efficacy without increased additional side effects showcase this as an ideal all-in-one treatment package for patients.

SUBMISSION TITLE: SAFETY AND EFFICACY OF ALEXANDRITE PICOSECOND DEVICE, RADIOFREQUENCY MICRONEEDLING DEVICE, AND TOPICALS IN COMBINED TREATMENT ON PATIENTS WITH DARKER SKIN TYPES

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Background: Radiofrequency (RF) microneedling causes microinjuries and delivers thermal energy, which triggers tissue contraction and an increase in the production of collagen and elastin. RF combined with microneedling has an advantage over traditional microneedling because it delivers RF energy deeply into the dermis. For treating skin conditions similar to what an RF microneedling device may be chosen to treat, an Alexandrite picosecond laser is also a viable and valuable option due to its photothermolysis and photomechanical impact on the skin. A third treatment option that has grown in popularity due to its noninvasive and affordable nature is treatment with topicals. This study investigates the usage of an RF microneedling device, an Alexandrite picosecond laser, and topicals as a combined treatment for acne scars and facial aging. Specifically, this study seeks to treat these indications on a darker range of skin types to determine the safety and efficacy for what is commonly a more difficult demographic to treat.

Study Design/Materials and Method: Ten subjects with Fitzpatrick skin types ranging from III to V have been treated for a total of 37 treatments with the picosecond Alexandrite device and the RF microneedling device. All subjects were treated with an Alexandrite laser with a wavelength of 755 nm, and the average fluence across treatments was 0.42 J/cm^2. The number of pulses for this device ranged from 260 to 6022, with an average of 1634 pulses. Subjects were treated with a repetition rate from 5 to 10 Hz and a spot size of 6, 8, or 10 mm. For the microneedling treatment, subjects received an average of 169 pulses, an average power of 18 W, an average depth of 1.9 mm, a repetition rate of 1 or 2 Hz, and 1–3 passes per treatment. Following each treatment, subjects were given a topical product regimen to apply to their face for the duration of the study. Additionally, subjects were given a hyaluronic acid mask post treatment. Subjects are in the process of returning for their 30 and 90 day follow ups, in which they are asked their satisfaction (on a Likert scale of 1—extremely unsatisfied to 6—extremely satisfied) and their level of improvement on the Subject Global Aesthetic Improvement Scale (SGAIS) and Physician Global Aesthetic Improvement Scale (PGAIS) from 1—very much improved to 5—worsened. Some subjects have attended the 30 day follow up visit, and 90 day follow up visits have not yet happened.

Results: Typical posttreatment side effects were erythema, edema, and pin-point bleeding, and all side effects were transient. There have been no reported instances of postinflammatory hyperpigmentation. Six out of ten subjects have currently completed their 30 day follow up visit, and 67% of them were satisfied, 17% were slightly satisfied, and 17% were extremely satisfied. According to the SGAIS scores, 50% of subjects graded themselves as "Improved," 33% of subjects graded themselves as "Much Improved," and 17% of subjects graded themselves as "Very Much Improved." The physician graded 50% of subjects as "Much Improved," 33% of subjects as "Improved," and 17% of subjects as "No Change." The two subjects with Fitzpatrick skin types V were "Extremely Satisfied" and "Slightly Satisfied," graded themselves as "Much Improved" and "Improved," and were also graded as "Much Improved" and "Improved" by the Physician at the 30-day follow up.

Conclusion: Currently, the pain scores and lack of adverse events showcase the potential of the Alexandrite picosecond laser, RF microneedling, and topicals combined to be a tolerable and safe treatment. The treatment results thus far also indicate high levels of efficacy. The safety and efficacy data collected additionally support this combination as being a safe and effective treatment for subjects with higher Fitzpatrick skin types.

SUBMISSION TITLE: SAFTY PROFILE FOR THE TOPICAL APPLICATION OF TARGETED ALKALI THERMOLYSIS (TAT)

Authors: Erin Tims; Suzanne Kilmer; Jesse Rosen

Candesant Biomedical; Laser and Skin Surgery Center of Northern California, University of California, Davis, School of Medicine; Candesant Biomedical

Background: Topical application of Targeted Alkali Thermolysis (TAT) is being proposed as a novel approach to reducing sweat production. A GLP animal study was conducted to describe the safety profile of the TAT patch under conditions of exaggerated use and misuse. Outcomes from this GLP animal study on this energy-based, single-use, disposable patch are intended to characterize the spectrum of the dermatological responses and assess acute injury and chronic healing. The study was conducted using a swine model, commonly used in dermatological applications.

The intent of the TAT patch is to inactivate sweat glands leading to a reduction in sweat production for patients who suffer from excessive sweating. The technology is based on the principle that alkali metals in combination with water generate thermal energy. The TAT patch contains a thin layer of sodium metal that, when in contact with the water (sweat) generates a microthermal injury to the sweat duct/gland. The desired effect, verified by clinical studies, is a temporary reduction in sweat production.

Unlike other energy devices, the energy from the TAT patch is mediated by the volume of water (sweat) that comes into contact with the alkali metal. In clinical conditions this is controlled by the amount of sweat produced at the location of patch application (axilla) for the maximum 3-minute clinical application time.

To establish a safety margin associated with the device, this GLP animal study had to design a way to simulate a range of energy levels. Since the porcine abdomen does not have sweat glands, this was achieved by applying the TAT patch in the presence of varied volumes of artificial sweat which were applied to the skin surface to mimic different energy exposures. Additionally, the patch was left in contact with the tissue for extended periods of time beyond the 3-minute clinical treatment. Note that these experimental conditions were designed to represent exaggerated situations; they differ significantly from clinical conditions where the TAT patch is applied to dry skin for no more than 3 minutes. Clinically, the TAT patch generates heat slowly as the patient sweats, however in this study the patch is exposed to a bolus volumes of sweat which result in higher rates of heat transfer from the patch and corresponding increased tissue temperatures.

Gross tissue observations and histology were analyzed following these exaggerated treatment conditions to characterize the extent of injury and subsequent healing. A systemic toxicity assessment following application of the TAT patch was also conducted.

Study Design/Materials and Method: Four Yorkshire pigs were sedated and maintained under general anesthesia. Each animal underwent six applications of the TAT patch at predefined and separate locations on their abdomens which had been previously marked by tattoo. Additionally, two controls of untreated tissue were collected for histology evaluation.

Each abdominal location was randomly assigned a treatment regime, which defined the time of patch application as 3, 9, 12, or 15 minutes (representing the maximum clinical treatment time of 3 minutes and 3×, 4×, and 5× the clinical treatment time) and the volume of artificial sweat that was to be present, the two treatment variables that can impact the amount of energy generated by the patch. The amount of artificial sweat applied to the skin was based upon published clinical study data. Specifically, the value for mean sweat volumes in subjects with hyperhidrosis (mean HH) was established and used to determine incremental volumes including 3× mean HH sweat volume and 5× mean HH sweat volume to simulate worst-case energy generation in the TAT patch. The total volume of sweat was administered by pipette in a uniform layer across the treatment area in three equal amounts spaced at 1-minute intervals. This was done to partially simulate the gradual secretion of sweat exhibited in humans.

All TAT patch applications were administered consecutively in a single procedure on Day 0. Following the procedure, standard daily clinical observations were taken including qualitative daily food consumption, weekly body weight, photographs and local irritation using Draize Dermal Irritation Scoring* at the following timepoints: 24, 48, and 72 hours, then 7, 14, and 28 days.

* Draize Dermal Irritation Scoring

ERYTHEMA

Grade 0: no reaction

Grade 1: mild erythema (barely perceptible)

Grade 2: moderate erythema (well defined)

Grade 3: severe erythema (dark redness)

Grade 4: severe erythema to slight eschar formation (dark redness, darkened areas, exudates, and/or eschar formation)

EDEMA

Grade 0: no reaction

Grade 1: mild edema (very slight thickening)

Grade 2: mild to moderate edema (well defined, raised <1 mm)

Grade 3: moderate edema (raised ~1 mm)

Grade 4: severe edema (raised > 1 mm; extends beyond the boundaries of dose site)

Punch biopsies were taken from pre-defined locations. Two animals underwent tissue harvesting by punch biopsy at 3 days and necropsy at 7 days. The other two had punch biopsies conducted at 14 days with necropsy at 28 days.

Tissue samples were processed, sectioned and stained with H&E for histological evaluation. The study pathologist evaluated all sections and recorded abnormalities. Specifically, an assessment of dermal thickness and depth of tissue necrosis (burn injury) was made and measured using the morphometry software (Lumenera Infinity Analyze 6.5.2) in use with the Lumenera INFINITY 2 camera (photomicroscope). The percentage of dermal depth of injury was calculated for each tissue sample.

A gross necropsy and examination for any gross lesions was performed on all animals by the study pathologist and organ weights were recorded (heart, liver, adrenal glands, pituitary, thyroid/parathyroid, kidneys, spleen, thymus, brain, ovaries and lungs).

Results: Summary:

All animals were healthy and thrived over the course of this study. No unanticipated medical treatment was necessary at any phase of the study. In some cases, dermatologic injury was observed, associated with the exaggerated misuse of the device, however the injury was deemed acceptable by the study pathologist and mostly resolved over 14 days. No residual scarring or fibrosis were observed at any of the treatment sites. No signs of systemic toxicity or other systemic adverse effects were observed.

Specific dermatologic observations were as follows:

1. The TAT patch placed on dry skin (i.e., no artificial sweat) showed no erythema or edema and did not result in injury in any case, even when applied for up to 5× clinical treatment time.
2. The TAT patch applied at all sweat volumes showed an immediate visual response:
   a. When mean HH sweat volume was applied for 3 minutes:
      i. Erythema was most pronounced immediately post application (5–7 minutes) and showed lessening almost immediately with complete resolution as early as 4 hours.
      ii. With increased application time, injury increased, but usually with erythema noted in less than 50% of the application site, except for two sites with extended (12- and 15-minute) exposure times.
      iii. By Day 7, 42% of sites with HH sweat volume showed full resolution and remaining erythema was mild and focal, except for one 12-minute exposure time case.
      iv. No erythema was observed after Day 14 with mean HH sweat
   b. When higher volumes of sweat (3× and 5× mean HH) were applied:
      i. Severe erythema was sustained in 75% of sites 4 hours posttreatment
      ii. Erythema gradually decreased with only focal and mostly mild to moderate erythema in 20% of treatment area remaining at 7-days.
      iii. By Day 28, only two sites showed any evidence of injury.
3. Edema scoring was similar but milder than erythema with shorter time to resolution. Edema was largely resolved by 3-days. The 5× mean HH sites showed the most severe scores. Edema was completely resolved in all sites after Day 7.
4. All injury observed had an onset time immediately following TAT patch application; there was no observed nor histological evidence of delayed dermal effects from TAT patch treatment.
5. A comparison of photographic erythema data with histologic injury analysis show that histologic injury findings correlated well with erythema data.
6. Histological scores showed some injury, but no residual scarring or fibrosis at any of the treatment sites. Specifically:
   a. Mean HH sweat volume sites with acute thermal injury confined to the epidermis or just beneath withlesions essentially healed by 7-days.
   b. At 5× mean HH sweat volumes more severe injury was observed. Findings generally consisted of coagulative, thermal necrosis with varying degrees of depth, in rare cases were classified as a 3rd degree burn injury reaching subdermal fat. Even the most severe lesions were healed by 28-days with no observable residual injury or fibrosis.
7. Extended application times (9, 12, and 15 minutes) overall showed less severe outcomes compared to application in the presence of higher volumes of artificial sweat.

Conclusion: This GLP animal study showed no tissue injury when applied under clinical conditions; these outcomes offer important evidence of the safety of the TAT technology and are verified by data from clinical studies on the TAT patch.

Moreover, this animal study showed that even in the most exaggerated conditions (i.e., the patch applied for five times longer than recommended with five times the maximum amount of sweat expected to be present) only minimal dermatologic injury occurred with complete healing in less than 28 days.

Importantly, the comprehensive data suggests that the amount of sweat present on the skin surface has a more significant impact on dermal injury compared to extended

application times of the TAT patch. Specifically, the increased application times did not demonstrate a clear correlation with erythema, edema or histological injury scores. However, it was observed that increased injury did correlate directly with increased applied volumes of artificial sweat. These data suggest that a misuse injury in a clinical setting would be more likely to occur in the case of inappropriate patient preparation (failure to remove sweat before application of the TAT patch) rather than exceeding the 3-minute application time.

Finally, since even the most exaggerated conditions showed mild-moderate injury, it is unlikely that any misuse injury from the TAT patch would be more than mild-moderate, even in the most extreme misuse cases. Moreover, it is important to note that this experimental condition of repeatedly applying the TAT patch in one location in the presence of a large volume of water on the skin surface is not a realistic clinical situation. The method, which was necessary to due to the lack of sweat ducts in pig skin, resulted in a higher level of heating and dermal injury would be expected clincally, even if the TAT device is grossly misused on a patient.

In conclusion, this GLP animal study confirms that when used as directed, there was no injury seen with application of the TAT patch. It further showed that the most likely potential misuse conditions in the clinical setting (i.e. those associated with prolonged application time or with excess sweat present on the skin surface) that could lead to injury, would most likely be a mild to moderate tissue injury and with localized pain isolated to the application site; unlikely to require prolonged treatment or hospitalization. These data have been confirmed by clinical studies, thus establishing the safety profile of the TAT technology for axillary treatment to reduce excessive sweating.

SUBMISSION TITLE: SPLIT ADJUSTABLE FLUENCE AND SPOTSIZE FOR SKIN REJUVENATION, SKIN PIGMENTATION, AND ACNE SCARS WITH A DIFFRACTIVE LENS ARRAY -FACE STUDY WITH A NEW PICOSECOND ALEXANDRITE LASER WITH INCREASED OUTPUT ENERGY, INDEPENDENTLY

Authors: Emil Tanghetti; Sean Dougherty

Center for Dermatology and Laser Surgery; Cynosure

Background: The Picosecond Alexandrite with the flat optic and the diffractive lens array has become an important tool for skin rejuvenation, abnormal pigmentation, and treatment of tattoos. It is a particularly important device with the fractional optic in darker skin types. To address these demands, an adjustable fluence picosecond laser with an increased energy output was developed. This split-face study evaluated the use of a picosecond laser with independently adjustable fluence and spotsize for skin rejuvenation and the treatment of pigmentation and acne scars.

Study Design/Materials and Method: Twenty-three subjects were enrolled in this two sites study. Subjects had two to four treatments with diffractive lens array the original 200 mJ/pulse picosecond device settings, as a baseline, on one half of their face with average fluence of 0.51 J/cm² and the new 300 mJ/pulse picosecond alexandrite laser on the other half of their face with average fluence of 0.58 J/cm². A subset of three subjects with melanin index (MI) between 21 and 36, Fitzpatrick skin type III to V, were treated with 8 mm spot, 0.4 J/cm² on one half of their face and with 10 mm spot, 0.38 J/cm² on the other half of the face. Evaluation for satisfaction (on a 6-point Likert scale) and improvement (graded with the GAIS Questionnaire) were evaluated by the subjects and the physicians. Subjects were also evaluated after each treatment, comparing the baseline vs the adjustable settings.

Results: At the 30 day follow up, all subjects who attended were satisfied and noticed improvement; blinded graders rated 75% of the patients as 3—improved and 25% as 2—much improved on the GAIS scale. All subjects who filled questionaries were also satisfied immediately after treatment on both slides of their faces. When asked about how the skin feels after treatments, subjects responded "tighter" in 41%, "smoother" in 23% and "firmer" in 17%. Both sets of laser settings received similar responses from all subjects. Throughout this study, no serious adverse events occurred. The average pain scores were 5.1/10 and 5.3/10 for the baseline and the adjustable settings, respectively. Split-face patients where the 8 and 10 mm handpieces were compared at similar settings were threated on average with 12% smaller number of pulses on the 10 mm side, $p < 0.05$. When all treatments for 8 and 10 mm spot sizes were analyzed, the 10 mm treatments were completed with 36% smaller number of pulses, $p < 0.01$. We will also present mathematical model and data on the importance of cadence and pulsing stacking with fractionated picosecond lasers.

Conclusion: In this split-face study, both the baseline and the adjustable laser settings were safe and tolerable with no analgesic and provided excellent efficacy results for the treatment of pigmentation, acne scars and skin rejuvenation. The increased energy output and the independently adjustable fluence and spotsize settings allowed these excellent results to be achieved with a statistically significant smaller number of pulses. Our experience and modeling data suggests that the treatment is safe for all skin types with appropriate cadence and avoidance of pulse stacking.

SUBMISSION TITLE: THE DESIGN AND EVALUATION OF A NOVEL TOPICAL SERUM DESIGNED TO BE UTILIZED WITH ENERGY-BASED DEVICES FOR PIGMENT CONTROL AND IMPROVEMENT OF SKIN ELASTICITY

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Background: Melanonychia is characterized by brown or black pigmentation on the nail caused by melanin and other exogenous pigments. Common causes of melanonychia include benign nevi, trauma, onychomycosis, medications, and subungual melanoma. Diagnosis and treatment of melanonychia is challenging given the small size and unique anatomical structure of the nail unit, and difficulty of nail matrix biopsy procedures which may result in delayed diagnosis, or treatment. Less-invasive techniques for the treatment of melanonychia are needed in addition to those that produce long-lasting results. Here we describe the use of the RevLite Q-switched Nd:YAG photoacoustic technology pulse (PTP) laser for melanonychia.

Objective:

To investigate the efficacy of the novel RevLite Q-switched Nd:YAG photoacoustic technology pulse (PTP) laser in the treatment of frictional melanonychia.

Study Design/Materials and Method: A 60-year-old woman presented with well-defined, longitudinal bands of black pigmentation on multiple toenails with at sites of repeated trauma due to tight fitting shoes. Empirical treatment of suspected onychomycosis was previously attempted with failed courses of antifungals including terbinafine, fluconazole, itraconazole, and ciclopirox olamine lacquer over the course of 3 years. The patient underwent two treatment sessions, spaced by 3 months, using the Q-switched Nd:YAG Photoacoustic Technology Pulse (PTP) laser (RevLite C6 ®; Cynosure) at a wavelength of 1064 nm with a 6-mm spot size and a fluence of 5.7 J/cm^2 in two shortly stacked 5–7 nanoseconds pulses over all toenails. Photographic documentation was obtained at baseline, immediately after, and 6 months the final treatment.

Results: Immediately after the first treatment the black pigmentation located over all toenails showed immediate resolution. On the 3-month second treatment barely no pigment was noted and the patient requested a second session. Clinical resolution was observed including marked improvement in the hyperpigmentation which was achieved in this patient without any adverse effects and results were maintained at the 6-month follow-up visit.

Conclusion: The use of a Q-switched Nd:YAG PTP laser therapy should be considered as a clinically effective therapy in improving the appearance of hyperpigmentation in cases of frictional melanonychia. Melanonychia may cause significant cosmetic and psychological distress therefore warranting the investigation of novel therapies. This new laser technique is advantageous given the long-lasting results, and may be repeated as needed. Additional clinical trials including a greater number of patients are needed to validate and confirm the results observed in our case and to verify the safety/efficacy of this methodology.

Key words: melanonychia; onychomycosis; RevLite Q-switched Nd:YAG laser; photoacoustic technology pulse

SUBMISSION TITLE: THE EFFICACY AND SAFETY OF LONG PULSE IPL IN THE TREATMENT OF ATROPHIC ACNE SCAR

Authors: Xiaoning Li

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Background: Throughout the years, our skin gradually shows signs of aging as connective tissue content decreases over time, and the skin becomes lax and loses its elasticity. Skin laxity frequently occurs in areas where a large amount of adipose tissue is covered by a relatively thin layer of skin, such as the abdomen or upper arms. This study investigates the efficacy of a novel procedure combining radiofrequency and targeted ultrasound for treating skin laxity in such problematic areas.

Study Design/Materials and Method: This was a multicenter, single-arm, open-label study recruiting 30 subjects at baseline (33–73 years old, skin types II-IV), followed up to 6 months posttreatment. Subjects were scheduled to undergo four treatments (7–14 days apart) on the abdomen or upper arms. Each treatment lasted between 15 and 30 minutes, based on the investigator's assessment of the skin laxity severity. Digital photographs (GAIS scale evaluation), skin elasticity, subject comfort, and satisfaction were documented.

Results: The interim evaluation of the study data showed that treatments were comfortable on both the abdomen and arms. More than 89% of subjects noticed an improvement in skin laxity and overall appearance in the treatment area. The high satisfaction rates were also accompanied by the expert's GAIS evaluation, showing that the subject's appearance improved or much improved at the latter follow-ups. This was accompanied by an increase in elasticity values, peaking at 3 months posttreatment.

Conclusion: A combination of monopolar radiofrequency and targeted ultrasound considerably improved skin tissue quality, reduced laxity, and achieved high satisfaction rates amongst the treated subjects. This may be attributed to the hypothesized synergy of both energies delivered to the tissue simultaneously. However, further research is required to verify the exact effects of this procedure.

SUBMISSION TITLE: THE POSSIBILITY OF REDUCING DOWNTIME BY USING TWO TYPES OF LASER DEVICES IN COMBINATION

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Background: In cosmetic medicine, the reduction of downtime is paramount. Against this background, the use of lasers has become popular instead of surgical techniques. On the other hand, even in the case of laser treatments, further reduction of downtime is required because of symptoms such as pain, swelling, and crusting that occur when wounds are caused at the dermal level, as in the case of fractional lasers treatment.

Currently, these lasers used for aesthetic purposes are specialized for various functions and are of multiple models, some of which may be utilized to reduce downtime.

For example, the long-pulse Nd:YAG laser (1064 nm) heats the dermis gently, thereby promoting collagen production, skin tightening, and biological activity (biomodulation).

We have previously shown that cosmetic ingredients are also effective in reducing downtime. For example, fullerene, an antioxidant, shows anti-inflammatory effects by suppressing reactive oxygen species produced by lasers. In addition, 2-aza-8-oxohypoxanthine (AOH), a cell-growth agent, promotes stratum corneum recovery and suppresses transdermal water loss after laser irradiation at an early stage.

In this study, we examined whether irradiation with a long-pulse Nd:YAG laser immediately after CO_2 fractional laser irradiation causes differences in recovery. In addition, we examined whether further improvement could be expected by applying either fullerene or AOH, cosmetic materials that have been shown to reduce downtime, after the combined irradiation.

Study Design/Materials and Method: The inner upper arms of three healthy Japanese subjects were used as the test site, and five test sites (a–e) were set up there.

Test site a was treated with SmartXIDE2 (DEKA: Power 11 W (2.09 J/cm^2), pulse width 600 microseconds, density 9.6%) as a CO_2 fractional laser.

Test site b was irradiated with Excel V (Cutera: Power 4.0 J/cm^2 pulse width 0.3 microseconds, wavelength 1064 nm, until reaching 40°C) immediately after the CO_2 fractional laser irradiation.

Test sites c–e were irradiated with both lasers, and then the following cosmetic formulations were applied twice daily, morning and evening. Test site c: 2 ppm fullerene/oil cosmetic, test site d: lotion with 0.01% AOH, and test site e: lotion with 0.1% AOH.

Evaluation was conducted by photography, and images were recorded at appropriate times.

Results: The areas treated with CO_2 fractional laser irradiation alone showed pain and swelling immediately after irradiation, while those treated with the long-pulse Nd:YAG laser (1064 nm) tended to show less swelling. Even several days after irradiation, redness tended to be suppressed in the area treated with the long-pulse Nd:YAG laser (1064 nm). Similarly, crusting improved earlier at the combined site (test site b) than at the single treatment site (test site a).

When cosmetic formulations were applied to the combined site, the crusts disappeared earlier at the AOH-applied site (test sites d and e) than at the non-applied site (test site b). In addition, crusts on the fullerene-applied site (test site c) improved more quickly than those on the no-applied site, although more slowly than those on the AOH-applied site.

Conclusion: Various approaches have been studied to reduce downtime as postlaser care. The results of this study showed that the combination of a long-pulsed Nd;YAG laser with biomodulation effect with the highly invasive CO_2 fractional laser can alleviate the symptoms of fractional laser. Furthermore, the application of cosmetic ingredients after the procedure was shown to reduce downtime. The results of this study indicate a new approach to reducing downtime by combining laser treatments. In the future, we plan to investigate new options for reducing downtime by using various laser devices in combination.

SUBMISSION TITLE: TOWARDS A MECHANISM OF ACTION OF SKIN CHANGES AFTER CRYOLIPOLYSIS

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Background: Cryolipolysis noninvasively targets subcutaneous fat for elimination through controlled cooling through the skin. While skin changes post-cryolipolysis have been clinically observed, the mechanisms behind these changes are not known. During treatment, the skin is supercooled (nonfrozen) for a set period of time and then rewarmed to body temperature. After cryolipolysis treatment, skin remodeling processes such as neocollagenesis have been identified. However, the etiology of these processes and extracellular matrix (ECM) interactions requires further investigation.

Study Design/Materials and Method: Skin tissue samples from pre-abdominoplasty patients (avg. age/BMI = 41.8/29.59) were taken 3 days, 1 week, and 3 weeks after treatment along with samples from untreated controls. RNA-sequencing (RNA-Seq), immunohistochemistry (IHC), RNA in situ Hybridization (RNA-ISH), and H&E histology were performed on the samples. We used ingenuity pathway analysis (IPA) bioinformatic software to investigate enriched molecular

signaling pathways and identify upstream regulators from the RNA-Seq data set. ECM interactions were studied by exploring the matrisome, an ensemble of genes encoding ECM and ECM-associated proteins.

Results: The top five significant canonical signaling pathways from IPA were (1) activation of the complement system, (2) granulocyte and agranulocyte adhesion and diapedesis, (3) leukocyte extravasation, (4) phagosome formation, and (5) wound healing. Growth factor TGF-beta was predicted to be a main upstream regulator. We identified significant differentially expressed genes (173) of the matrisome across our data set: glycoproteins (47), collagens (9), proteoglycans (7), ECM-affiliated proteins (25), ECM regulators (48), and ECM secreted factors (37). Comparative analysis among timepoints permitted the identification of the most common genes (40). By network analysis, we inspected their relationships to TGF-beta and other commonly used gene groups for specific cell/physiological functions. Tissue histology revealed increased inflammatory infiltrates forming perivascular aggregates by H&E, higher collagen expression by RNA-ISH, and greater TGF-beta expression by IHC.

Conclusion: Previous experimental animal research of nonfreezing cold injuries to the skin microvasculature revealed increased capillary permeability, leukocyte adhesion, and transendothelial extravasation as signs resembling postischemic injury. Furthermore, complement activation is commonly observed in ischemia–reperfusion injuries. Our findings revealed the activation of molecular signaling pathways, significant mRNA gene expression, and histological features that capture the occurrence of like processes. Overall, the mechanism of action of cryolipolysis in the skin resembles an ischemia-reperfusion injury that triggers ECM remodeling and could explain the clinically observed improvement in skin texture and tightening.

SUBMISSION TITLE: TREATMENT OF VASCULAR AND PIGMENTED LESIONS ON THE FACE AND BODY WITH A NOVEL DUAL-WAVELENGTH ADJUSTABLE PULSE LASER WITH INTEGRATED COOLING

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Background: Recently echo intensity measurement gained popularity in the assessment of muscle quality.

Skeletal muscle is composed not only of contractile proteins, but also of noncontractile elements, such as adipocytes and fibrous tissue, which generally have different (higher) echo intensities compared to muscles. The principle of this method is based on detecting changes in echo intensity manifested by its decrease in case of better muscle quality and vice versa. This study examines the effect of a novel HIFES modality in combination with Synchronized radiofrequency for noninvasive facial remodeling and improvement of quality of delicate facial muscles.

Study Design/Materials and Method: The effect of HIFES + RF technology on facial appearance and muscle quality in this single-center, one-arm, open-label, prospective study was examined. Ten subjects (9 females and 1 male) in the age range 42–70 years (53.4 ± 10.1) were enrolled, undergoing 1- and 3-month follow-ups. The treatment duration was 20 minutes, applied four times, each treatment spaced 5–10 days apart. The therapy was administered using single-use applicators on both cheeks and forehead. Digital photographs were taken to be assessed using the Global Aesthetic Improvement Scale (GAIS) scale. In addition, the facial (m. frontalis) and cheek (m. zygomaticus major) muscles were examined by ultrasound for changes in echo intensity. Satisfaction, comfort, and safety of the therapy were monitored.

Results: The interim results based on ultrasound images show a decrease in echo intensity by up to 20% after 1 month and up to 30% after 3 months post-treatment for both frontalis m. and zygomaticus m. Echo intensity decline manifested as significant ($p < 0.05$) and demonstrates an improvement in the quality of the examined tissue. As a result of muscle remodeling, according to GAIS scale, the aesthetic appearance of the treated subjects was noticeably enhanced. However, the exact relationship between echo intensity and facial appearance remains to be investigated. The treatment was rated as comfortable and not painful.

Conclusion: According to interim data, the simultaneous combination of HIFES and synchronized radiofrequency effectively targets delicate facial muscles, thus promoting changes in visual appearance. The therapy is safe, comfortable, and accompanied by high patient satisfaction.

SUBMISSION TITLE: USE OF ONABOTULINUM TOXIN A FOR RECALCITRANT FACIAL NEURALGIA ASSOCIATED WITH PARRY-ROMBERG SYNDROME

Authors: Karen Karimi; Lori Fiessinger; David Pearson

University of Minnesota Dermatology, Minneapolis, MN; University of Minnesota Dermatology, Minneapolis, MN; University of Minnesota Dermatology, Minneapolis, MN

Background: We report the case of 61-year-old female patient with progressive hemifacial atrophy (Parry-Romberg syndrome) and disease-associated migraine headaches and trigeminal neuralgia. Facial pain was constant, severe, characterized as a deep burning, was

predominantly on the left forehead and left cheek, and caused significant reduction in quality of life. Her facial pain was recalcitrant to traditional analgesics including ibuprofen, acetaminophen, opioids, and gabapentin, as well as to immunomodulatory and targeted agents including hydroxychloroquine, methotrexate, mycophenolate mofetil, tocilizumab, and galcanezumab. Onabotulinum toxin A injections have been reported useful in children with Parry-Romberg syndrome, however reports are limited in adults. Due to the refractory nature of her facial pain, she was treated with onabotulinum toxin A injections. We report the case of 61-year-old female patient with Parry-Romberg syndrome with hemifacial atrophy, migraine headaches, and trigeminal neuralgia. Facial pain was constant and severe, predominantly on the left forehead and left cheek, and described as a constant headache-type, as well as deep burning in nature. She noted the facial pain was severe and significantly disturbing to her quality of life. Facial pain associated with Parry Romberg syndrome can be recalcitrant to traditional over-the-counter relievers such as ibuprofen and acetaminophen, and her disease was also recalcitrant to systemic agents such as methotrexate, hydroxychloroquine, mycophenolate mofeitil, tocilizumab and galcanezumab. The use of botulinum toxin was then considered to address the underlying left-sided neuralgia. The use of botulinum toxin A injections has been reported in children, however limited reports are available of use in adults.

Study Design/Materials and Method: At the first session, 0.5cc preserved normal saline was used to dilute a 50-unit vial, and an outlined injection plan was followed, omitting the forehead. Two units of onabotulinum toxin A were injected into each of 18 points spaced about 1 cm apart on a grid within the area of severe pain on the left cheek, with caution to avoid infraorbital foramen, nasolabial folds, and angle of the jaw, for a total of 36 units injected into the left cheek. The left forehead was included from the second session onwards.

Results: The patient returned to clinic reporting marked improvements in pain levels that were sustained until month 3 after injection, with therapeutic effects fully worn off by month 4. We performed three sessions of onabotulinum toxin A injections before limitations imposed by the COVID-19 pandemic. After 1 year, we resumed injections, for a total of eight sessions to date, with consistent self-reported improvements in baseline pain levels that are sustained for the first 8 weeks after injection. Unfortunately, this treatment did not prevent progression of her underlying disease, and she reported spread of pain medial to the area of injection on the left cheek.

Conclusion: We report the use of onabotulinum toxin A in the treatment of an adult patient with severe Parry-Romberg syndrome-associated facial neuralgia that was recalcitrant to multiple medical therapies. Future considerations may include the addition of injectable hyaluronic acid for volume restoration of the atrophy caused by Parry-Romberg syndrome.

Lightning Round

SUBMISSION TITLE: 308NM EXCIMER LASER IN THE TREATMENT OF REFRACTORY SCALP DYSESTHESIA

Authors: Paige Olson; Laurel Wessman; Sophia Fruechte; Ronda Farah; Maret Gjerde

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Background: Nowadays, noninvasive facial therapies are gaining popularity. High-intensity focused ultrasound or radiofrequency heating are the preferred options when it comes to facial treatments. The procedures based on these technologies rely on the reorganization of connective tissue and skin texture improvement. However, not only skin contributes to the overall facial appearance, the underlying structures such as muscles and fascia are involved equally. These components together form a unit. Therefore, proper care requires a comprehensive approach. This study aims to assess the safety and efficacy of a novel procedure combining radiofrequency (RF) heating and HIFES technology, which in synergy targets skin and underlying soft tissue structures for facial remodeling.

Study Design/Materials and Method: This multicenter, single-arm, open-label study was conducted in a nonrandomized design with subjects undergoing the therapy of face administering the combination of HIFES and RF. Four treatments were applied once per week. In total, 21 patients (24–60 years) were recruited. To document changes in facial appearance, digital photographs were taken after the last treatment, and at 1- and 3-month follow ups. Photographs were evaluated by GAIS score and linear measurements of facial tissue lifting. The patients' satisfaction, safety, and comfort were documented throughout the study.

Results: The interim data indicated a noticeable improvement in the overall facial appearance and a concomitant firming of its contours. The 26% lifting effect was found in brows and cheeks. A 97.8% subject satisfaction with treatment results was monitored. The

assessment of digital photographs, the GAIS score, was in concordance with the subjective assessment, where a measurable shift was recorded when comparing baseline and posttreatment photos about 27% on 3-month follow-up. The treatments were safe and accompanied by high therapy comfort.

Conclusion: According to data from various evaluation means, the simultaneous noninvasive treatment by synchronized RF and HIFES technology showed promising potential as an alternative to current procedures for facial tissue lifting.

SUBMISSION TITLE: 532NM Q-SWITCH LASER TREATMENTS FOR DISSEMINATED SUPERFICIAL ACTINIC POROKERATOSIS - A CASE SERIES

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Background: Patients have a strong preference for choosing noninvasive aesthetic procedures. The popularity of energy-based devices in recent years has been met with pause due to some of the side effects that can occur with these devices not limited to erythema, blistering, infection and pigmentary changes. Striae distensae (SD) is a common skin condition that affects males and females in areas such as the abdomen, breasts, thighs and buttocks and is associated with significant cosmetic morbidity. Topical medications, energy-based devices and surgical procedures have led to unsatisfactory and disappointing results in treating this prevalent condition. Here we report the success of utilizing a laser-based, needleless microject transdermal drug delivery system for the treatment of this condition.

Study Design/Materials and Method: Female patients with striae distensae were recruited to participate in this study at five different clinical centers. The patients were treated with a precise, controlled injection of PDLA solution through the microjet injection system at once or twice monthly intervals for a total of five treatments. Postprocedure side effects were minimal with transient bleeding.

Results: All patients in this study had significant improvement in the appearance of their striae distensae after a total of five treatments. Patient satisfaction of the procedure was also extremely high, due to the short nature of the treatment, quick recovery time and preclusion of needles or anesthesia.

Conclusion: Herein, we report the success of using a laser-powered needless microject injector for the viable treatment of striae distensae.

SUBMISSION TITLE: A LASER-POWERED, NEEDLESS MICROJET INJECTOR FOR THE TREATMENT OF STRIAE DISTENSAE

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Background: Treatments have traditionally revolved around using lasers and other energy-based devices for many aesthetic indications, including rhytides, skin laxity, and scars. More recently, a novel device was developed with microcoring technology (MCT), where a unique skin-coring mechanism precisely controls the location and depth of hollow coring needles to rapidly excise full-thickness microcolumns of dermal and epidermal tissue. The tissue columns are then removed from the needles via integrated suction system. With this treatment, there is no evidence of scarring or thermal damage to the tissue. This study highlights our real-world safety and effectiveness data in using MCT for a variety of clinical indications.

Study Design/Materials and Method: A retrospective chart review was performed during 2022 to evaluate recent clinical cases involving treatment with a novel MCT device (Ellacor; Cytrellis Biosystems). Patients were treated with MCT for any indication, had 4-week minimum follow-up, and had adequate clinical photographs available for evaluation. Demographic, treatment, and safety data were collected. Photographs were rated using 5-point Global Aesthetic Improvement Scale (GAIS) (5: Very much improved; 4: Much improved; 3: Improved; 2: No change; 1: Worsened).

Results: A total of 37 patients were treated using MCT in our clinic. More recently, 11 patients were treated in this series. Median age was 54 years (R: 24–80 years), and 63.6% were women. Majority were FST I–III (81.8%; $n = 9$), while there was 1 each of FST IV (9.1%) and V (9.1%). Clinical indications included rhytides and laxity (54.5%; $n = 6$), acne scars (36.4%; $n = 4$), surgical scars (18.2%; $n = 2$), and other scars (9.1%; $n = 1$). All patients were treated on face or neck. Most patients had one treatment (45.5%; $n = 5$), while others had 2 (27.3%; $n = 3$) or 3 (27.3%; $n = 3$).

Treatment density varied 5%–8%, with median depth of 3.5 mm (R: 2.5–4 mm). Total core count varied 162-8034 depending on density and area. Median GAIS was 4, which correlated to "Much improved." All surgical scars improved in depth, texture, and discoloration, while all atrophic acne scars improved in depth and texture. All patients treated for rhytides and laxity had improvements in skin texture and tone. There were no documented adverse events, including scarring, prolonged dyspigmentation, or infection. Expected transient erythema was common.

Conclusion: MCT is a novel minimally invasive technology that can safely and effectively treat a variety of clinical conditions in various skin types, while achieving clinical improvement early on even after single treatment.

SUBMISSION TITLE: A PILOT STUDY, COMBINING FRACTIONAL MICRONEEDLING WITH RADIO FREQUENCY AND POLYDIOXANONE THREADS IN TREATING SKIN LAXITY AND BROW PTOSIS IN ASIAN PATIENTS

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Background: For much of the Asian population, skin laxity around the eye and brow ptosis are the first to be observed with aging. Descending of the upper lid due to skin laxity over the entire eyes and less arching of the brows translates as "tired or sad look" which prompts patient to seek consult.

Blepharoplasty although considered as the gold standard in upper lid ptosis treatment is a surgical procedure that may inevitably lead to surgical complications such as under/over correction, scarring and infection. Due this possibility, minimally invasive nonsurgical procedures are now the treatment of choice for most patients who are hoping to avoid or delay surgery.

Fractional micro needling with radio frequency uses insulated needles that delivers thermal bulk heating deep into the dermis creating a response similar to wound healing that stimulates fibroblast to synthesize and lay down new collagen. Considered a very safe procedure with efficient cooling mechanism and minimal downtime.

Thread lifting with a biodegradeable polymer polydioxanone (PDO) sutures is a procedure where lax tissue is lifted and repositioned trying to create a more youthful looking facial contour. Once the threads are inserted under the skin, they induce a local inflammatory response as the body's natural defense mechanisms commence in response to a foreign object.

Combining these two modalities will address skin laxity and allow tissue reposition that can significantly improve eye aging problems. Moreover, these treatments offer minimal downtime and good procedure tolerance amongst the subjects.

Study Design/Materials and Method: Study of 20 patients male and female was selected, aged 35–45 years old with Fitzpatrick skin type IV.

All subjects had one session of Fractional micro needling with RF around the eye area over the orbital rim, with the following parameters:

Level 5, depth 1 mm, RF time 500 mms, 1 Hz, RF pulse 5, cooling on, 3 j per shot, total of 300–400 J delivered per area. Skin cooling for 30 minutes then followed by PDO thread insertion over the upper brow area 10 pieces mono threads and lower lid 15 pcs per area. Topical antibiotics was applied after the procedure, ice packs and analgesics were given as needed.

For evaluation:

Digital photos were taken and measurement of the (1) midline brow height with reference to the mid pupillary line and (2) margin crease distance before the procedure and 3 months after the procedure was recorded. (3) Skin laxity measurement over the lower lids was measured by doing Lid distraction test.

Gathered data was tallied, interpreted and statistically analyzed. Patient satisfaction was also determined. Side effects and complications were also noted.

Results: A single combined treatment of fractional micro needling with radio frequency and polydioxanone threads increased brow height of an average of 3.5 mm, widened the upper lid crease by 2–3 mm and improved skin laxity scores by minimum of 2 Grades.

All patients observed significant degrees of skin tightening, brow elevation, texture improvement and wrinkle reduction in the eye area. Statistical data analysis was significant.

Healing commenced after 3–5 days. Side effects include swelling, bruising, skin irregularities and dryness resolved spontaneously over a few days.

Conclusion: This study proved that by combining fractional micro needling with radio frequency and polydioxanone threads showed significant improvement in upper lid ptosis and brow ptosis based on measurement of the (1) Midline brow height with reference to the mid pupillary line and (2) Margin crease distance on all patients. This also showed improvement in scores of patient's lid distraction test. Safety of the treatment is also established. Patient satisfaction is was also very high and majority would want to repeat the treatment again after 6 months.

SUBMISSION TITLE: A PILOT STUDY COMPARING THE EFFICACY AND SAFETY OF COMBINED FRACTIONAL CARBON DIOXIDE LASER AND MONOPOLAR RADIOFREQUENCY VERSUS FRACTIONAL CARBON DIOXIDE LASER ALONE IN THE MANAGEMENT OF LATERAL CANTHAL LINES

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Background: Lasers for dermatologic use have been approved by the U.S. Food and Drug Administration (FDA) for a number of dermatologic indications including pigmented lesions, tattoo or hair removal, scars, and chronic wounds. Recent data, however, suggests that substantial published literature regarding the use of lasers for the treatment of these approved conditions lacks diverse racial representation or omits the reporting of specific Fitzpatrick skin types among clinical trial participants. Of the dermatology journals leading in publications on lasers for clinical use, Lasers in Surgery and Medicine ranked 33 out of 52 journals for total percentage of published articles on skin of color relative to the total number of articles published between 2018 and 2020. Given that Fitzpatrick skin type is an important factor in the visual presentation of dermatologic conditions as well as in monitoring treatment response and adverse effects, representation of the entire range of Fitzpatrick skin type is essential among dermatologic clinical trials and published literature as a whole. We conducted a review within Lasers in Surgery and Medicine to summarize the dermatologic conditions for which laser treatment in skin of color patients has been described and to review the overall representation of patients with skin of color within this journal. The objective is to review the representation of skin of color patients in the articles submitted to the Lasers in Surgery and Medicine Journal.

Study Design/Materials and Method: The authors searched Lasers in Surgery and Medicine Journal in November 2022 for eligible articles with keywords including: "skin of color." All studies were searched with the following filters: Publication Date: 2017–2022, Subject: Dermatologic Surgery. We included articles in the English language that focused on skin of color, lasers, and dermatologic disease. Articles were excluded if they were not focused on a dermatologic disease and nonhuman participants.

Results: Of the 267 identified articles, 70 met the inclusion criteria. Fitzpatrick skin types IV–VI was reported in 69 of the articles. Dermatologic conditions included scars (20.59%), skin rejuvenation (14.71%), acne (11.76%), hair removal (8.82%), tattoo removal (7.35%), striae (7.35%), Nevus of Ota/Ito (5.88%), melasma (4.41%), lentigines (4.41%), café-au-lait spots (2.94%), postinflammatory hyperpigmentation (1.47%), pigmented lesions (1.47%), dark circles (1.47%), riehl melanosis (1.47%), alopecia (1.47%), skin laxity (1.47%), hyperhidrosis (1.47%), telangiectasia (1.47%).

Conclusion: Our findings suggest underrepresentation in laser research for skin of color patients. Conditions such as hyperpigmentation and dark circles, which are some of the most common conditions affecting skin of color patients, represented only 1.47% of articles. Our findings call for additional research in lasers and how they affect skin of color patients, specifically regarding conditions that are eminent in this population.

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SUBMISSION TITLE: A RETROSPECTIVE STUDY OF A NEW PICOSECOND 755-NM ALEXANDRITE LASER WITH AN INCREASED ENERGY OUTPUT FOR NON-ABLATIVE REJUVENATION IN CHINESE SKIN

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Background: This is a retrospective analysis of all patients who underwent a new picosecond 755-nm alexandrite laser with an increased energy output as a part of nonablative facial treatment in a private dermatology center within 11-month period (Feb 2022–Jan 2023). This study explores the efficacy and safety of the new picosecond 755-nm alexandrite laser treatment of multiple aesthetic concerns associated with photoaging of the face including skin texture irregularities, dyspigmentation, enlarged pore size, rhytides and skin laxity.

Study Design/Materials and Method: The age, skin type, type of lesion, and number of treatments performed were recorded. all patients who underwent a new picosecond 755-nm alexandrite laser with an increased energy output as a part of the nonablative treatment, pulsed dye laser was also used to treat the vascular component. The baseline and most recent standardized photographs were assessed by trained physicians for comparison.

Results: A total of 21 subjects were included. The number of treatment sessions received ranged from one to five. According to Physician-evaluated outcome, pore size and skin texture were significantly improved ($p < 0.001$). Also, there was wrinkle improvement but not significant ($p = 0.057$).

Conclusion: The new picosecond 755-nm alexandrite laser with an increased energy output is a safe and effective non-ablative modality for targeting facial skin texture irregularities and dyspigmentation in Chinese skin.

Keywords:
nonablative, skin rejuvenation, Alexandrite laser, picosecond laser

Acknowledgment: This study was supported by Cynosure.

SUBMISSION TITLE: A REVIEW AND COMPARISON OF NON-INVASIVE SKIN TIGHTENING DEVICES FOR THE FACE

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Background: Body contouring has experienced a leap with the introduction of new-age, noninvasive techniques to target muscle and fat tissues. Reducing excess body fat and improving poor muscle strength or tone have been long-standing goals conventionally achieved by surgery-assisted liposuction (SAL) and physical exercise. Leading nonsurgical body-shaping therapies utilize cryolipolysis, ultrasound, lasers, radiofrequency (RF), high-intensity focused electromagnetic (HIFEM) field, and electrical or magnetic muscle stimulation (EMS or MMS). However, the recently pioneered application of simultaneous use of HIFEM and RF energies set a benchmark providing concurrent fat reduction and muscle toning, ultimately improving aesthetic appearance. This research aims to expound on synchronized HIFEM and RF application effects compared to other popularized body-shaping treatment options.

Study Design/Materials and Method: A systematic electronic search was carried out to identify available clinical literature and/or conference papers describing the results and use of popular noninvasive modalities. The research documenting the induced changes in adipose and muscle tissue was assessed and summarized. Special attention was given to quantitative and objective evaluation methods, such as caliper measurement or medical imaging modalities such as magnetic resonance imaging (MRI), ultrasonography, or computer tomography (CT) scans. Besides, secondary outcomes, including but not limited to patient comfort and satisfaction, have also been reviewed.

Results: In the body parts most frequently treated by surgery-assisted liposuction, which are the front and lateral abdomen, the combination of HIFEM and RF energy showed the most promising results, with approximately a 30% reduction in fat thickness and a 25% increase in muscle tissue on average. Noninvasive fat reduction by other methods showed lesser efficacy in fat loss, namely, in descending order the cryolipolysis, standalone radiofrequency, lasers, and high-intensity focused ultrasound. The peer-reviewed research has also more adequately evidenced the effects of combined HIFEM and RF energies on muscle and fat tissues in various areas, including the abdomen, buttocks, thighs, calves, and arms. Unlike other techniques, simultaneous HIFEM plus RF procedure uniquely targets fat and muscle tissue without requiring consecutive time-consuming treatments. Additionally, no severe adverse events or extensive downtime was documented postsynchronized HIFEM and RF procedures. However, the efficacy of EMS and MMS may be limited since quantitative effects on muscle have not been sufficiently documented clinically and, thus far, effect on fat has yet to be demonstrated.

Conclusion: The noninvasive body shaping devices rely on various energies and approaches when it comes to the enhancement of aesthetic appearance. However, this research evidenced the superior effectiveness of simultaneous HIFEM and RF procedures on fat reduction and muscle toning compared to the rest of the most frequently utilized aesthetic therapies in the current practice.

SUBMISSION TITLE: A REVIEW OF TREATMENT OF PORT-WINE STAINS WITH PULSED DYE LASER IN FITZPATRICK SKIN TYPE IV-VI

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Background: In this day and age, facial aesthetics has become one of the leading industries in the world owing to the quest to freeze youthful appearance. Treatment for periorbital wrinkles, which includes lateral canthal lines, is one of the most sought procedures in the clinics because it is one of the earliest signs of chronologic aging. Genetics, lifestyle, and harsh environmental exposure, including sun exposure, all contribute to developing wrinkles. The search for the best solution in addressing the problem led to trials of various treatment modalities such as topical medications, chemical peels, injectables, dermabrasion, lasers, and the like. From the last decade to this date, the use of laser has been gaining popularity and is therefore continuously being developed and upgraded to better address aesthetic concerns in general.

Several studies regard ablative lasers, such as CO_2 laser and erbium: yttrium-aluminum garnet, as the gold standard of treatment for photodamaged skin. Despite the dramatic improvement of photodamaged skin with ablative lasers, their use is associated with risks that include pigmentary changes, infection, inflammation and scarring. This led to development of nonablative and fractional lasers as well as other nonlight-based technologies such as radiofrequency and ultrasound devices in attempt to provide the same effects of the fully ablative lasers with minimal side effects.

Despite the significant advancements in technology to address rhytids and photodamage in general, the dilemma of which of these modalities or combination of the currently used modalities could best address rhytids still stands. Hence, this study explored the effectiveness of the combination treatments with two widely used devices, fractional CO_2 laser (FCL) and monopolar radiofrequency (MRF), in managing lateral canthal lines.

In this study, we aimed to compare the efficacy and safety of combination treatment with FCL and MRF versus FCL alone in managing lateral canthal lines. The subjects' satisfaction, the frequency of improvement in skin color homogeneity and texture, and the occurence of adverse events for each treatment regimen done to each side of the face were also determined and compared.

Study Design/Materials and Method: This is a controlled, randomized, split-face pilot study that was conducted at the Jose R. Reyes Memorial Medical Center Department of Dermatology from January 2021 to November 2021.

Pretreatment and posttreatment (1 month after the last treatment session) photographs of bilateral lateral canthal lines of enrolled participants were taken in a well-lit room using a 12-megapixel smartphone camera with standardized settings. Two photographs for each side of the face were obtained, one of which included the measurement of lateral canthal lines using an improvised caliper.

Randomization was performed by coin toss to determine the treatment group of each side of the face. One side of the face received a total of six treatments, comprising of two sessions of MRF and four sessions of FCL, with an interval of 4 weeks per session. The initial treatment was MRF followed by two consecutive sessions of FCL. Another MRF treatment was done on the fourth session that was followed by two more sessions of FCL. The other side of the face received four treatments of FCL with an interval of 4 weeks.

In the performance of the monopolar radiofrequency treatments, the device used was a fourth-generation RF technology that utilizes grid RF energy that creates a thermal grid zone emitting RF energy in fractional pattern. The subjects received a maximum of 50 pulses per session using a 7 mm × 7 mm tip. Two initial passes were made to preheat the treatment area in a circular gliding motion with an energy level of 112 J/cm^2. Two passes of pulsed application in stamping technique with an energy level of 87 J/cm^2 followed. Finally, two additional passes set at 112 J/cm^2 were done from inner to outer direction in gliding motion. The CO_2 laser (10,600 nm wavelength) was set on fractional mode using a preset smart protocol for wrinkles. The pulses were delivered through a 15 × 15 mm beam in array pattern with fluence of 45 mJ/dot, depth of 1 μm, and density level of 12.

Lateral canthal lines on each side of the face were graded using the Investigator's Global Assessment of Lateral Canthal Line severity scoring to evaluate the primary outcome measure. This validated 5-point grading system categorizes lateral canthal lines based on depth and length (0 = No visible wrinkles; 1 = Minimal wrinkles, within 1.5-cm radius of the lateral canthus [LC], may be minimally etched; 2 = Shallow wrinkles,

extending between 1.5- and 2.5-cm radius of LC, minimally etched; 3 = Moderately deep wrinkles, extending between 1.5- and 2.5-cm radius of LC, moderately etched; and 4 = Very long wrinkles, extending 2.5-cm radius of LC and may be deeply etched). The photographs were assessed for any difference in the appearance of skin texture and color homogeneity. Satisfaction for the treatment outcome for each side of the face were graded by the subjects using the FACE-QTM Satisfaction With Outcome questionnaire. Immediate and late adverse effects such as erythema, burning, itching, pain, hypo-/hyperpigmentation, scarring, infection, and others were assessed every session.

Results: A minimum of 10 subjects were enrolled in this pilot study as calculated using a formula that is based on confidence level with which one would like to detect a particular problem and on actual probability that it will manifest in a potential study participant. For this pilot study, 95% confidence level and 0.25 problem probability were used.

Ten subjects with minimal to severe bilateral lateral canthal lines were included in the study. One patient was considered a dropout after failing to follow up after the 4th session of treatment due to unknown reason. The results of treatments for the nine subjects were used for data analysis. The mean age of the subjects was 54.9 ranging between 42 and 64 years old.

The assessment for the FCL group showed improvement in wrinkle severity at rest with an average decrease of 0.4 (p-value 0.033). Both the median wrinkle severity at baseline and 1 month after the last treatment session were scored 2 (IQR: 1.0–3.0) that corresponds to moderate severity. The FCL plus MRF group also had improvement in wrinkle severity at rest with an average decrease of 0.4 (p-value 0.005). The median wrinkle severity at baseline was 1.5 (IQR: 1.0–2.0) corresponding to minimal to mild severity and a median wrinkle severity of 1 (IQR: 0.0–2.0) 1 month after the last treatment session that corresponds to minimal severity. Although both groups had statistically significant decrease in wrinkle severity, the difference in the average decrease between the treatment groups was not statistically significant (p-value 0.830).

The change in IGA-LCL severity scores of the treatment groups were also compared. In the FCL plus MRF group, 44.4% had one level decrease in the IGA-LCL severity score and 55.6% had no change. On the other hand, in the FCL group, 11.1% had two level decrease; 27.8% had one level decrease; 55.6% had no change; and 5.6% had one level increase in the IGA-LCL severity score. The change of IGA-LCL severity scores between the groups was not statistically significant (p-value 0.370).

Skin texture improved in 61.1% of the FCL plus MRF group and 44.4% in the FCL group. Improvements in skin color homogeneity were observed in 50% and 33.3% of the FCL plus MRF and FCL groups, respectively. The improvements in skin texture (p-value 0.322) and color homogeneity (p-value 0.316) were not statistically significant.

The FCL group had a mean satisfaction grade of 88.6 and a median grade of 87.0 (IQR: 79–100). On the other hand, the FCL plus MRF group had a mean satisfaction grade of 89.4 and a median grade of 87.0 (IQR: 79–100). The difference in patient satisfaction scores between the groups were not statistically significant (p-value 0.851).

For both groups, the most observed adverse event is pain (p-value 0.004) followed by erythema (p-value 0.042). There were reports of itching and pigmentation but none of the participants had scarring or infection. No other adverse events were also reported.

Conclusion: Although the synergistic effect of FCL and MRF treatments cannot be deduced in this study, it is safe to conclude that the combination treatment will at least result to improvement in the severity of lateral canthal lines as well as in skin color homogeneity and textural concerns similar to that of FCL monotherapy. Successive treatments with FCL and MRF with adequate time interval will likely not result to higher risk of adverse events. Despite these, performing two treatment modalities without an assurance of significantly better outcome compared to single treatment modality is not practical and cost-effective for patients and clinicians alike. Further studies that will include larger sample size and longer follow-up periods are needed to verify the results of this preliminary study.

SUBMISSION TITLE: A SERIES OF CASE STUDIES USING A NOVEL 6 NANOSECOND FRACTIONAL WITH BOTH DEEP AND HIGH COVERAGE APPROACH FOR TISSUE REJUVENATION

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Background: Thirty-four years female presenting with multiple scars after a traumatic bike accident that led to her receiving an asphalt burn to her face and displacement of her bottom teeth through her bottom lip. The patient was noted to have multiple dark brown hyperpigmented patches along her right cheek as well as a pink linear scar above her right upper lip and chin area.

Study Design/Materials and Method: The patient was subsequently treated with PDL laser to her hands, R cheek, upper and lower lip followed by 1064 nm picosecond laser to the affected areas.

Results: After a series of four treatments, the patient was noted to have dramatic improvement in

the appearance of her scars. No serious adverse effects were observed during the treatment or follow up period.

Conclusion: Pulsed dye laser, in combination with picosecond laser application appears to be safe and effective in improving scars after traumatic injury.

SUBMISSION TITLE: A SINGLE-CENTER STUDY ON NOVEL ULTRASOUND-BASED DELIVERY OF A PROPRIETARY PEPTIDE-BASED TOPICAL HAIR CARE FORMULA FOR DIFFUSE MALE AND FEMALE PATTERN ALOPECIA

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Background: Scalp dysesthesia is a cutaneous disorder characterized by abnormal sensations of the scalp including burning, itch, and tingling, often in the absence of skin pathology [1,2]. Attributable causes are primarily neurologic and psychiatric in nature [2,3]. Several treatments have been described, usually with suboptimal success. These include topical steroids, compounded amitriptyline/lidocaine/ketamine, oral antihistamines, analgesics, pregabalin, gabapentin, and muscle strengthening exercises [3,4]. A paucity of data exists utilizing light based therapy for this condition. We present two patients who experienced benefit from 308 nm excimer laser therapy. Patient A, a 51-year-old Caucasian female with depression and posttraumatic stress disorder presented with intense pruritus of the scalp in the absence of significant skin pathology. She tried ketoconazole shampoo, topical and oral corticosteroids, antihistamines, nonsteroidal anti-inflammatory drugs, and duloxetine before undergoing excimer laser therapy. Patient B, a 77-year-old white female with anxiety and fibromyalgia presented with intractable scalp itch without relief from oral antihistamines and montelukast, topical and intralesional corticosteroids, ketoconazole shampoo, azithromycin, and duloxetine before trialing excimer laser.

Study Design/Materials and Method: Patient A underwent two treatments with the excimer laser to the scalp at dose setting: 400 mJ/cm^2. Patient B underwent 59 treatments, at dose setting 1100 J/cm^2. Both patients reported improvement.

Results: Patient A reported 100% improvement in symptoms after two treatments separated by 3 weeks. Patient B reports ongoing improvement with treatments 2–3× weekly in conjunction with intralesional steroid injections q4-6w. Improvement was not seen for patient B with intralesional steroids alone. We hypothesize the excimer laser/light therapy has an effect on neurogenic inflammation. Further studies are needed to better elucidate how this therapy may work at a cellular level, optimal treatment settings in this condition, and the necessity for maintenance.

Conclusion: We hypothesize the excimer laser/light therapy has an effect on neurogenic inflammation. Further studies are needed to better elucidate how this therapy may work at a cellular level, optimal treatment settings in this condition, and the necessity for maintenance.

SUBMISSION TITLE: A SPLIT-FACED STUDY ON SAFETY AND EFFICACY OF A NOVEL ALEXANDRITE PICOSECOND LASER DEVICE WITH HIGHER AND ADJUSTABLE FLUENCES

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Background: Radiofrequency (RF) technology continues to experience a rapid expansion of uses for nonsurgical treatments. A recently enhanced, 10 mm hand-piece has been created to address periocular rhytids and wrinkles of the face. Commonly, patients may also desire improvement of other conditions, such as benign pigmented or vascular lesions. This study aims to assess a multi-device treatment for facial aging by targeting wrinkles and rhytids around the eyes, in addition to wrinkles, rhytids, and benign pigmented/vascular lesions around the face.

Study Design/Materials and Method: Thirty-five subjects were enrolled and treated under an IRB approved prospective study for the treatment of periocular rhytids and facial wrinkles as well as benign pigmented and vascular lesions of the face. Subjects were treated with an updated RF hand-piece each visit, and every other visit, they were additionally treated with an intense pulsed light (IPL) device immediately following the RF treatment. Subjects had up to five treatments with the RF hand-piece, and up to three treatments with the intense pulsed light (IPL) device. Subjects were treated for an average of 4 minutes and 26 seconds per zone, and the average set target temperature averaged at 42.5°C with the enhanced, 10 mm hand-piece. IPL treatments averaged a fluence of 32 J/cm^2 over 30 pulses. Subjects were re-examined at 30 and 90 days after the last treatment.

Results: Thirty-five subjects completed their 30 and 90-day follow ups after receiving a combination of RF and IPL treatments at 1–2-week intervals. Subjects found the treatments comfortable with an average pain score of 0.25/10 and 3.9/10 for the RF and IPL devices, respectively. No severe adverse effects were reported. 100% of subjects were satisfied with the treatment results at each follow up. At the 1 month follow up, 97% of subjects had improvement based on the Subject Global

Aesthetic Improvement Scale (SGAIS) and 97% of subjects had improvement according to the Physician Global Aesthetic Improvement Scale (PGAIS). Subjects experienced a statistically significant decrease in concern over skin elasticity, wrinkles and fine lines, and pigmentation around the eyes at both 1- and 3-month follow ups. A 1 month follow up questionnaire indicated that 97% of subjects reported revitalization of periocular skin as well as improvement in the appearance of red, uneven skin tone. 94% of subjects found the skin around their eyes to look younger, their wrinkles less noticeable, and that the brightness of their periocular skin had improved. Additionally, 91% of subjects agreed that the skin around their eyes both felt and looked tighter.

Conclusion: Use of a novel 10 mm RF hand-piece in combination with IPL treatments, when used consecutively, were shown to have high efficacy, in addition to being safe and well tolerable.

SUBMISSION TITLE: AN ATYPICAL CUTANEOUS MANIFESTATION OF ERDHEIM-CHESTER DISEASE SUCCESSFULLY TREATED USING MEDICAL AND LASER THERAPY

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Background: Laser treatments are increasingly being incorporated into the management of complex medical skin diseases and their sequelae, including rosacea, melasma, and connective tissue diseases. We report a rare cutaneous manifestation of Erdheim-Chester Disease (ECD) and demonstrate successful treatment with a multimodal approach of systemic treatment, topicals, and laser treatments.

Study Design/Materials and Method: This retrospective case report evaluated a 44-year-old female with Fitzpatrick skin type II who presented with 6-month history of erythematous papules that coalesced into pruritic tender plaques over the face, followed by the trunk and extremities. Four months later, she developed lower extremity pain and was noted to have polydipsia and polyuria. Her skin biopsies showed CD163 positive, BRAF V600E negative xanthogranulomatous histiocytosis. MRI showed pituitary microadenoma, and nuclear bone scan showed asymmetric bilateral lower extremity uptake. Overall, her presentation was consistent with ECD.

Cobimetinib 40 mg daily was initiated with resolution of her systemic symptoms and negative PET scans by 6 months. There was 70% improvement of her cutaneous findings, with flattening of the plaques but persistent brown postinflammatory hyperpigmentation. After 2 years on cobimetinib, she had systemic remission of disease, but developed medication side effects including cognitive changes, joint pain, diarrhea, and fatigue. Cobimetinib was discontinued, and she was transitioned to topical tacrolimus applied over areas with residual cutaneous involvement. For the persistent facial hyperpigmentation, triple bleaching cream (5% vitamin C, 12% hydroquinone, and 6% kojic acid) was initiated. For dermal component of facial dyspigmentation, telangiectasias, and more prominent rhytides and thinning that developed in setting of treatment side effects, her face was treated with one session of pulse dye laser followed by fractionated photothermolysis laser (Fraxel DUAL). The V-beam pulsed dye laser was used at 595 nm with a 7 mm spot at a fluence of 14 J/cm2 with 40 milliseconds pulse duration for the telangiectasias of the nose, and a 7 mm spot at a fluence of 9 J/cm^2 with 6 milliseconds pulse duration for the bilateral cheeks and chin. The thulium 1927 nm handpiece was used with treatment level 4, 10 J/cm^2 fluence, and 8 passes.

Results: To date, she has achieved 95% improvement of her facial skin lesions and is returning for additional treatment with Fraxel laser at 2-month intervals.

Conclusion: ECD is a rare non-Langerhans histocytosis with multiorgan involvement, including the skin. Our case highlights the importance of recognizing atypical cutaneous manifestations of ECD beyond the typical xanthelasma-like lesions for accurate diagnosis. For treatment, this case not only supports the effectiveness of cobimetinib for BRAF V600E negative ECD, but also demonstrates the importance of a multimodal approach with topicals and laser treatment to improve cosmetic sequelae and adverse effects of treatments.

SUBMISSION TITLE: ANALYSIS OF THE CLINICAL EFFICACY OF SUPRAMOLECULAR SALICYLIC ACID (SSA) 30% CHEMICAL PEELS COMBINED WITH ELECTRO-OPTICAL SYNERGY (ELOS) TECHNOLOGY IN THE TREATMENT OF ROSACEA IN CHINESE POPLULATION

Authors: Yan Lei

New Beauty Plastic Surgery Hospital

Background: To explore the clinical efficacy and safety of supramolecular salicylic acid (SSA) 30% chemical peels combined with electro-optical synergy (ELOS) technology in the treatment of rosacea in chinese poplulation.

Study Design/Materials and Method: A total of 96 patients were enrolled and randomly divided into SSA chemical peeling group or SSA combined ELOS group. All of them received the therapy for 10 weeks. The frequency of the single SSA treatment group was twice a month; the combination treatment group: ELOS was applied once a month, while SSA was twice a month, concomitant treatment was allowed for every

4 weeks. Patients were evaluated at baseline, the 2nd, 4th, 6th, 8th, and 10th weeks during the treatment process, and 1 month follow-up at the end of all the procedure. Treatment results were evaluated by the Investigator Global Assessment (IgA) and the Clinician Seryzhema Assessment (CEA), and adverse reactions were observed during each patient's visit. The Patients had finished the Rosacea Specific Quality of Life QuestionNaire (Rosaqol). SPSS 22.0 software were used for statistics.

Results: (1) The IGA treatment rate of the SSA combined ELOS treatment group is higher than the SSA treatment group, $p < 0.05$, which is statistically significant; (2) In terms of prolonged erythema, the CEA treatment rate of SSA combined with ELOS group is better than the single SSA treatment group, $p < 0.05$, with statistical differences; (3) The ROSAQOL scores of the two groups of patients have decreased significantly after treatment, there is no significant difference between the two groups, No obvious adverse reactions were observed during each patient's visit.

Conclusion: The combination treatment of Electro-optical synergy technology and SSA 30% chemical peels was an effective therapy for rosacea. The papules and pustules, prolonged erythema leisions are significantly improved. The limitation of the present study was that it was a retrospective analysis; more high-quality, prospective, blinded, controlled clinical trials are required to evaluate the efficacy based on the current study.

SUBMISSION TITLE: ASSESSMENT OF PUBLISHED ARTICLES OF SKIN OF COLOR IN LASERS IN SURGERY AND MEDICINE: 2017–2022

Authors: Daphne Eckembrecher; Francelia Eckembrecher; Isabella Camacho; Sofia Perez; Shrey Patel; Keyvan Nouri

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Background: Low-level light therapy (LLLT) has been used for the treatment of androgenetic alopecia (AGA). Multiple studies have been published assessing the efficacy and safety of LLLT for treatment of AGA with widely varying results. We aimed to perform an updated meta-analysis of published literature.

Study Design/Materials and Method: We searched PubMed for published literature comparing efficacy of LLLT in patients with AGA. Studies had to be in English language and had to use either no laser or sham laser as comparison. Mean difference (MD) and 95% confidence intervals (CI) were calculated. Statistical analysis was performed using RevMan software.

Results: A total of 14 studies with 1009 patients were included. Compared to no laser or sham laser therapy, use of LLLT was associated with significant increase in hair density (MD: 18.34, CI: 13.52–23.16, $p < 0.00001$). Heterogeneity analysis revealed significant heterogeneity between published studies ($p < 0.0001$).

Conclusion: Compared to no laser therapy, the use of LLLT is associated with significant improvement in hair density. Large randomized control trials are needed to confirm these findings.

SUBMISSION TITLE: CAN CRYOPHOTOTHERMOLYSIS® BE A NOVEL ALTERNATIVE TO SOLAR LENTIGO TREATMENT? - A RETROSPECTIVE STUDY OF 490 CASES

Authors: Jewan Kaiser Hwang

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Background: Selective photothermolysis introduced by Anderson and Parrish in 1983, has been recognized as the most important principle in the dermatologic laser industry for last 40 years. However, in the real world clinical practice, SPTL is not an absolute, but rather a relative theory. As the laser absorbed not only by target chromophore but also by nontarget chromophore which can cause unwanted tissue reaction. The cause of tissue reaction after laser treatment is basically an inflammatory response. To date, it is widely recognized that main component of the inflammatory response is locally distributed cells. However, in reality, damage to the capillary loops located in the papillary dermis, can result in the vascular hemorrhage, migration of inflammatory cells, also persistent and systemic inflammatory response by migrated cells. We assume these phenomena could be more important factors in inflammatory response after laser treatment.

Vasculature Salvage Laser Surgery® is a combination of technologies that apply the theories and concepts explained above. Reepot® is the first q-switched 532 nm laser to which VSLS® is applied. VSLS® system actively

controls nontarget chromophore through cryophototermolysis® and a lesion recognition algorithm named Autoderm® in the aid of augmented reality head-mount apparatus.

Study Design/Materials and Method: We performed a retrospective analysis of patients who visited Charm Skin Dermatology Clinic for solar lentigo treatment from Jul. 2022 to Nov. 2022. Patients received laser treatment with Reepot®. Clinical follow-ups with photography were made at 2 and 6 weeks. Additional follow-ups were made in necessary cases.

Results: A total of 490 patients identified. Complete clinical remission observed in all cases at follow-up. In cases of suspicious dermal melanophages, we performed additional treatment with q-switched lasers other than Reepot®.

Conclusion: With Reepot® system, we observed excellent clinical outcome with minimal downtime. We hope VSLS® technology can be applied to various other laser systems in the near future.

SUBMISSION TITLE: CLINICAL ASSESSMENT OF SKIN QUALITY AND DERMAL LINE IMPROVEMENT FOLLOWING PERIORAL BIPOLAR RADIOFREQUENCY MICRONEEDLING TREATMENTS

Authors: Nicole Vingan; Jasmine Panton; Jennifer Barillas; John Hoopman; Yucel Akgul; Abby Culver; Jeffrey Kenkel

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Background: Perioral rhytids and fine lines are hallmark features of the aging face and are a result of intrinsic and extrinsic photoaging pathways. Noninvasive, energy-based treatments offer a range of solutions for patients seeking improvement in the appearance of rhytids. One such energy-based treatment, transcutaneous radiofrequency (RF) microneedling, has been found to rejuvenate aging skin by stimulating dermal and subdermal collagen formation while minimizing energy transfer to the epidermis. The primary objective of this study is to evaluate the safety and efficacy of perioral RF microneedling treatments and quantify improvements in fine lines and rhytids.

Study Design/Materials and Method: The authors conducted an IRB-approved, single-center, nonrandomized prospective pilot study to assess the efficacy of perioral radiofrequency microneedling. Eligible patients underwent four treatments at 1-month intervals using the Morpheus8 (InMode) fractional radiofrequency microneedling device. Perioral skin was treated bilaterally at 0.5, 1, 2, 3, and 4 mm depths with 2 passes and 50% overlap. Radiofrequency energy levels were 20–30 kW, depending on the depth of treatment.

Our primary endpoint included clinical assessment of fine lines, wrinkle severity, and skin texture after treatment, assessed in-person and quantified using the Lemperle Wrinkle Assessment Scale, the Allergan Fine Line Scale, and the Subject and Clinician Global Aesthetic Improvement Scales (SGAIS and CGAIS). Additionally, noninvasive measurements objectively captured ultrastructural changes after radiofrequency treatment, and included measurements of epidermal and dermal thickness, elasticity, and trans-epidermal water loss.

Results: Thirteen patients enrolled in the study. Subjects were 100% female, and the mean age of the cohort was 61.4 ± 4.6 years. One patient withdrew before the first treatment. Ninety-two percent ($n = 12$) of the initial cohort underwent the first treatment in March 2022, after which four patients withdrew due to recovery downtime ($n = 2$), an unfavorable healing response ($n = 1$), and the treatment being not as expected ($n = 1$). Sixty-two percent ($n = 8$) of patients underwent the remaining three treatments and completed 3- and 6-month follow-up. No postinflammatory pigmentation, scarring, or dyschromia was observed, and no serious adverse events occurred.

Clinical assessment of perioral fine lines resulted in statistically significant improvements in bilateral upper ($p = 0.044$), corner of mouth ($p = 0.032$), and lower lip lines ($p = 0.052$) at 6-month follow-up. Fine lines continually trended downward over the study period, though these findings were not statistically significant at 6 months ($p = 0.21$). Allergan skin roughness assessments showed improvements in skin roughness at 3 months ($p = 0.052$) and 6-month ($p = 0.013$) follow-up. Noninvasive assessment of epidermal and dermal thickness showed statistically significant improvements in dermal density ($p = 0.031$). Measurements of elasticity showed favorable improvements in elasticity ($p = 0.004$), energy absorption ($p = 0.039$), and viscoelastic deformation ($p = 0.029$), and ultimate deformation ($p = 0.039$) in response to perioral radiofrequency treatment. Stratum corneum integrity, as measured through trans-epidermal water loss, also improved favorably at 6-month follow-up ($p = 0.080$). Subjectively, SGAIS scores were significantly improved at both 3- ($p = 0.01$) and 6-month ($p = 0.008$) follow-up. CGAIS

scores trended similarly and were also significantly improved at 3- ($p = 0.020$) and 6-month ($p = 0.005$) follow-up.

Conclusion: Despite a small cohort size, our results suggest that bipolar radiofrequency microneedling is subjectively and objectively effective for improving the appearance of perioral fine lines and rhytids and is tolerated well by patients with minimal adverse effects. These findings echo results in the literature which suggest that full clinical effects may take up to several months postprocedure to become appreciable. Thus, continued follow-up with subjects several months after treatment may continue to yield gradual improvements in skin texture, laxity, and fine line appearance.

SUBMISSION TITLE: COLLAGEN AND ELASTIN FIBERS REMODELLING IN HUMAN SKIN TISSUE AFTER RADIOFREQUENCY SYNCHRONIZED WITH FACIAL MUSCLE STIMULATION

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Background: The psychosocial impact of acne and the exacerbating effect of the resulting scarring has been well documented. Treatment of scarring can help to minimize the associated psychological distress but can be challenging in extensive cases, particularly those with significant atrophic scarring. Fractional ablative lasers, such as carbon dioxide (CO_2) and erbium:YAG, are effective in atrophic scarring by creating columns of microscopic thermal injury that initiate wound healing with dermal remodeling and collagen deposition. However, deeply depressed scars may not respond as well as typical acne scarring to these laser treatments alone. The addition of laser-assisted drug delivery (LADD) of poly-L-lactic acid (PLLA) can augment treatment through its action of fibroblast stimulation resulting in further neocollagenesis. Reported cases and studies of LADD of PLLA typically focus on facial scarring and cosmetic rejuvenation or small, focal scars elsewhere on the body. Although the total number of cases and sample sizes are small for scar treatment, improvement was noted in the vast majority of scars. Reviews of LADD of PLLA for all indications had no reports of nodule formation hypothesized to be due to higher dilution, more even distribution, and more superficial dermal depth of PLLA that causes less immune stimulation. We report a case of an 18-year-old male with a history of acne conglobata resulting in extensive atrophic scarring on the back from posterior neck to lumbosacral area and bilateral shoulders. Scars were originally of various sizes with a maximum diameter of 4 cm and depth of 1 cm. The patient underwent treatment with LADD of PLLA with CO_2 of all atrophic scars with some direct injection of PLLA in larger scars simultaneously with noticeable improvement of atrophy and no adverse effects. Patient has a planned second treatment at 6-month interval to be completed in January 2023. Treatment was completed under general anesthesia due to large body surface area treated. This case demonstrates that LADD with PLLA can be effective for extensive, deeply atrophic scarring on non-facial areas. In severe cases multiple treatments are likely needed to maximize improvement and meet treatment goals. Excellent photographs before and after treatments will be presented.

Study Design/Materials and Method: Study design: Case report

MATERIALS AND METHODS

Procedure was performed under general anesthesia due to large body surface area treated. Treatment was with fractionated carbon dioxide laser (UltraPulse® Encore laser, Lumenis, Inc.) with settings of DeepFX, 25 mJ, 400 H, and 5% density. Laser treatment was immediately followed by PLLA (Sculptra®, Galderma, 367.5 mg vial, 6 mL dilution) administered majorly through topical application in addition to a small volume used for deeper injection of the most severe atrophic scars.

Follow up (planned in January 2023) will repeat the treatment as above.

Results: Improvement with decreased atrophy and treated scars at 6-month follow up evaluation. No adverse events were noted. No nodule formation on exam.

Conclusion: Treatment of severe atrophic acne scars on the trunk with carbon dioxide laser assisted drug delivery of poly-L-lactic acid showed significant improvement for our patient. This treatment is promising as an effective option for severe atrophic scarring in nonfacial areas with low risk of adverse events.

SUBMISSION TITLE: COMBINATION THERAPY WITH PULSED DYE LASER AND PICOSECOND LASER TO TREAT TRAUMATIC SCARS

Authors: Jane Yoo
Mount Sinai School of Medicine

Background: Treatment of vascular lesions has been greatly improved with the addition of prelaser pulse dynamic spray cooling to protect the epidermis. The prelaser cooling improves outcomes but may still cause significant discomfort. This study was performed to observe whether 10–15 milliseconds of post spray cooling significantly reduced patient discomfort.

Study Design/Materials and Method: We treated 25 patients with cheek telangiectasias from photoaging or

rosacea with cooling settings of 10 milliseconds of precooling, 15 milliseconds delay and 15 milliseconds of postcooling (Derma V; Lutronic). Laser parameters were 10 milliseconds consisting of 9 submillisecond pulses and 5–7 J with a 532 nm beam. Patients graded their discomfort levels on a scale of 1 – 10 with 10 being the worst pain. These same patients were previous treated with a 590 nm laser with precooling of 20 and 20 milliseconds delay (V-beam Perfecta; Candela). Laser parameters were 10 milliseconds with an array of 8 submillisecond pulses, and fluence of 7–8 J.

Results: The median pain score for the precooling and postcooling device at 532 nm was 2 (range: 0–4). Median pain score was 5 (range: 3–7) for the precooling only 590 nm device. Clinical results were similar with both devices and were not rated for this pain assessment study.

Conclusion: The additional of a thermal quenching post pulse dynamic cooling spray significantly reduces patient discomfort when accompanied by prepulse dynamic cooling. Clinical results appear to be dependent on the fluence and pulse duration and not by additional cooling after the laser pulse.

SUBMISSION TITLE: COMPLICATIONS OF ENERGY-BASED DEVICES AND CHEMICAL PEELS PERFORMED BY COSMETIC SURGEONS: A RETROSPECTIVE ANALYSIS

Authors: Taryn Murray; Shelby Kubicki; Sean Boutros; Paul Friedman

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Background: Dermatologists have long been regarded as pioneers in the field of minimally invasive aesthetics, contributing significantly to advances in areas including laser surgery, chemical peeling, dermabrasion, soft tissue augmentation and botulinum toxin, among others. Recently, there has been a rise in physicians of different levels of experience and training offering minimally invasive cosmetic procedures. Even in the hands of capable and well-trained cosmetic and laser surgeons these procedures are not without risk. In this study we seek to identify complications of minimally and non-invasive cosmetic procedures referred to our center by cosmetic surgeons.

Study Design/Materials and Method: We performed a retrospective chart review (Nextech) of patients presenting for complications following minimally invasive and noninvasive cosmetic procedures performed by cosmetic surgeons between 2013 and 2023. Charts were reviewed for documentation of the procedure type, provider specialty, and type of complication. Patients were excluded if there was insufficient documentation of the aforementioned, or if there were not any photos of the complication in the medical record.

Results: Seventeen patients were identified as having complications of minimally or noninvasive cosmetic procedures performed by cosmetic surgeons. Patients were female ($n = 14$) and male ($n = 3$) with ages ranging from 8 months to 77 years old at time of presentation. Fitzpatrick skin types included FST II ($n = 4$), FST III ($n = 12$), and FST IV ($n = 1$) Devices causing the complications included CO_2 laser ($n = 5$), chemical peels ($n = 4$), long-pulsed Nd:YAG ($n = 3$), 595-nm pulsed dye laser ($n = 1$), intense pulsed light ($n = 1$), Q-switched laser ($n = 1$), radiofrequency ($n = 1$), and 1550-nm erbium-doped fiber laser ($n = 1$). In five cases, the minimally invasive procedure was performed concomitantly with an invasive surgical procedure including face lift with chemical peeling ($n = 2$), face lift with 1500 nm-erbium doped fiber laser ($n = 1$), face lift with CO_2 laser ($n = 1$) and lower blepharoplasty with CO_2 laser ($n = 1$). Complications included scarring (atrophic or hypertrophic) ($n = 14$), postinflammatory erythema ($n = 13$), postinflammatory hyperpigmentation ($n = 3$) and postinflammatory hypopigmentation ($n = 4$), with instances of multiple complications occurring within a given case. Specialty types included plastic surgeon ($n = 13$), facial plastic surgeon/otolaryngologist ($n = 3$) and oculoplastic surgeon ($n = 1$).

Conclusion: Intimate understanding of mechanism of action, tissue interaction and clinical endpoints is critical when performing minimally invasive cosmetic procedures to optimize outcomes and minimize complications. Appropriate parameter selection and adequate cooling are imperative, especially for devices lacking specific endpoints or in situations where patients are unable to provide real time feedback, such as with general anesthesia. Complications can arise even in experienced and well-trained hands, thus those offering advanced cosmetic procedures must be well-equipped to identify and rapidly manage or refer complications, should they arise. The management of these referred complications by our office will be discussed in a future publication.

SUBMISSION TITLE: DESIGNING TISSUE PHANTOMS FOR OPTICAL COHERENCE TOMOGRAPHY AND TWO-PHOTON EXCITED FLUORESCENCE IMAGING

Authors: Taliah Gorman; Zuzana Adams; Jennifer Barton

University of Arizona, Tucson, AZ; University of Arizona, Tucson, AZ; University of Arizona, Tucson, AZ

Background: The development of optical imaging systems requires initial testing and quality control, and

long-lasting tissue phantoms can help calibrate imaging systems for ongoing applications. Tissue phantoms mimic optical properties of human tissue, such as the absorption coefficient (μa), reduced scattering coefficient (μ's), and fluorescence excitation/emission spectra. Tissue phantom materials may vary depending on their functional need. For our purposes, we wish to produce a long-lasting and reproducible phantom with varying μ's from discrete scattering centers for optical coherence tomography (OCT) and subresolution fluorescence emitters with known excitation/emission properties for two-photon excited fluorescence (2PEF).

Study Design/Materials and Method: Polydimethylsiloxane (PDMS) was used as the base material for the phantoms and titanium dioxide (TiO_2) was used as the scattering agent. Fluorescent polystyrene microspheres with a dimeter of 0.2 μm were used as the fluorescence emitter with excitation at 540 nm and emission at 600 nm. The initial tissue phantom was created with a TiO_2 concentration of 0.75 mg/mL to produce a μ's of 1 mm^{-1} at 720 nm according to the literature. All of the materials were mixed together with the curing agent and poured into silicone molds for a slowing curing process. To measure μ's, the phantom material was also cured into a rectangular cuvette. The cuvette phantom was used in a double integrating sphere setup with a laser at 632.8 nm to measure the total reflectance and total transmittance values. Both valves were inputted into an inverse adding-doubling (IAD) code to calculate the μa and μ's of the phantom.

Results: We created tissue phantoms of various form factors with smooth surfaces, visibly even TiO_2 particle distribution, and no visible bubbles. Flat phantoms for microscopy, and cylindrical phantoms for side-firing miniature endoscopes were created, with inner diameters of 1.6–2.2 mm. Measured optical properties were $\mu a = 0.0348\ mm^{-1}$ and $\mu's = 0.3583\ mm^{-1}$.

Conclusion: Calculated and measured μ's values varied, likely due to light leakage from the rectangular cuvette. Future experiments will involve creating more complex, multilayered phantoms for OCT and 2PEF. These initial results suggest that PDMS-based tissue phantoms can be produced in a standard laboratory and customized to an optical imaging system's specific need.

SUBMISSION TITLE: DEVELOPMENT OF A MULTISPECTRAL SHORT WAVE INFRARED IMAGING DEVICE FOR CUTANEOUS WATER ASSESSMENT

Authors: Quinlan McGrath; Derek Bashe; Leo Shmuylovich

Washington University in Saint Louis, MO; Washington University in Saint Louis, MO; Washington University in Saint Louis Department of Dermatology, MO

Background: Skin diseases affects one in four Americans with an annual cost of $75 billion USD. Inflammatory skin diseases constitute a major subset, with an estimated 2%–20% of the worldwide population affected by a chronic condition (PMID: 28259441, 35755063). Visual inspection of disease-associated changes in skin morphology is the main clinical tool for inflammatory disease diagnosis and management (PMID: 19251582). Clinician experience and interobserver variability significantly limit the accuracy and reliability of visual inspection, particularly for mild to moderate cases. This can lead to misdiagnosis and underestimation of disease severity, prolonging patient suffering and morbidity. Additionally, the subjective nature of visual assessment makes standardized monitoring of chronic disease progression and response to treatment difficult. These challenges are exacerbated in nonwhite patients as erythema presents more subtly in pigmented skin, and this challenge leads to under treatment of patients of color (PMID: 30240779, 12410701). Thus, there exists an urgent clinical need for a technology that can objectively and quantitatively evaluate cutaneous inflammation across diverse skin tones.

While cutaneous inflammation is visually marked by tissue erythema, physiologically cutaneous inflammation consists of local changes in tissue fluid content (PMID: 16675964). Therefore measuring water content within the skin may offer a more direct physiological measure of inflammatory skin disease state assessing erythema (degree of redness).

The short wave near infrared (SWIR) spectrum (~900–1800 nm) is an emerging biological imaging window that is well suited for interrogating cutaneous water content. The chromophores that dominate the SWIR spectrum with respect to absorption are water, lipid, and protein, and in the visible spectrum these chromophores are effectively invisible. Importantly melanin absorption peaks in the visible and decreases exponentially with increasing wavelength. Thus SWIR imaging is predicted to be significantly less sensitive to melanin than visible imaging. It has been shown that SWIR hyperspectral imaging provides high contrast quantitative imaging of tissue water content in the setting of skin inflammation PMID: 32418362), but past work has relied on benchtop research device that could not be easily translated to clinical practice. Furthermore previous work in SWIR imaging has not explored the impact of skin pigmentation on imaging contrast.

Recent technological advances in InGaAs sensors, sensitive to infrared spectra beyond the 900–1000 nm limit of Silicon-based detectors, have made point-of-care SWIR imaging more feasible. We propose developing a filter-wheel-based multispectral SWIR imaging device that can be utilized in the clinical setting and support full body multispectral SWIR imaging. Our central hypothesis is that a multispectral SWIR imaging modality would provide higher contrast imaging of water content than visible imaging alone, even in setting of pigmentation.

Thus the major goals of this study were (a) build and characterize a novel multispectral clinic-ready SWIR imaging modality (b) validate the ability of the device to achieve high contrast imaging of water in the SWIR in the absence and presence of pigmentation.

Study Design/Materials and Method: A clinic-ready, short wave infrared multispectral imaging modality (SWIR-MSI) was built. The system incorporates an InGaAs camera (G-008 Cool TEC1; Allied Vision) and a 25 mm focal length SWIR lens (VisSwir Hyper Apo; Computar). Two collimated broadband (400–2200 nm) tungsten halogen lamps (QTH10; Thorlabs) with 35 W bulbs were positioned at equal distance beside the camera lens and controlled with relay switches. The beam was diverged using -75 and -100 mm plano-concave lenses to provide uniform and sufficiently large illumination (LC1315 and LC1093; Thorlabs). Surface glare was reduced by incorporating cross polarization with infrared linear glass polarizers (PS1000; Midopt). Imaging field of view (FOV) and spatial resolution were determined by imaging a resolution target (NBS 1963A; Thorlabs). Illumination power was measured with a power meter (S122C; Thorlabs).

A fast switching (25 milliseconds switching time) 6-position filter wheel was placed in front of the lens to permit rapid multispectral imaging (OptoSpin25; Cairn). Six 10–12 nm narrowband bandpass filters (FKBIR10; Thorlabs) ranging from 1100 to 1600 nm at 100 nm increments were placed in the filter wheel. All components were connected to a desktop Windows computer, and a custom MATLAB interface was written to automate control. An algorithm was developed to support wavelength-specific exposure time, so as to correct for differences in illumination intensity. Appropriate registration and flat field correction was applied to each image before analysis. The entire assembly was placed on a mobile cart to support clinical use.

A phantom was developed to compare the ability of the novel SWIR-MSI device to obtain high contrast images of water in the presence of skin pigmentation. A resin-based 3D printer (Elegoo Saturn S) with optically clear flexible resin (Monocure 3D Flex 100) was used to make a pigmented and non-pigmented control 1.5 mm thick tissue mimicking phantoms (PMID: 34429467). Phantom pigmentation was achieved by mixing the resin with India ink, which has absorption properties similar to melanin. Pigmentation of each phantom was determined by measuring the color with a Konica Minolta CM700d spectrophotometer and calculating Individual topography angle (ITA). A square clear glass container was half filled with water and the pigmented and unpigmented phantoms were positioned vertically next to each other on the container, so that part of each phantom covered both a region with and without water. The phantom was imaged three times at 0, −5, +5, and +10 mm from the center of the field, with the SWIR-MSI device at a distance of 0.5 m. Visible images were obtained with an iPhone 13 camera. For each phantom the contrast between the region with and without water was determined at each SWIR wavelength and from the visible image by calculating the Weber contrast value (ratio of the difference between higher and lower pixel intensity to the lower pixel). The ratio of Weber contrast obtained by SWIR imaging to Weber contrast obtained by visible imaging was calculated. The mean and standard deviation (STD) of the calculated contrast value at each wavelength and each imaging location was determined.

Results: Device parameters were obtained at working distances ranging from 0.2 to 0.5 m, which are convenient distances to use in the clinical setting. With the 25 mm focal lens, the FOV increased linearly from 5.2×6.5 cm at 0.2 m to 11.3×14.2 cm at 0.5 m. Spatial resolution decreased from 51 to 111 μm as distance increased from 0.2 to 0.5 m. The resolution and FOV remained constant regardless of which SWIR filter was used, indicating that the 25 mm Hyper Apo lens remained in focus across the entire measured SWIR spectrum. Maximum illumination power density decreased from 14.2 to 4.8 mW/cm^2, which falls well within permitted skin exposure limitations.

Mechanical switching between all filters was achieved in 125 milliseconds. However to achieve equal signal intensity with each optical filter, exposure time had to customized to each filter. Thus to ensure equal signal across all measured SWIR bands, exposure time varied from 244 to 507 milliseconds, for a total integration time of 2.2 seconds. Software-based camera control added an additional 6 seconds, totaling to an average of 8.35 seconds to obtain all the multispectral SWIR images. Integration time can be vastly reduced by optimizing camera control software and increasing illumination power.

The unpigmented control phantom had calculated ITA of 83.2° (consistent with "very light" skin tone), while the pigmented phantom had ITA of –63.2° (consistent with "very dark" skin tone).

As expected, water appeared transparent in the visible images. Contrast in both pigmented and control phantoms between regions with and without water was poor. The Weber contrast 0.155 for control and 0.0082 for pigmented).

SWIR images of both pigmented and unpigmented phantoms at every wavelength demonstrated high contrast between regions with and without water. Results will be reported for 1100, 1200, 1300, 1400, 1500, and 1600 nm herein. For the unpigmented control phantom Weber contrast at each wavelength was 1.08 ± 0.002, 4.45 ± 0.14, 7.44 ± 0.17, 3.17 ± 0.04, 2.80 ± 0.03, 2.44 ± 0.04, respectively. These values are between 6.98 and 48.00 times greater than the contrast measured from the visible images. For the pigmented phantom Weber contrast decreased relative to the control phantom, with 0.58 ± 0.01, 2.09 ± 0.07, 4.35 ± 0.13, 1.64 ± 0.01, 1.54 ± 0.03, 1.23 ± 0.03 at each wavelength, respectively. Though these values are lower than the control phantom,

when compared to the contrast measured from the pigmented phantom in the visible images, these values are 70.43 to 528.04 times greater. Thus while pigmentation is associated with some decrease in SWIR imaging contrast of water, the contrast in the SWIR remains high relative to visible imaging.

When the location of the phantom within the field of view was changed, contrast measures remained high and consistent. Compared to calculations made with one location, averaging regions of interest across all four locations resulted in Weber contrast values of 1.08 ± 0.02, 4.51 ± 0.38, 7.68 ± 0.78, 3.30 ± 0.30, 2.86 ± 0.25, 2.46 ± 0.21 for the unpigmented phantom, and 0.58 ± 0.04, 2.14 ± 0.29, 4.38 ± 0.68, 1.69 ± 0.22, 1.60 ± 0.21, 1.27 ± 0.15 for the pigmented phantom.

Conclusion: This work evaluated a novel imaging modality, motivated by the clinical need for a more objective and equitable method of inflammatory skin disease assessment. The imaging system is capable of wide field, high resolution, multispectral imaging at six SWIR spectral bands. Its portability, FOV, and automated software supports clinical translation. Future design directions include optimizing integration times to minimize image acquisition time and enabling full body imaging with a vertical scanning stage.

Skin pigmentation is known to make skin disease visualization more challenging by eye and with traditional light based devices. Melanin has lower absorption in the SWIR spectrum relative to the visible spectrum, but the impact of melanin in SWIR imaging has not been fully explored. Using a simple phantom that mimics the absorption properties of melanin, we found that the novel multispectral SWIR image device achieves high contrast between regions with and without water even in the presence of significant pigmentation. Thus our data suggests that SWIR imaging may provide a strategy to ensure that cutaneous imaging devices are equitable and meet the needs of all patients regardless of skin tone. Clinical translation will require additional human studies testing the ability of the multispectral SWIR imaging device to detect intradermal water in subjects across the full spectrum of skin pigmentation.

Successful clinical translation of this device could have profound impact on clinical management of inflammatory skin disease. In current practice inflammatory skin disease is most often qualitatively assessed by eye, and in some cases quantitative indexes such as the psoriasis area and severity index (PASI) are derived from clinical visual assessment. Visual assessment is subjective however, and even for validated indexes like PASI inter observer variability can be high particularly for patients with pigmented skin whose disease often appears more subtly due to lower contrast of red on pigmented skin vs red on non-pigmented skin. More subtle appearance of skin disease can lead to misdiagnosis or under-diagnosis in patients with pigmented skin, resulting in prolonged suffering from treatable conditions in patients who already face greater societal barriers to equitable medical care. The multispectral SWIR imaging device would instead provide a quantitative measure of skin disease severity in a relatively skin-pigmentation-independent fashion. Such a device would have broad applicability, including more accurate quantification of allergic contact dermatitis patch test results, accurate assessment of disease severity to help guide appropriate levels of therapeutic intervention, and quantification of changes in cutaneous inflammation during therapy to provide insight into the efficacy of a given therapy. Applications could extend to clinical trials of novel anti-inflammatory agents, where quantification of cutaneous inflammation could reveal actionable subclinical changes in disease state weeks or months before a clinical response is observed.

SUBMISSION TITLE: DIVERSITY IN CLINICAL TRIALS FOR INTENSE PULSE LIGHT LASER: 2013-2023

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Background: Port-wine stains are a congenital vascular malformation that affects 0.3% to 0.5% of newborns. It is a benign capillary malformation that commonly occurs on the head and neck. It is formed by progressive dilations of the postcapillary venules and as the patient ages it is associated with hypertrophy and nodularity which can lead to cosmetic disfigurement and psychological aggravation. There are many choices of treatment such as cryosurgery, cosmetic tattooing, dermabrasion, amongst others. The treatment of choice is PDL because it is both effective and safe to use. In darker skin types (Fitzpatrick skin types IV–VI), treatment is more difficult. Caution when treating darker skin types with PDL comes from the fact that there is an inverse correlation between vessel specificity of the PDL and skin pigmentation. The objective is to review the literature and discuss the manuscripts that describe the treatments of PWS with PDL in patients with Fitzpatrick skin type IV–VI.

Study Design/Materials and Method: Authors searched the PubMed Medline in the English language from database inception through December 2022 for eligible articles. The keywords searched included "PDL," "pulsed dye laser," "skin of color," "Fitzpatrick skin types IV–VI," "Fitzpatrick," "pigmented skin," "Port-wine stain," and "PWS." The articles that were included discussed PDL in the treatment of PWS in patients of skin of color. Any additional similar articles that were cited in our search were also included. Articles that were excluded did not discuss Fitzpatrick skin types IV–VI, darker skin type, or PDL. Data collected from each article included the number of participants, Fitzpatrick skin type, age, and laser parameters.

Results: There were 120 articles that were reviewed from our search and a total of 10 articles met inclusion criteria with 178 patients that were considered Fitzpatrick skin type IV–VI. The patients were of a wide range of ages from 1 month to 74 years old. In our review, patients that are treated at a younger age had better results than when treated at an older age. The results show that darker skin individuals have better results when treated at a younger age compared to adults, they can experience complete resolution. Adults that were treated saw a variation of results, from improvements in the appearance to hyperpigmentation/hypopigmentation or scarring of the treated area.

Conclusion: Patients that are Fitzpatrick skin type IV–VI are at higher risk of adverse events when treated with PDL for PWS when compared to patients of other skin types. Studies show that PDL can be beneficial for PWS in patients of skin of color, however, there are risks of hyperpigmentation, hypopigmentation, and scarring that are important to take into consideration when treating patients. Further research is warranted to improve the understanding of PDL for PWS in patients of skin of color.

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SUBMISSION TITLE: DUAL-LENGTH MICRONEEDLE RADIOFREQUENCY-INJECTOR SIMULTANEOUSLY TARGETING PAPILLARY AND RETICULAR DERMIS FOR REJUVENATION: A SPLIT-FACE DESIGNED IN VIVO ANALYSIS USING HUMAN SKIN

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Background: Acne is a common skin condition that commonly occurs in adolescence and is closely related to endocrinological factors. In adults, other forms of acne may occur due to hormonal and metabolic abnormalities, genetic disorders, and most commonly medications. One of the most common medications that induce acne is steroids. Steroid is a very commonly used medication either in topical or systemic forms and can reduce inflammation and suppress the immune system. This medication is often used to treat variety of conditions, including asthma, allergies, autoimmune disorders, and prevention of organ donor rejection.

Iatrogenic acne due to systemic steroid is characterized by a medical history of glucocorticoid intake, sudden onset, unusual age of onset, appearance on the face and neck, and an unusual location of the lesions beyond the seborrheic areas. Clinically it presents as monomorphous papulopustular eruption mainly on the face, trunk, and extremities. Comedones, if present, are secondary lesions, unlike regular acne.

Treatment of iatrogenic acne due to steroid is difficult and mostly require cessation of medication. The use of medication available for regular acne may also be limited, as patients with iatrogenic acne often have pre-existing medical conditions unsuitable for the administration of more medications. Microneedling Radiofrequency (MRF) is a minimally invasive device that utilizes fine needles to deliver radiofrequency energy into the skin. This device has been used in skin rejuvenation and acne scars and recently has also been used to treat active acne by denaturation of sebaceous glands and reduction of Cutibacterium acnes.

Study Design/Materials and Method: A 44-year-old male came with severe papulopustular eruptions on his face, mainly on his jaw 3 months before his coming to our clinic. The patient has a history of polycystic kidney disease requiring a kidney transplant 7 months ago. Since then, the patient was started with multiple immunosuppressive medications including tacrolimus and methylprednisolone to minimize the risk of organ rejection. The dermatology examination revealed

multiple erythematous papules and pustules on the facial area, with several comedones present.

The patient refused any systemic medication and was seeking an alternative approach. In this case, we selected the Microneedle Radiofrequency (MRF) to be done three sessions at 4-week intervals. Images were taken before therapy, during every treatment session, and 4 weeks after the last session.

Results: A significant decrease in the inflammatory lesions (erythematous papules and pustules) was visible. Acne grading score according to Plewig and Kligman decreased from the baseline 3 to 1. No severe adverse effects were present.

Conclusion: MRF is a safe and effective treatment for severe iatrogenic acne due to prolonged systemic steroid usage. We recommend the use of MRF to treat severe iatrogenic acne especially when regular medication is not an option.

SUBMISSION TITLE: EARLY DETECTION OF CUTANEOUS NEUROFIBROMAS USING SPATIAL FREQUENCY DOMAIN IMAGING (SFDI) WITH HISTOLOGICAL VERIFICATION

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Background: Cutaneous neurofibroma (cNF) impacts almost every patient with neurofibromatosis type I (NF1)—a genetic disorder that occurs in ~1:3000 individuals. Tumors appear on skin at puberty and increase in size and number throughout the patient's life. Despite being benign, cNF associated psychological distress and physical discomfort deteriorate NF1 patient's quality of life (QOL). Currently, cNF management consists of monitoring smaller lesions and surgical excision of large-sized tumors. Significant morbidity including postsurgical scarring is associated with existing treatments. Unless therapy is administered before tumors become disfiguring, existing treatments provide a small improvement in patients' QOL. Instead of allowing cNF to develop into large lesions, if treatment is administered at the earliest possible time, social stigmatization and suffering could be minimized. Our objective is to detect and subsequently treat cNF very early before they become visible to maintain patients' QOL. We reported that Spatial Frequency Domain Imaging (SFDI) can be employed to identify suspect nascent cNFs before lesions are clinically apparent. A key indicator in the process of identifying these is that the magnitude of the wavelength-dependent reduced scattering coefficient in regions containing nascent cNF is substantially lower than surrounding tissue, even these regions appear normal to the unaided eye. Histological analysis has been performed to verify SFDI findings.

Study Design/Materials and Method: We imaged chest, back and arms of seven NF1 subjects using a commercial SFDI device and optical coherence tomography (OCT). SFDI projects a patterned illumination at eight wavelengths and five spatial frequencies. SFDI provides large field-of-view maps (15 cm × 18 cm) of calibrated reflectance at 40 combinations of wavelength/spatial frequency. In combination with an appropriate model of light propagation, spatially resolved optical properties can be deduced over the entire region of interest. Suspect nascent cNFs are identified as small regions of lower optical scattering compared to surrounding uninvolved skin areas. High-resolution, three-dimensional OCT structural and angiographic images of suspect nascent cNFs were recorded to explore microstructure and microvasculature variations. Three biopsies (visible cNF, suspect nascent cNF and uninvolved skin) were taken from each of three subjects and histological analysis performed.

Results: Suspect nascent cNFs, previously not apparent to the unaided eye, were identified in patients as young as 10 years old. Up to seven suspect nascent cNFs were found in a $15 \times 18\ cm^2$ skin area in addition to 11 visible cNFs observed in the same area on an adult patient. Combinations of wavelength and spatial frequency were identified that give enhanced contrast between suspect nascent cNF and the surrounding uninvolved skin. A conical-shaped, low-scattering region and other abnormal structures were observed in OCT images of nascent cNFs. Hematoxylin and eosin staining confirmed the presence of cNF in biopsies with suspect nascent cNFs identified with SFDI.

Conclusion: Our results suggest that optical scattering can be used as a cNF biomarker for noninvasive detection and monitoring. The ability of SFDI was demonstrated to identify nascent cNF and the use of OCT to image micro-structural features of cNF. Development of low morbidity treatment approaches based on early detection of cNF with SFDI could improve cNF patient QOL.

SUBMISSION TITLE: EFFECT OF INVASIVE FRACTIONAL MICRONEEDLE RADIOFREQUENCY IN THE TREATMENT MELASMA

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Background: To investigate the efficacy and safety of Invasive Fractional Microneedle Radiofrequency for melasma.

Study Design/Materials and Method: A total of 124 patients diagnosed with melasma from 2018 to 2022 were selected and received a single treatment with Invasive Fractional Microneedle Radiofrequency. The modified Melasma Area and Severity Index (mMASI) and the Physician Global Assessment (PGA) and Patient Satisfaction were used to evaluate the treatment efficacy before treatment, 1, 3 and 6 months after treatment, respectively, and the adverse reactions were observed and recorded.

Results: Compared with the baseline, the mMASI score was significantly decreased after treatment ($p < 0.05$), and was continuously declined at 3 months after treatment compared with 1 month after treatment ($p < 0.05$). The number of patients whose PGA score showed moderate improvement after treatment was more than 65%, and the patient satisfaction score showed that 68.55% of patients were satisfied and 16.13% of patients were very satisfied. Adverse effects were not observed in any patient during RF treatment, and all patients noted momentary pain which did not persist and did not discourage them from choosing the next treatment

Conclusion: For patients with melasma of type Fitzpatrick III to V, Invasive Fractional Microneedle Radiofrequency has good clinical effect and high safety.

SUBMISSION TITLE: EFFICACY AND DOSING OF MICROCHANNEL DELIVERY OF BOTULINUM TOXIN IN THE TREATMENT OF PERIOCULAR RHYTIDES AND WRINKLES

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Background: Acne scarring, a common sequalae of acne, results from the disruption of collagen fibers and subcutaneous fat during the inflammatory phase of acne vulgaris healing [1]. The result is either excess or decreased collagen deposition, that corresponds to hypertrophic/keloid or atrophic acne scars, respectively [2, 3]. Given its detrimental impact on quality of life, early and effective treatment is essential to maximize cosmetic outcomes. Treatment options for acne scarring include including retinoids, microdermabrasion, dermal fillers, and surgical techniques such as subcision [4]. Lasers and other energy-based devices such as radiofrequency have gained traction as a noninvasive option to treat acne scarring. Yet, a clear consensus on the ideal laser and laser setting selection is lacking in the literature.

The aim of this updated review is to describe the therapeutic potential of lasers for acne scarring with focus on atrophic facial acne scars. We describe a sample cohort of lasers used for acne scarring at an academic institution (Mayo Clinic). We then synthesize these results with an overview of the latest clinical trials in laser treatments for acne scars available in the literature.

Study Design/Materials and Method: Retrospective review was conducted to identify patients with acne scarring between January 1996 and December 2017 who received laser resurfacing. Patient demographics and procedural details were recorded. A subsequent literature search was conducted in PubMed using a variety of related keywords with attention to clinical trials completed in the last 5 years; results were summarized in narrative format.

Results: We describe the results from 27 laser treatments performed at the Mayo Clinic, Rochester, MN between 1996 and 2017. This is a limited and sample cohort. Nd:YAG 1064 nm laser ($n = 13$) was utilized with the following mean settings: energy of 500 mJ (range: 300–500 mJ), 1.5 passes (range: 1–3 passes) and frequency of 8.7 Hz (range: 8–10 Hz). Fraxel (erbium glass) ($n = 9$) was also utilized with the following mean settings: energy of 50 mJ (range: 45–60 mJ), 6.1 passes (range: 2–8 passes), area of 199 cm^2 (range: 113–285 cm^2) and energy of 3.14 kJ (range: 2.41–3.87 kJ). Median treatment level was 8 (range: 6–8). Carbon dioxide (CO_2) laser resurfacing with dermabrasion ($n = 2$) used energy of 275 mJ, power of 5 W, 2.5 passes (range: 2–3 passes) and density of 5 J/cm^3. CO_2 laser alone ($n = 2$) utilized mean settings were an energy of 287.5 mJ (range: 275–300), power of 60 W, 4 passes (range: 3–5 passes) and density of 5 J/cm^3. V-Beam laser ($n = 1$) used spot size of 7 mm, wavelength 595 nm, fluence 7 J/cm^2, pulse duration 10 milliseconds, and 20 pulses total. This sample represents the ablative and nonablative lasers that are often utilized in an academic cosmetic practice. Literature review found that ablative lasers offer the most significant improvement in acne scars [1], although they carry a higher risk of postprocedure hyperpigmentation than nonablative lasers [5]. Another study found that nonablative lasers were effective in reducing acne scars in addition to reduction in postinflammatory erythema and should be considered in patients who present with this combination [6]. Overall, laser selection is a patient-centered

process that requires attention to the type of scarring present, the patient's goals, and the advantages and disadvantages unique to each laser.

Conclusion: Herein we provide an overview on laser selection and settings for a collection of laser types used to treat atopic acne scarring at an academic institution (e.g., Nd:YAG 1064 nm laser, Fraxel [erbium glass] laser, CO_2 laser, and V Beam pulsed dye laser). We additionally present an overview of the latest clinical trials in laser treatment for acne scarring within the past 5 years and current guidelines on energy-based devices to treat atrophic acne scars.

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SUBMISSION TITLE: EFFICACY AND SAFETY OF ELECTRICAL MULTI-DIRECTIONAL STIMULATION FOR ABDOMINAL CONTOURING IN ASIANS WITH NORMAL BODY MASS INDEX

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Background: Body contouring via electrical multi-directional stimulation (EMDS) is a relatively novel technique. Studies evaluating its therapeutic outcome in Asians with normal BMI are currently limited.

Study Design/Materials and Method: This study aimed to evaluate the efficacy and safety of EMDS for the improvement of the abdominal contour of Asians with normal BMI. Twelve participants with normal BMI received a series of six EMDS treatments. Follow-up assessments were scheduled 1, 2, and 3 months after the final treatment. Measurements of body weight, height, abdominal circumference (AC) and skinfold thickness were recorded at baseline and during all follow-up visits. Patient tolerability to treatment and adverse events were also recorded.

Results: A significant reduction in the mean AC of 1.9% (1.4 cm) compared to baseline was noted ($p = 0.024$) at 1 month after the final treatment. Maximal skinfold thickness reduction of 4.5 mm (13.7%) was achieved 1 month after the final treatment ($p = 0.004$). Five out of 12 participants (41.7%) experienced 2–3 hours of dysesthesia after EMDS treatment. No other serious side effects were reported.

Conclusion: EMDS treatment is well-tolerated and demonstrated significant reduction in AC and skinfold thickness in Asian patients with normal BMI causing only minimal and transient adverse effects.

SUBMISSION TITLE: EFFICACY AND SAFETY OF PICOSECOND ALEXANDRITE LASER AND EXOSOMES IN TREATING MELASMA AMONG ASIAN PATIENTS- A PILOT STUDY

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Background: Melasma is a prevalent disorder of acquired focal symmetric facial hyperpigmentation. The disorder is chronic, and its etiological basis is not known. The prevalence of melasma varies between 1.5% and 33.3% depending on the population. Epidemiological studies have reported higher prevalence among more pigmented phenotypes, such as Southeast Asians, Middle East Asians, Hispanic Americans, and Mediterranean-Africans. Treatments for melasma can be broadly classified into topical preparations, laser, or

other therapies. Outcomes are variable and may be associated with side effects such as irritation, inflammation, and scarring. Laser and light therapies represent potentially promising options for patients especially those who are refractory to other modalities. Q-switched alexandrite laser emits a wavelength which penetrates deep enough to treat dermal pigmentation. Results for Fitzpatrick skin types I–III patients with melasma refractory to topical treatments were satisfactory but for Asian skin with Fitzpatrick skin types IV–V, postinflammatory hyperpigmentation remained to be the most common side effect. Exosomes are emerging bioactive substances in multiple biochemical and cellular processes of skin. Exosomes are able to affect angiogenesis, cell proliferation and differentiation, apoptosis, and inflammation, hence have gained interest and application in skin regeneration and healing. Several articles describe exosomes as anti-inflammatory and in some, regulate melanocytes with potential to address melasma.

Study Design/Materials and Method: This is an open label, multicenter, single-blind cohort study. Twenty female patients with mean age 38.2, skin type IV with no history of topical or laser treatments in the last 3 months for melasma were included in this study. Informed consent forms and pretreatment photos were taken at the onset of the study. All the patients underwent four sessions of picosecond alexandrite laser followed by application of 5cc of exosomes delivered through nappage method using turtle pins at 4 weeks interval. Sunscreen was prescribed to all participants. Melanin Index (MI) and Erythema Index (EI) reading using Mexameter and MASI scoring were performed, immediately before each session and 1 month after the last treatment. Clinical photos were also taken during each visit.

Subjective global assessment by the patients and blinded assessors were conducted during the last follow up. A six-point scale was used.

Safety analysis was done by recording all side effects, adverse events, and complications.

Results: Twenty patients completed the study. There were statistically significant reductions in both MI (57.89%) and EI (43.75%) after the last treatment. Significant reduction was first observed after the third session of the combined procedure. After the first session, a nonsignificant increase of the erythema index (10.5%) was observed.

Significant decrease in MASI (36.8%) was recorded after the last treatment. There was no significant difference between the Patient's and clinical assessor's Global assessment scores. 70% of the patients and 75% of the independent assessors rated the final outcome with marked and excellent improvements.

Side effects recorded were erythema, mild swelling, bronzing, burning sensation and scaling. All of which, resolved within 48–120 hours.

Conclusion: Picosecond alexandrite laser and topical exosomes is an effective and relatively safe combination in treating melasma among Asian patients. The two procedures, combined, may be a useful alternative treatment option for melasma when topical bleaching is ineffective or not tolerated. The result of this study however needs to be interpreted in the light of the presence of risk of bias due to lack of randomization and double blinding. Further studies is suggested with more subjects and long term follow ups and monitoring.

SUBMISSION TITLE: EFFICACY OF LOW-LEVEL LIGHT THERAPY FOR TREATMENT OF ANDROGENETIC ALOPECIA: A META-ANALYSIS

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Background: Fractional technology has been a main component in the aesthetic/medical market since its development. Systems have been designed for multiple indications in the millisecond, microsecond, and picosecond domains. This study is to evaluate the safety and efficacy of a novel 6 nanoseconds system with a deep penetrating fractional optic and a high coverage optic. Being as nanosecond falls between picosecond and millisecond, both photo thermal and photo acoustic effects of laser light are able to be utilized. This system is the first of its kind, so several conditions were targeted in an exploratory fashion.

Study Design/Materials and Method: Five patients from two centers were treated in using the 6 nanoseconds based fractional approach for skin rejuvenation. All of which occurred in a single treatment session.

Patients had 1- and 3-month follow-up photography taken for monitoring.

Results: Patients saw improvement in tone and texture, clearance of unwanted pigment, and reduction in fine lines. Reduction in rosacea/diffuse redness was noted. When reviewed by two expert physician graders, the before and after images averaged a score of "much improved" on the Global Aesthetic Improvement Scale. Both graders were also able to correctly identify the pre- versus post treatment imagery 100% of the time. Patient and physician satisfaction was 100% "satisfied" or higher.

Conclusion: The 6 nanoseconds fractional approach with both deep and high coverage delivery is a safe and effective method for skin rejuvenation.

SUBMISSION TITLE: FACIAL REMODELING BY MUSCLE QUALITY IMPROVEMENT: SIMULTANEOUS USE OF NOVEL NON-INVASIVE FACIAL MUSCLE STIMULATION TECHNOLOGY AND SYNCHRONIZED RADIOFREQUEN

Authors: Yael Halaas

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Background: Photodynamic therapy (PDT) is a well-known technique that couples a photosensitizing agent with light energy to destroy target cells following light activation. It is useful in the treatment of various benign, premalignant, as well as malignant cutaneous lesions. We report a case of a robust phototoxicity after blue light PDT that we hypothesize was a result of an occlusive effect of a surgical mask worn during incubation of the photosensitizing drug on the facial skin surface.

Study Design/Materials and Method: A 41-year-old Fitzpatrick skin type II male who last underwent facial red light PDT 2 years ago presented for a blue light photorejuvenation PDT treatment. He was pretreated with topical 20% 5-aminolevulanic acid in alcohol solution applied to the forehead, temples, nose, cheeks mandible, and chin. During a 1-hour incubation period in the clinic waiting area, the patient wore a surgical mask, as the treatment took place during the COVID-19 pandemic. At the conclusion of the incubation period, the patient's face was treated with blue light photodynamic therapy at a fluence of 10 J/cm^2 and a total treatment time of 16 minutes and 40 seconds utilizing a 400 nm light source. Following the treatment, a topical sunscreen was applied and the patient was discharged from clinic in an expected degree of pain and discomfort from the procedure.

Results: The patient developed a robust clinical response to the treatment beginning several hours after the treatment, with worsening erythema and edema affecting the entire treatment area. Pain was reported as 8/10 in severity. At 3 days posttreatment, deeper red erythematous patches were visible in a sharply demarcated distribution consistent with areas covered by a mesh surgical mask that had been worn during the 1-hour incubation before PDT. The most significantly affected areas included the zygomas and medial cheeks. The erythema was most pronounced at areas occluded by the edge of the mask, best illustrated by the findings that were photographed on the left zygoma. The treated skin later desquamated and eventually healed without residual erythema.

Conclusion: Surgical mask wear during 5-aminolevulanic acid incubation may increase absorption in the skin covered by the mask by way of an occlusive effect, especially where edges of the mask contact bony prominences of the face. Increased heat and moisture under the mask may also assist in photosensitizer absorption as well. This may translate to a more robust clinical response and increase the risk of phototoxicity, as observed in the presented patient. Treating providers should be aware of this possibility when selecting treatment parameters to best predict the likelihood of adverse effects of treatment, the expected clinical results, and to optimize the overall patient experience.

SUBMISSION TITLE: FACIAL SKIN REJUVENATION BY POLY-D,L-LACTIC ACID INJECTED WITH NEEDLELESS INJECTOR USING LASER-GENERATED MICROJETS

Authors: SUK BAE SEO; Wooseok Koh

The association of Koran Dermatologists; The associiation of Korean Dermatologists

Background: A laser-induced needle-free microjet injector has been developed for rapid drug delivery. This device can deliver microliter amounts of drugs into the skin with high speed and fast repetition rates. The present study aimed to evaluate the clinical rejuvenation effect of highly repeated dermal injection of the collagen simulator poly-**D**,L-lactic acid (PDLLA) using this device.

Study Design/Materials and Method: This retrospective analysis was based on clinical photographs, three-dimensional (3D) images, medical records, and routine questionnaires of patients who underwent routine treatment from July to December 2022. Two independent dermatologist investigators evaluated the global aesthetic improvement based on a 5-point scale. Subjective global improvement data were collected from a routine 5-point scale questionnaire. Redness, smoothness, brightening, pore reduction, and landmarks vector change were evaluated based on the clinical photograph and 3D image analysis. The routine treatment protocol was five consecutive treatment sessions at 3–4 weeks intervals, using PDLLA as the injected material. PDLLA has an average size of 30 μm with a round foam structure, and it was injected into the patient's entire face, including above the hairline.

Results: Clinical results of 20 female patients in their 40s or older were evaluated. In the subjective evaluation, most patients showed increased moisturization, brightening, and elasticity. In the investigators' evaluation data, moderate to marked improvements were observed in most patients in redness, smoothness, brightening, and pore reduction. In monitoring vector change with 3D imaging, more than 1.5 mm movements of the skin surface were observed in most patients. There were no significant side effects observed after the procedure.

Conclusion: The results of this study demonstrate that the highly repeated dermal injection of PDLLA using the novel laser-induced microjet injector is an effective and safe modality for skin rejuvenation. Despite small amounts of material being injected in each session, the treatment resulted in significant improvements in moisturization, brightening, elasticity, redness, smoothness, and pore reduction, as well as noticeable skin surface movements in most patients. Patient satisfaction and safety were also confirmed. Overall, these findings suggest that PDLA injected evenly into the dermis using the present novel injector device offers an excellent approach to achieving skin rejuvenation with high efficacy, patient satisfaction, and safety.

SUBMISSION TITLE: FRACTIONAL CO2 LASER FOR THE TREATMENT OF PORT WINE STAIN BIRTHMARKS WITH HYPERTROPHY: A CASE REPORT

Authors: Tingwei Zhang; Yin Li

Emory University, Nell Hodgson Woodruff School of Nursing; Emory University

Background: Atrophic acne scars cause great problems to patients both physically and psychologically. At present, there are many treatment options for atrophic acne scars. However, due to the obvious pain and recovery period, it has become the primary reason to stop patients from continuing treatment. In this study, the intense pulse light is set to long pulse width around 30–60 milliseconds to avoid the absorption of target organs of the skin, the light energy is converted into heat energy to treat atrophic acne scars. The treatment has no recovery period. The safety and effectiveness of long pulse width IPL was studied in this paper.

Study Design/Materials and Method: This study included 30 patients with atrophic acne scars. All patients received comprehensive intense pulsed light treatment, but were randomly selected to receive additional long pulse width intense pulsed light treatment on one side of the face. They received three treatments, with an interval of 4 weeks. They were followed up for 3 months using visia system and photography. At the same time, a questionnaire survey rating dermatology quality of life index for posttreatment of redness, pigmentation, pain score, dryness and scab was completed.

Results: Long pulse width intense pulse light improved the texture of 92% of patients, improved the scar appearance of 87% of patients, initial improvement in the acne scar were noted after one to two treatment in 65%, and 30% of patients felt improvement after three times treatment.

Among the patients who completed the treatment of atrophic acne scars with long pulse width intense pulse light, 68% of the patients obtained "significant benefits" from laser treatment, and 15% of the patients thought the benefits were only moderate. No patient thinks that laser therapy is not beneficial.

Conclusion: Long pulse width intense pulse light treatment is safe and effective treatment for atrophic acne scar, The appearance of the scar and texture on the side treated were significantly improved. There is no hyperpigmentation and most importantly no recovery period, which provides a new option for the treatment of acne scars.

SUBMISSION TITLE: HOW I DO IT —PDL & CO_2 SCAR TREATMENT EXPERIENCE FROM THE PEDIATRIC BURN CENTRE

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Background: In Children's Hospital Zagreb we provide PDL and CO2 fractional ablative laser treatments for children between 1 and 18 years of age for all types of scars: postburn hypertrophic scar tissue, postoperative scars, acne scars, posttraumatic scars. Clinical results and patients & parents satisfaction is very good.

Study Design/Materials and Method: Scars in children have a profound psychosocial impact and require early and aggressive treatment. In this age group in particular, however, attention must be placed on the methodology so as not to trigger additional trauma—whether physical or emotional—as a sequel to the treatment. We assess the safety and efficacy of the common PDL and fractional CO_2 treatment in a prospective study of pediatric scars from various etiologies. Twenty-four children, aged 2–16 years, with postburn hypertrophic scar tissue and hypertrophic postoperative scars following plastic surgery of giant pigmented naevi, defects of the skin and soft tissues after extensive excisions and trauma underwent common PDL and fractional CO_2 laser resurfacing. Recovery, clinical response, and adverse events were monitored at 1 and 2 months after the common treatment. Photographs were taken before treatment and 2 months after the treatment independently evaluated and scored by two experienced pediatric plastic surgeons.

Results: All patients tolerated treatment well, with minimal erythema and edema. The clinical improvement was scored as excellent in 14 patients (58%), good in seven (29%), and fair in three (13%). No cases were graded as poor or worse. No adverse events were noted.

Conclusion: The study supports the common use of PDL and fractional CO_2 resurfacing of pediatric scars as well-tolerated and effective. Given the particularly rapid healing and clinical improvement of pediatric skin,

common PDL and fractional CO_2 treatment should be offered early to mitigate both the physical and psychosocial stigmata of scars as early as possible.

SUBMISSION TITLE: HYBRID LASER FOR FACIAL REJUVENATION

Authors: ARISTIDES ARELLANO
NO AFFILIATIONS

Background: The hybrid laser for rejuvenation consists of the combination of two CO_2 wavelengths of 16,000 nm and Erbium of 1570 nm. Indicated for the treatment of fine wrinkles, acne scars, postsurgical scars, stretch marks, facial rejuvenation, and hyperpigmentation. Its technology allows choosing between different combinations of shape, size, and density of the light beam for optimal treatment, as well as the proportion of CO_2 laser and Erbium Glass, which is chosen depending on the pathology to be treated.

It has an intense cooling system that numbs the skin, protecting the tissue, increasing patient comfort during treatment.

The Pro scan handpiece allows us to perform an intelligent ablative treatment with the CO_2 laser (10,600 nm) and cold coagulation with the Erbium Laser (1570 nm) with the HyGrid scanning pattern.

It is safe not to give different precise and versatile combinations of both wavelengths, with and without overlap.

The HyGrid mode allows us to use both lasers in various percentages, for example, CO_2 and Erbium at 50% each, CO_2 66% and 33% Erbium or 33% CO_2 and 66% Erbium. It is a highly effective treatment in just one or two sessions, both wavelengths maintain their original effect next to each other.

Study Design/Materials and Method: It is also possible to use both laser sources (CO_2 and Erbium) at the same application point with hands-free application.

After laser administration, a solution of hyaluronic acid, vitamin C, and so forth, can be applied to the laser-treated area. Any of these medication options is introduced with this device called Impact, which is a Transdermal Ultrasound that helps the cosmeceutical penetrate directly into the tissue. This system improves the result and reduces itching and pain by stimulating the cells that have been damaged. These treatments are usually developed every 7, 15, 21, or 30 days depending on the patient's need.

It requires a short downtime ("over the weekend") because it allows a low density of each wavelength.

It is done on an outpatient basis. Local anesthetic cream is used to minimize the sensation of heat for about 45 minutes. The patient will present inflammation, redness, and peeling during the following days (5–8 days) and may persist for longer

Results: The following points were especially clarified:

- This treatment is contraindicated for patients with any concurrent cancer or a history of skin cancer, active infection, or bacterial disease.
- A bacterial, viral, or fungal infection can occur. The most common infection is an outbreak of the herpes virus. In most cases, the herpes virus is present on the skin, but lies dormant.
- Weeks after treatment, treated skin may become darker (hyperpigmentation) or lighter (hypopigmentation) than it was before treatment. Permanent skin color changes are more common in people with darker skin.
- Treated skin may itch, swell, and become red. The redness can be intense and can last for several months. Aggravation of an existing skin condition, such as rosacea, can contribute to redness.
- The patient with acne-prone oily skin may present acne breakout activation or millium.

Conclusion: Improvement of wrinkles and soft tissue depressions can be achieved by other treatments, including, but not limited to, treatments such as chemical peels, dermabrasion or other skin procedures, alternative types of fillers for tissues or surgery, such as a face or forehead lift where indicated.

Although cosmetic laser treatments are effective in most cases, there is a risk that it may not be effective in your case or that the result may not be what the patient expected. Not achieving the expected result or suffering adverse effects can have a physical and psychological impact.

SUBMISSION TITLE: INTRAORAL LASER HAIR REMOVAL ON SKIN GRAFT UTILIZING A Q SWITCHED 755 NM ALEXANDRITE LASER

Authors: Timothy Holland; Rudy Schmiedecke
United States Air Force, Naval Medical Center, San Diego, CA; Defense Health Agency, Fall Church, VA; Bureau of Naval Medicine, Defense Health Agency

Background: Ultrasound waves of high intensity can induce thermal injury in the dermis, while the subsequent inflammatory cascade can help to stimulate new production of elastin and collagen fibers. Clinically, this can translate to skin tightening and lifting of lax skin. More recently, a newer ultrasound device has been developed to simultaneously deliver large volumes of thermal energy using seven synchronous parallel ultrasound transducers. This has already been demonstrated to offer clinical improvements on the face. This study evaluates the utility of this treatment for improving skin laxity on the body that is associated with cellulite.

Study Design/Materials and Method: A prospective, multicenter, clinical study investigated the utility of a novel high-intensity, high-frequency, parallel ultrasound

beam device (Sofwave) for improving skin laxity on the body associated with cellulite. Women with mild to moderate cellulite were treated with two sessions on the thigh and buttock area. Two independent and blinded reviewers identified randomly arranged 3-month post-treatment photographs and evaluated skin laxity severity using a 4-point laxity scale (LS). Anticipated tissue responses and safety were recorded. Subjects ranked their discomfort during treatments using Likert scale (0: No pain; 10: Worst possible pain).

Results: Sixty-five subjects completed the study. Mean age was 46 years, and mean BMI was 24.05. The majority (57.4%) had grade 3 Cellulite Severity Score, and baseline LS score was 1.60 ± 0.71 (slight-to-moderate draped appearance). The two blinded reviewers agreed in identifying pretreatment and posttreatment photographs for 89% of subjects. There was a significant reduction of 0.70 ± 0.47 ($p < 0.01$; 95% CI [0.58, 0.82]) units in LS score at 3 months posttreatment. This corresponded to an improvement of 44% when compared to baseline. No device-related adverse events occurred during the study, and only anticipated immediate responses were observed, including erythema and edema.

Conclusion: Treatment with a novel ultrasound device that utilizes high-intensity, high-frequency, parallel ultrasound beams can safely improve skin laxity on the body associated with cellulite.

SUBMISSION TITLE: INVESTIGATING THE EFFICACY OF A FRACTIONATED 1927NM LASER FOR DIFFUSE PIGMENTATION AND ACTINIC CHANGES

Authors: Nicole Vingan; Jasmine Panton; Jennifer Barillas; John Hoopman; Jeffrey Kenkel; Abby Culver

UT Southwestern Medical Center, Dallas, TX; UT Southwestern Medical Center, Dallas, TX; UT Southwestern Medical Center, Dallas, TX; UT Southwestern Medical Center, Dallas, TX; UT Southwestern Medical Center, Dallas, TX; UT Southwestern Medical Center, Dallas, TX

Background: Facial actinic irregularities are frequent targets for noninvasive, energy-based treatment. These irregularities are multifactorial and driven by both intrinsic factors such as aging, genetics, and hormone exposure, and extrinsic factors, such as UV exposure.[1,2] Clinically, this photodamage manifests as dyschromic skin disorders like melasma and actinic features such as solar lentigines.

Fractionated 1927 nm (f1927 nm) nonablative lasers are suitable for targeting epidermal lesions and have been shown to be effective in resurfacing photoaged skin as well as addressing pigmented lesions without exacerbation.[6–13] The purpose of this study was to quantify the magnitude and duration of actinic pigment and photodamage response in patients of Fitzpatrick skin phototypes (SPT) I–IV who underwent two treatments with a fractionated, nonablative 1927nm thulium laser (MOXI™; Sciton).

Study Design/Materials and Method: The authors conducted an IRB-approved, single-center, prospective, nonrandomized study to evaluate the efficacy of f1927 nm nonablative lasers in the treatment of diffuse dyspigmentation and actinic irregularities. Patients underwent two treatments with f1927 nm nonablative laser at a 1-month interval. F1927 nm treatment and energy parameters included a fluence of 15 mJ, density of 15% with 15% coverage, and 6 passes completed.

The primary endpoint for this study was pigment response after treatment, measured using the VISIA Skin Imaging and Analysis System (Canfield Scientific). Pigmentary lesions measured and analyzed included Spots, UV Spots, and Brown Spots. The Physician's Global Assessment Scale was used by blinded plastic surgeons to provide a subjective clinical assessment of melasma response.

Wilcoxon rank sum testing was used to assess and compare VISIA results across the study period. A paired two-sample t test was used to assess blinded clinician evaluations. A $p \leq 0.05$ was considered statistically significant.

Results: Twenty-seven patients underwent two treatments with nonablative, f1927 nm laser in May and June 2022. Ninety-six percent of patients ($n = 26$) completed 1-month follow-up and 89% of patients ($n = 24$) completed 3-month follow-up. The study cohort was 100% female, with a mean ± SD age of 47.0 ± 11.5 (range: 29–74), and a mean Fitzpatrick SPT of 2.8 (range: I–IV). No serious adverse events were observed during study treatment or follow-up.

Overall, analysis showed statistically significant improvements in pigmented lesions according to pigment type and anatomic location at 1 month and an increase in pigment toward baseline at 3 months. At 1 month, there was a statistically significant decrease in Spots ($p = 0.002$), UV Spots ($p < 0.001$), and brown spots ($p < 0.001$) compared to baseline. At 3 months, brown spots remained significantly improved compared to baseline ($p = 0.05$), while UV spots ($p < 0.001$) and brown spots ($p = 0.002$) increased toward baseline. Analysis showed 9.9% improvement in pigment on the left ($p < 0.0001$) and 7.5% improvement in pigment on the right ($p < 0.0001$) face. Right pigment remained significantly improved at 3-month follow-up ($p = 0.02$).

Clinician evaluators' mean ± SD Physician's Global Assessment Score was 3.5 ± 1.87 (min: 0; max: 6), which corresponds to a 50%–74% clearance of hyperpigmentation when comparing 3-month photographs to baseline (Figure 1).

Conclusion: These results demonstrate that fractionated, nonablative 1927nm laser treatment is an effective modality for improving clinical and subclinical photodamage. The magnitude and duration of pigment

improvement is potentially influenced by the propensity for photodamage during the summer months, which may suggest the need for multiple f1927 nm treatments over time to maintain results.

SUBMISSION TITLE: LASER TREATMENTS FOR FACIAL ACNE SCARRING: A REVIEW

Authors: Rachel Ziebart; Luis Antezana; Olivia Crum; Magnus Lynch; Saranya Wyles

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Background: The appearance of the face and neck typically changes with age, including laxity of the middle and lower face. Surgery can improve the situation but as it is invasive and the patient's acceptance is poor. From laser absorption spectroscopy, the targets of wavelength 1064nd:YAG laser includes melanin, hemoglobin and water. The laser can produce thermal effect through targets absorption, but the absorption rate for 1064nd:YAG is relatively weak, so 1064nd:YAG laser could relatively penetrate to the deep layer, up to 4–6 mm which is fat layer. through the diffuse heating effect of long pulse width 1064 laser on the dermis and fat tissue, skin tightening effect and lower face lifting can be achieved and with help of DCD epidermal temperature control, epidermis could be protected and no treatment down time.

Study Design/Materials and Method: Twenty patients with mild to moderate laxity in the middle and lower part were randomly assigned to receive 1064nd:YAG laser with long pulse width single treatment or two treatments with an interval of 1 month. The treatment energy level and DCD time were titrated according to the patient's tolerance, with the range of pulse width of 100 milliseconds, energy of 10–30 J/cm, and the number of light spots ranged from 3000 to 3500. Acute clinical reactions were recorded after each treatment. Standardized photos were taken before treatment and 1 month and 6 months after four blind doctors with experience in laser therapy in dermatology independently evaluated the improvement of nasolabial fold, marionette lines, jowls and overall appearance using the percentage scale. In addition, all subjects completed the quality of life survey 1 month and 6 months after.

Results: Nine patients received single long pulse width 1064nd:YAG laser treatment, and 11 patients received two sessions. all the subjects had mild redness and swelling after the treatment, which subsided after 30 minutes. One patient had post treatment hyperpigmentation, self-improve 1 month later, and no patient had burns, blisters and scars. During the 6-month follow-up, patients in two sessions groups scored higher in all categories of photo analysis; The difference in improvement of nasolabial groove was statistically significant ($p = 0.03$). In the self-evaluation score, the subjects who received two sessions reported more improvement than the subjects in the single treatment group 6 months after treatment ($p = 0.03$). The doctor's photo evaluation showed that the condition of all subgroups continued to improve during the evaluation period of 1 month and 6 months ($p < 0.05$). Seventy-five percent of the subjects ($n = 15$) said they are happy to receive more sessions.

Conclusion: In the 1- and 6-month follow-up of single session group and two session groups, the middle and lower face laxity were all improved, Among the subjects who received two sessions of 1064nd:YAG laser treatment, the improvement effect of nasolabial fold and marionette lines was significantly improved than that of single treatment. which provide a safe and effective treatment option for middle and lower face laxity.

SUBMISSION TITLE: MULTICENTER STUDY IN THE TREATMENT OF FACIAL AGING, WRINKLES AND LESIONS ON THE FACE WITH RADIOFREQUENCY DEVICE AND INTENSE PULSED LIGHT DEVICE

Authors: Robert Murgia; Edward Jaccoma; Raminder Saluja; Sean Doherty

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Background: As skin ages, collagen and elastin degenerate, fat and muscle deteriorate, and bone resorption occurs. Therefore, fine lines, rhytides, sagging, and skin laxity become more apparent. Frequently, patients pursue management options with less down time than surgery and ablative skin resurfacing, and patients are often not candidates for facelifting procedures. In the past few years, several radiofrequency and focused ultrasound devices have emerged that allow for noninvasive skin tightening by utilizing heat to stimulate fibroblastic function and induce cytokine production [1–12]. There are few reviews in the literature to compare these devices for skin tightening on the face. The objective of this study is to provide a review that analyzes the most prevalent noninvasive skin tightening devices for the face and discuss the authors' clinical experience and real-world experience with the devices.

Study Design/Materials and Method: The authors searched PubMed for peer-reviewed studies, clinical trial

data, case series, and case reports using a combination of different keywords.

Results: Twenty-four articles that focused on noninvasive skin tightening devices, including monopolar radiofrequency, microfocused ultrasound, and synchronous ultrasound parallel beam technology, were reviewed. Clinical trials have demonstrated that these devices can improve skin sagging, but the ideal patient for each device is still to be delineated. The devices have been well received and well tolerated by patients with minimal and transient side effects.

Conclusion: An array of noninvasive skin tightening devices work by heating dermal tissue to 60–65°C to trigger a wound healing response, tighten collagen, and simulate fibroblasts [1–12]. As results vary between patients, patient selection and management of expectations are important. The authors hypothesize that certain noninvasive skin tightening devices can work better in some patients versus others based on skin thickness and degree of laxity. The authors advise a second procedure as well as combining these procedures with additional treatment options for maximal improvement.

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SUBMISSION TITLE: NECK REJUVENATION WITH COMBINED HYPERDILUTE CALCIUM HYDROXYLAPATITE, PLATELET RICH PLASMA, HYALURONIDASE, AND SYNCHRONOUS PARALLEL BEAM ULTRASOUND

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Background: Picosecond laser technology is a well-known and widely used option for nonablative aesthetic treatments. Although there are many devices currently in the market that use this type of technology, there is an increasing demand for new methods and novel laser technology to improve treatment outcomes. A novel picosecond device, allowing 50% higher, adjustable fluences, was recently developed, and its efficacy and safety were tested in this study.

Study Design/Materials and Method: Fifteen subjects were enrolled and are scheduled to receive up to four split-faced treatments for pigmentary lesions and/or skin revitalization. FitzPatrick skin types II–IV, with a Melanin Index (MI) ranging from 15 to 29, were treated in the study. Each subject had one half of the face (fixed fluence side) treated with fixed parameters using standard recommended settings based on parameters available from a previously commercially available 755 nm alexandrite picosecond laser, while the other half (increased fluence side) was treated with same spot size but increased fluence (~13%) at each subsequent treatment, as tolerated. Each subject is to return for 30 and 90 days post their last treatment to evaluate efficacy results through subject and physician questionnaires and photographic evidence. All subjects were treated with the 6 mm diffractive lens array starting on both sides of the face at a fluence of 0.7 J/cm^2 at the first visit. This is the max fluence available for diffractive optics in the previously commercially available 755 nm picosecond laser. The novel 755 nm picosecond laser provides 50% higher and adjustable fluence at the 6 mm spot size. Each subsequent treatment increased the fluence on increased fluence side of the face by 0.1 J/cm^2, while the fluence on the other side of their face was held at 0.7 J/cm^2. At the 4th treatment visits, most

subjects received the treatment fluence of 1.0 J/cm^2 on the increased fluence side.

Results: Overall, the treatment was well tolerated with pain scores averaging 3.4/10 on the fixed fluence side and 3.7/10 on the increased fluence side. For most treatments, subjects reported a difference in <1 point (on a scale of 10 points) in pain scores between the two sides, and in only 5.6% of all treatments subjects reported a 2 point (on a scale of 10 points) higher pain score on the higher fluence side. Common side effects were erythema, edema, and pain/tenderness, all of which were mild and transient, resolving within days. Subjects experienced the same side effects on both sides of their faces. Both sides showed promising improvement in pigmentation and textures noticed by both patients and physicians, some as early as after their first treatment. Thirty and 90 days follow up are currently on going to analysis efficacy post treatments.

Conclusion: Given the increasing demand for adjustable treatment fluences to tailor to individual treatment plans for potentially better efficacy, this study demonstrated that increased fluence available in this novel alexandrite picosecond laser device can be used safely on skin types II–IV for the treatment for pigmentary lesions and/or skin revitalization. Similar patient treatment experience should be expected as well when the fluence is increased by up to 50%.

SUBMISSION TITLE: NON-INVASIVE, REAL-TIME DIAGNOSTICS AND TREATMENT MONITORING OF KELOIDS UNDER LINE FIELD OPTICAL COHERENCE TOMOGRAPHY (LC-OCT)

Authors: Samavia Khan; Babar Rao; Tricia Mae Raquepo

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Background: The United States is becoming progressively more diverse, and many patients have darker complexions. Laser therapy has been around for many years and has been extensively studied in individuals with lighter complexions. However, there is limited literature on the use and safety of these lasers in individuals with darker complexions due to their heightened risk of laser-related adverse events. Intense pulse light (IPL) laser is used to treat many skin conditions such as scars, melasma, rosacea and is also used for cosmetic reasons such as skin rejuvenation and hair removal but its treatment options among skin of color patients remains unclear. Therefore, to appropriately assess the risks and efficacy of these individuals, it is vital to include them into clinical trials. The objective is to review and quantify the representation of Fitzpatrick skin types IV–VI in Intense Pulse Light clinical trials from 2013 to 2023.

Study Design/Materials and Method: The authors searched keywords "Intense Pulse Light," "IPL," and "Clinical Trials" on PubMed database in December 2022 for eligible trials. All studies were searched with the following filters: Results by year: 2013–2023, Article type: Clinical Trial and Randomized Controlled Trial, Language: English. Variables of interest included Fitzpatrick skin types IV–VI, skin of color, and dermatologic conditions. Trials were excluded if there were no Fitzpatrick skin types IV–VI, no skin of color, and no dermatologic disease.

Results: Of the 96 identified clinical trials, 39 trials included the variables of interest with a total of 1445 patients. The trials demonstrated Fitzpatrick Type IV (12.04%), Fitzpatrick Type V (1.38%), and Fitzpatrick Type VI (0.00%). The dermatologic conditions that were treated included acne (23.08%), hair removal (17.95%), skin rejuvenation (17.95%), scars (10.26%), melasma (10.26%), rosacea (5.13%), IPL-induced adverse effects (5.13%), scar prevention (2.56%), Port-Wine Stain (2.56%), facial telangiectasia (2.56%), and hidradenitis suppurativa (2.56%).

Conclusion: Our findings suggest that there is a lack of Fitzpatrick skin type IV–VI representation in IPL clinical trials. This may lead to undertreatment of patients with darker complexions due to lack of safety data or may lead to off-label use. It is important to diversify clinical trials to adequately assess the safety and efficacy of IPL lasers in these populations.

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SUBMISSION TITLE: NON-INVASIVE TREATMENT OF SKIN LAXITY ON ABDOMEN AND UPPER ARMS BY A COMBINATION OF MONOPOLAR RADIOFREQUENCY AND TARGETED ULTRASOUND

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Background: Laser therapy is an important modality for treating a wide array of pigmented and vascular lesions. An Nd:YAG laser that emits both 532 and 1064 nm light in

addition to novel cryogen cooling and adjustable pulse duration was designed to treat both vascular and pigmented lesions. In addition to millisecond pulse durations, microsecond pulse durations allow for treatment of very fine vessels. Integrated cooling with a unique positioning of the cryogen spray allows for more economical, comfortable, and effective cooling, as well as being able to treat vascular lesions without epidermal heating. Both integrated cooling and adjustment of post-cooling reduces the incidence of swelling typical of 532 lasers. The ability to switch between the 532 and 1064 nm wavelength by the press of a button allows clinicians to provide a more comprehensive treatment in a shorter timeframe. Optimization of the cooling technique via positioning reduces the amount of cryogen needed while increasing the overall patient comfort and safety. We performed a retrospective study on our early experiences with this laser.

Study Design/Materials and Method: Subjects received one to three treatments in 1-month intervals. Vascular treatments typically included one pass with the 532 nm wavelength at a spot size of 12 mm and energy of 4–5 J, with a second pass focusing on visible telangiectasias, if present, with a spot size of 8 and an energy of 7–8 J/cm^2. Postcooling was not used for initial treatments for vascular indications, however, the author discovered that by adding 10–15 milliseconds of postcooling, posttreatment edema was diminished. For vessels 1 mm or over, the 1064 nm wavelength was used with a spot size of either 8 or 12 mm, a median pulse width of 15 milliseconds and a median fluence of 70 J/cm^2. Postcooling was also increased over preset parameters set by the company, resulting in less discomfort for the patients. The patients were treated for a variety of clinical indications including rosacea, photorejuvenation, and port wine stain. An experienced cosmetic dermatologist served as a blinded rater of photographs.

Results: Twenty-eight subjects were included in the results and safety analysis. Two subjects in the study were male while the remaining 26 were female. Twenty-four subjects were skin types I–III and four subjects were skin types IV and IV. The following indications were treated: port wine stain (1), rosacea (11), rejuvenation (10), postinflammatory erythema/hyperpigmentation (5), surgical scar (1), paranasal vessels (1). Swelling was seen after the first treatment in many early patients but when post cooling was adjusted to the 10 milliseconds setting, both the swelling and overall downtime for the patients significantly decreased, particularly in patients treated for rosacea. Subjects reported that the treatment was well tolerated without any anesthesia, and no adverse effects were noted following treatment apart from the immediate post treatment erythema and edema. Most patients noticed visible results after one treatment although significant benefit was seen with additional treatments. One case was a rosacea patent who had failed prior treatment with 595 nm pulsed dye laser, as well as IPL and microsecond "painting" technique with low fluence 1064. Patients with postinflammatory changes from prior procedures improved significantly after one to two treatments. Eighty-one percent of the posttreatment subject images were correctly identified by the blinded evaluators with the typical subject having a median of 40% improvement even after only one or two treatments. Ninety percent of subjects were satisfied with their results with most subjects reporting satisfaction as soon as after two treatments.

Conclusion: Both the 532 and 1064 nm wavelengths were well tolerated, effective, and safe in as early as one treatment for a large majority of patients. Integrated cooling 532/1064 increases the therapeutic window for the 532 lasers, allowing for treatment of both redness and pigment with confidence, even in darker skin (up to Type 5 skin). Pulse durations in the micro and millisecond domains as well as ease of 1064 nm use allows for treatment of any sized vessels. Addition of postcooling reduces adverse events and adds to comfort for patients. Additional treatments with longer term-follow up should be completed to evaluate more precise efficacy. A larger study population should be explored to determine the optimal parameters for each separate indication.

SUBMISSION TITLE: NONPHARMACOLOGIC SOLUTION FOR IATROGENIC ACNE IN A POST-RENAL TRANSPLANT PATIENT

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Background: Epilation performed via laser energy-based devices remains the gold standard for unwanted hair removal. Ideally wavelengths between 600 and 1100 nm are utilized to target melanin for effective hair shaft ablation. Epilation may also be considered for grafted skin in special sites, where terminal hair bearing areas may be grafted into regions where hair growth is undesired.

Study Design/Materials and Method: A 54-year-old male with a previous history of an ameloblastoma tumor of the left mandible underwent left segmental mandible resection with free osteocutaneous fibula reconstruction in addition to a split thickness skin graft from the right lower extremity. After several months, this graft demonstrated presence of dark, course terminal hairs. The patient presented to dermatology for consideration for intraoral laser hair removal. Initially, an attempt was made to treat the patient with a cryogen-cooled 755 nm alexandrite laser (GentleMax Pro Plus; Candela Corp.). Unfortunately, due to the larger handpiece size, the energy could not be safely delivered to the target tissue to achieve desired endpoints. The patient was then treated utilizing a Quality-switched 755 nm alexandrite laser (Candela TriVantage; Candela Corp.) in microsecond mode. This device has a smaller handpiece that allowed for improved maneuverability into the oral space

(floor of mouth, buccal mucosa, gingival sulcus) and accurate and safe delivery of energy to the target tissue. The patient was treated utilizing a 4 mm spot size at 20 J/cm^2 fluence.

Results: After two sessions with the Quality Switched 755 nm laser utilized in microsecond mode, we successfully achieved primary endpoint of lasting terminal hair shaft reduction without obvious adverse effects.

Conclusion: Intraoral cutaneous grafts present a challenge for patients as unwanted hair growth can be particularly distressing and uncomfortable in this area. Ectopic hair growth in this area may interfere with implant fit, mastication, food consumption, and mental wellbeing. Treatment may be cumbersome based on the intra oral anatomy, and by thorough understanding of principles of selective photothermolysis, innovative laser device use may yield effective and desirable endpoints despite nonstandard use of these devices. Consequently, it is imperative to also understand that nonstandard treatments may lead to adverse outcomes, and modest treatment settings should be chosen initially to reduce this risk.

SUBMISSION TITLE: NOVEL 532NM LASER FOR VASCULAR LESIONS WITH POST PULSE DYNAMIC COOLING FOR REDUCING TREATMENT DISCOMFORT

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Background: Folliculitis decalvans is an inflammatory recalcitrant scalp disorder characterized by follicular based papules and pustules that may progress to scaring alopecia. The etiology is not fully understood, yet though to be an inflammatory response to *Staphylococcus aureus*.

Objective: To report an effective treatment modality for the treatment of recalcitrant folliculitis decalvans.

Study Design/Materials and Method: This is a case report of folliculitis decalvans treated with Revlite laser (Qswitched Nd:YAG 1064 nm laser photoacoustic technology pulse [PTP] laser therapy). A 20-year-old man, Fitzpatrick skin type II presented multiple scattered papules, nodules, and abscesses on parieto-occipital scalp with associated pruritus, trichodynia and polythychia over the past 7 years. Multiple treatments were tried including topical clindamycin and mupirocin, several courses of oral antibiotics (rifampicin and clindamycin, azithromycin, sulfamethoxazole-trimethoprim, tetracycline), dapsone and photodynamic therapy with methyl aminolevulinate (MAL; Metvix) 160 mg/g cream with minimal improvement. Due to poor response to several commonly used treatment option the patient was started on 1064 nm Q-switched Nd:YAG with PTP, RevLite laser (Cynosure) to the affected areas on scalp. The Q-switched Nd:YAG 1064 nm setting of 5.7 J/cm^2, 6 mm spot size, 10 Hz. Hair was not shaved, and no cooling was used. A total of three sessions at 4–6-week interval was completed.

Results: Our patient was treated with combination of isotretinoin and multiple sessions of 1064 nm Q-switched Nd:YAG with PTP, RevLite laser. Marked improvement of inflammation and pustules with preserved terminal hairs was observed 7 years after the initial treatment.

Conclusion: The 1064 nm Q-switched Nd:YAG has been used with good results [3,4], and our case highlights that when used in these setting RevLite does not fully epilate the involved area on scalp, however reduces the follicular plugging and inflammation improving disease control. In addition, to laser treatment the patient was started on maintenance isotretinoin 20 mg 2×/week. The Q-Switched Nd:YAG laser may provide satisfactory results in combination with maintenance isotretinoin for the treatment of recalcitrant folliculitis decalvans.

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SUBMISSION TITLE: NOVEL 730 NM PICOSECOND TITANIUM SAPPHIRE LASER FOR TREATMENT OF CAFÉ-AU-LAIT MACULES IN SKIN TYPES III-VI

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Background: Keloids are raised scars that result from abnormal wound healing due to trauma or inflammation. Clinically, keloids appear as thick, firm nodules that

often do not regress with time and extend beyond the original wound margin [1]. Higher incidences are seen in darker-skinned individuals of African, Asian, and Hispanic populations. The incidence of keloid scarring in the Hispanic and African American populations ranges from 4.5% to 16%, while the incidence in Caucasian populations is below 1% [2]. Keloids are associated with pain, pruritus, and burning, significantly impacting the quality of life for many patients.

Although keloids are common, there is still no consensus on the exact pathophysiology of keloid formation. It is proposed that keloids form due to an imbalance between increased collagen synthesis and extracellular matrix and the decreased degradation of these products [3]. Increased extracellular matrix collagen is theorized to be due to the overexpression of inflammatory mediators, especially transforming growth factor-beta [3]. There are numerous treatments for keloids, such as occlusive dressings, intralesional steroids, compression therapy, topical imiquimod, interferon, and surgical techniques; however, there are no standardized guidelines for keloid management.

When choosing treatment, it is crucial to determine the underlying scar pathology. Recently, noninvasive real-time imaging of skin, such as optical coherence tomography (OCT) and line-field confocal optical coherence tomography (LC-OCT), show potential in elucidating the pathogenesis of keloidal lesions. A better understanding of the pathogenesis and structural morrphology of keloids will allow for the development of more targeted therapies.

OCT is a noninvasive technique that obtains high-resolution three-dimensional images of biological structures. In dermatology, it has been used to aid in diagnosing basal cell carcinoma, detecting non-melanoma skin cancers, characterize the microenvironment of facial pores, and observing the treatment response of inflammatory dermatoses [4]. When examining keloid scars, OCT revealed thickened stratum corneum and epidermis, a heterogenous morphology without a vascular supply, and deep, bright patches of densely ordered collagen [5]. OCT can help assess fibrosis to avoid biopsies that can worsen the scarring.

Although OCT has been a helpful imaging tool, it offers a resolution of only a few micrometers. LC-OCT is the latest noninvasive technology that visualizes the skin deeper, with structural mapping of the skin at the cellular level down to a depth of ~500 μm [6]. The deeper visualization of the skin layers shows potential for better visualization of changes during keloid scarring. To the best of our knowledge, there are no published studies using LC-OCT to image keloids.

Study Design/Materials and Method: We present a prospective cohort study that utilizes Line-Field Optical Coherence Tomography (LC-OCT) imaging to characterize the morphology of 20 keloids of varying Fitzpatrick skin types (I to VI). Three images were taken, at minimum, for each patient using the LC-OCT probe: on the keloid, at the boundary between keloid and normal skin, and on normal skin. Both reflectance confocal modes and optical coherence modes were used to create 2D and 3D block images for analysis. In addition to visualizing untreated keloids, this study also involved therapeutic monitoring of keloid lesions in those patients who chose to pursue treatment, as per standard of care. Keloid treatments included intralesional steroids, laser therapy, and surgical techniques.

Results: In this pilot study ($n = 20$), the following features were noted in the assessment of LC-OCT images: epidermal thickness, stratum corneum thickness, definition of the dermo-epidermal junction, dermis collagen matrix, and blood vessel density/vascular network. This study showed that keloidal skin demonstrated thickened stratum corneum, acanthosis, and densely ordered collagen bundles that appeared hyperreflective. Blood vessel architecture was not noted to be visually distinct from blood vessels in normal skin. Therapeutic monitoring of keloids treated with intralesional steroids, laser therapy and surgical techniques after 1-month demonstrated dermal changes in the collagen bundles as well as reduced acanthosis.

Conclusion: Compared to reflectance confocal microscopy, in which visualization of dermal changes are limited to the superficial dermis (150 μm), LC-OCT allows for greater visualization into the mid and deeper dermis. In addition, its ability to track dermal changes during therapeutic monitoring shows its potential to detect subclinical changes in lesions before clinical changes. This project is currently being expanded and more patients are being enrolled for further study of keloidal lesions under LC-OCT as well as therapeutic monitoring of such lesions. In addition, further research is being conducted to promote more uniform language in describing keloidal features visible under LC-OCT through a collaborative effort by a team of dermatopathologists and experts in other noninvasive technologies (reflectance confocal microscopy and optical coherence tomography). This study shows the promise of LC-OCT in visualizing other dermatologic conditions that show morphologic and structural changes, such as other forms of scarring (hypertrophic) as well as hidradenitis suppurativa.

SUBMISSION TITLE: PHACE SYNDROME: SUCCESSFUL TREATMENT OF SEVERELY ULCERATED FACIAL HEMANGIOMA WITH COMBINATION THERAPY

Authors: Ahmad Berjawi; Zeina Tannous

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Background: Dr. Suzanne Kilmer is the Founder of the Laser and Skin Surgery Center of Northern California, a

Clinical Professor at the University of California, Davis, and past president of ASLMS. She completed her MD. degree and dermatology residency at UC Davis Medical Center, then moved east for a laser surgery fellowship at Harvard Medical School's Wellman Laboratories of Photomedicine. She remained at Harvard as a faculty member for 2 more years researching the use of Q-switched lasers for treating tattoos and pigmented lesions and the rapidly pulsed CO_2 lasers now popular for resurfacing.

Upon returning to Sacramento, Dr. Kilmer was a principal investigator in the original trials for laser skin resurfacing, laser hair removal, pulsed dye, and fractional lasers for wrinkles and scars, picosecond laser treatment of tattoos, pigmented lesions, acne scars, and pico-toning, microwave technology for the treatment of hyperhidrosis, cryolipolysis, tissue tightening and body shaping devices, and several toxins and filler studies.

She lectures annually at national and international dermatology meetings and directs several laser courses. Widely published and on numerous medical advisory boards, Dr. Kilmer has served on the Board of Directors for ASDS and ASLMS, as well as the Past President, Secretary, and Laser Safety Officer for ASLMS. She was honored to be the 2008 Sturge-Weber Foundation roastee, the 2009 recipient of the ASLMS Ellet Drake lectureship award, and two ASLMS Presidential Citations in 2010 and 2019. Dr. Kilmer was honored with three distinguished awards in 2020: The ASDS Innovations in Aesthetic Dermatology Lectureship in honor of Vic Narurkar, MD, and the prestigious Leon Goldman and Caroline & William Mark Memorial Awards for outstanding contributions to laser medicine and surgery. In 2021, ASLMS honored Dr. Kilmer with Dr. Thomas E. Rohrer's 2021 Presidential Citation and the Melanie C. Grossman, MD Award for leadership, Mentorship & Public Advocacy for Women in Medical Science Award.

When not playing in the electromagnetic spectrum, she loves to ski, paddleboard, and play pickleball, puzzles, and games with her husband and children.

Study Design/Materials and Method: Fifteen subjects were enrolled in a prospective clinical trial. Subjects with port wine stains, rosacea, angiomas, vessels, and general rejuvenation were all recruited for the study. Pediatric as well as adult patients were included in the study with Fitzpatrick skin types II, III, and IV all treated. Subjects received up to total total treatments in 1 month intervals. Treatments included two passes utilizing first the submillisecond pulse format and then switching to the submicrosecond format for the second treatment with a spot size typically ranging from 10 to 14 mm, fluence from 4 to 10 J/cm^2, and a pulse width typically between 10 and 20 milliseconds. Subject's had photography taken throughout the study and returned for follow-ups up to 90 days post treatment.

Results: Fifteen subjects attended a follow-up visit following the completion of their treatment regimen. The average age of the adult subjects in the study was 48.6 years, and there were two pediatric patients aged 2 years and 8 months that were enrolled. 58% of subjects were female and the remaining 42% were male. Subject reported pain scores during the treatment were 3.6/10 on average. Blinded evaluators were asked to identify the randomized posttreatment image and were able to do so for 85% of the subjects on average. 86% of subjects were satisfied with their results at the end of the study. There were no adverse events reported during the study outside of the standard posttreatment edema and erythema

Conclusion: The long-pulsed adjustable pulse format cryogen spray cooled laser treatment utilizing 532 nm wavelength was found to be effective and safe in both adult and pediatric subjects seeking to improve their overall appearance in addition to port wine stains, rosacea, and angiomas.

SUBMISSION TITLE: PORE AND ACNE SCAR TREATMENT WITH A Q-SWITCHED LASER USING A NOVEL FRACTIONAL MDF (MULTI-DEPTH FOCUSING) HANDPIECE: A PILOT STUDY

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Background: Although skin rejuvenation is not within the usual repertoire of the Q-switched 1064 nm Nd:YAG (Q-NDY) laser, the development of a multidepth focusing (MDF) handpiece allowing user-selectable depths of focus has changed this. The current in-house pilot study was designed to assess the safety and efficacy of a Q-NDY laser fitted with an MDF handpiece in the treatment of enlarged pores and acne scars.

Study Design/Materials and Method: Ten patients with enlarged pores and acne scars were recruited into the study as volunteers. Clinical photographs were taken at baseline and then at 6 weeks (A1) and 3 months (A2) after the final treatment, based on which a quintile scale physician global assessment (PGA) was obtained at A2 scored by two independent blinded dermatologists. Patients subjectively scored their satisfaction with the treatment in a questionnaire at A2, also on a quintile scale.

Results: In general, patients showed a statistically significant improvement in both the pores and acne scars at both A1 and A2, with a trend towards continued improvement between the first and second assessments, more particularly for the acne scars. The average percentage improvements for the pores at A1 and A2 were $48.45 \pm 16.1\%$ and $57.8 \pm 15.2\%$ ($p = 0.001$ for both), respectively, for acne scars, the respective values were $27.8 \pm 15.0\%$ and $34.2 \pm 24.3\%$ ($p = 0.0008$ for A1, 0.0004 for A2). No difference was seen between the subjects who had three sessions and those who had four, suggesting that the three-treatment protocol was ideal, although numbers were too small to make any generalization. The average

PGA score was 3.3/4 and the average subject satisfaction score was 3.4/4. The average pain score was 3.7 (range: 3–5), and no adverse events were reported during both the treatment and follow-up periods.

Conclusion: Further controlled studies in larger populations are warranted to confirm the optimistic results of this pilot study.

SUBMISSION TITLE: POTENTIATION OF CLINICAL RESPONSE TO FACIAL PHOTODYNAMIC THERAPY DUE TO SURGICAL MASK WEAR DURING 5-AMINOLEVULANIC ACID INCUBATION

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Background: Disseminated superficial actinic porokeratosis (DSAP) is an autosomal dominant skin condition, that causes discrete scaly reddish-brown plaques on arms, legs and occasionally trunk. Although rare, individuals with DSAP are at risk for skin cancer, necessitating consistent follow-up. Although asymptomatic, patients dislike it because it is somewhat disfiguring.

Study Design/Materials and Method: Treatments for DSAP have been poorly standardized. DSAP is a progressive disorder of keratinization with a high lesion relapse rate after treatment, causing patients to seek novel treatment modalities after exhausting traditional treatment methods.

Results: In this case study, four patients were treated with Q-switched Nd-YAG laser (QSL) with success. PDT with aggressive microneedling and intense pulse light had previously also been successful in two of the patients but became financially burdensome.

Conclusion: Frequency-doubled QSL (532 nm) is often used for lentigines, red dye in tattoos and pigmentation. QSL is an easy, economical way to treat DSAP, especially given its often diffuse distribution.

SUBMISSION TITLE: REAL-WORLD EXPERIENCE USING DERMAL MICRO-CORING TECHNOLOGY (MCT) FOR THE TREATMENT OF LAXITY, WRINKLES, AND SCARS

Authors: Shirin Bajaj; Elizabeth Kream; Jordan Wang; Roy Geronemus

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Background: Treatment of lentigines is a common cosmetic procedure, which has traditionally been done using Q-switched nanosecond lasers. However, its utility was limited in darker skin types due to risks of dyspigmentation. More recently, a novel 532 nm picosecond laser was developed, which utilizes a 450 picoseconds pulse width, a flat-top multimode beam profile, and low lasing threshold. This laser has been used to successfully treat lentigines in darker skin types, with high reproducibility. This study reviews the safety and effectiveness of this treatment in Fitzpatrick skin types (FST) III and above.

Study Design/Materials and Method: A retrospective chart review was performed over a 3.3-year period. Patients who were FST III or above, who had lentigines treated with high-power 532 nm picosecond laser with unique flat-top multi-mode beam profile (PicoPlus; Lutronic), with 4-week minimum follow-up, and adequate clinical photographs were included. Photographs were rated using 5-point Global Aesthetic Improvement Scale (GAIS) (5: Very much improved; 4: Much improved; 3: Improved; 2: No change; 1: Worsened). Adverse events were recorded.

Results: A total of 44 patients met criteria and were included. Median age was 45 years (R: 24–73 years), and 86.4% ($n = 38$) were women. The majority were Asian ($n = 23$, 52.3%). Most patients were FST IV (61.4%; $n = 27$), while the remaining were FST III (38.9%; $n = 17$). All but one patient had lentigines treated on the face (97.7%; $n = 43$), with the remaining patient having a treatment on his back. Patients had median follow-up time of 46 days following the last treatment. Most patients underwent 1 treatment session (75.0%; $n = 33$; R: 1-5 treatment sessions).

Laser fluences were 0.7–1.6 J/cm^2 with a 3.3 mm spot size. When comparing pretreatment and posttreatment photographs, median GAIS was 4, which correlated to "Much improved." Two Asian patients experienced postinflammatory hyperpigmentation, which resolved with subsequent low-power, low-density 1927 nm thulium fiber laser treatment. There were no serious adverse events or long-term dyspigmentation documented.

Conclusion: The high-power 532 nm picosecond laser with unique flat-top multimode beam profile is safe and effective for treatment of solar lentigines in FST III–IV.

SUBMISSION TITLE: REMOVAL OF INTERMEDIATE HAIR WITH THE CYNOSURE REVLITE SI Q-SWITCHED ND:YAG PHOTOACOUSTIC TECHNOLOGY PULSE (PTP) LASER THERAPY IN SKIN OF COLOR

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Background: Diffuse male and female pattern alopecia affects approximately 50 million men and 30 million women and is a leading cause of hair loss worldwide. To date, few available treatments address both current hair loss and its progression. Platelet-rich plasma is one popular option; however, the harvesting and processing of platelets is time-consuming and the efficacy of treatment is variable. Topical therapy is more convenient and does not require injections, but carries the risk of increased shedding, facial hair growth or poor efficacy. Thus, there remains an unmet clinical need for a treatment that can consistently improve growth and stabilize progression without discomfort. One possible alternative is via transepidermal delivery. Widely studied in general medicine, ultrasound has been validated for penetration of topicals past the stratum corneum. Here, the efficacy and safety of a combination treatment with a novel ultrasound-based technology combining acoustic soundwaves and air pressure with a proprietary peptide-based topical hair formulation (Alma TEDTM + Hair Care Formula; Alma Lasers, Inc.) is assessed.

Study Design/Materials and Method: To evaluate the safety, efficacy, and tolerability of a novel ultrasound-based technology paired with a proprietary topical peptide-based formulation as a novel treatment in men and women with diffuse pattern alopecia, a single-center, open-label study of 11 participants (3 men and 8 women; mean age of 57) was conducted. Subjects were treated for a total of three sessions, 4–6 weeks apart, and treatment effect was assessed 30 days following the last treatment. The hair was parted into treatment zones, which varied among male and female subjects: female treatment areas included the frontal scalp, crown, and bilateral temples, while male treatment areas included the crown, vertex, and frontotemporal scalp. All treatment zones were first primed with ultrasound to condition the stratum corneum for 2 minutes each (50 Hz, 30% Impact). Second, the peptide-based hair formulation was applied to the scalp in the primed treatment zone. Third, the ultrasound was used again for 2 minutes or until the scalp was dry (50 Hz, 50% Impact). This three-step process was then repeated for each treatment zone. At each visit and 30 days following final treatment, changes in global presentation and hair density were captured using standardized imaging and evaluated using the Norwood or Ludwig Scales and GroTrack (GRO Technologies) system. At follow-up, a 4-point Subject and Physician-reported Global Aesthetic Improvement scale (S-GAIS, P-GAIS; 1 = No change, 2 = Improved, 3 = Much improved, 4 = Very much improved) was used. Four-point Subject Satisfaction (1 = Not satisfied, 2 = Satisfied, 3 = Much satisfied, 4 = Very much satisfied) was also assessed. At each treatment session and follow-up, subjects answered questions (Y/N) on whether they have observed hair growth and/or reduced shedding and were assessed for any adverse events. At each treatment session, subjects reported any pain using the 11-point Subject Pain Assessment Scale where 0 = no pain and 10 = extreme pain.

Results: At 30 days following the third treatment, 100% of patients were improved or better according to the S-GAIS evaluation with an average score of 3.8/4. All (100%) of subjects were satisfied, much satisfied, or very much satisfied. All (100%) of subjects reported a decrease in shedding, with 80% reporting this decrease after the first treatment and 20% reporting a decrease after the second treatment. Increases in hair growth were also noted by all (100%) subjects, with 40% reporting an increase in growth following the first treatment, and the remaining subjects reporting increases following the second treatment (40%) and third treatment (10%). Total mean hair density improved for all patients across all treatment zones by 24%. Growth was most pronounced in the temples, where hair density improved by 41%. In female patients, hair density in the temples increased more dramatically, with a 52% increase bilaterally. Importantly, none of the subjects reported pain (mean score = 0) at any of the sessions and there were no adverse events recorded throughout the duration of the treatment course and 30-day follow-up period.

Conclusion: In this single-center study, the treatment of diffuse male and female pattern alopecia using a novel ultrasound delivery of a proprietary peptide-based topical hair care formula appears to be a promising modality for improving hair density and global appearance. Importantly, subjects are able to recognize less shedding and increased hair growth early following the initiation of treatment and are overall highly satisfied with the results. Additionally, this Class I modality is easy to delegate, compatible with busy practice workflows, and does not require extensive preparation time nor does it demand patients tolerate painful injections.

SUBMISSION TITLE: REVIEW OF UTILITY OF HIGH-POWER 532NM PICOSECOND LASER FOR SOLAR LENTIGINES IN SKIN OF COLOR

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Background: Skin's exposure to ultraviolet light and extrinsic factors leads to age-related changes, resulting in

a decreased skin thickness and a lowered amount of the basic structural proteins in the skin—collagen, and elastin. Radiofrequency has been for a long time an established technology capable of restarting the natural regenerative processes in living tissues, widely used in the aesthetic practices. The objective of this study is to investigate the effects of radiofrequency heating synchronized with novel HIFES technology on the skin, particularly on the content of collagen and elastin, for the treatment of facial wrinkles and skin laxity.

Study Design/Materials and Method: This prospective, single-center, two-arm, open-label study recruited seven participants, allocated into the active ($N = 6$) and control ($N = 1$) groups. The active group received four 20-minute facial treatments delivered once a week through the bilateral cheek and single forehead applicators simultaneously emitting radiofrequency and HIFES fields, while the control subject did not receive any treatments. Punch biopsies of the skin (3 mm diameter) were obtained at baseline, 1- and 3-month follow-up from all subjects and evaluated for any changes in the collagen (Masson's trichrome stain) and elastin (Orcein stain) content. The secondary evaluation was based on digital photographs to assess the visual appearance, patients' satisfaction, therapy comfort, and safety.

Results: In the histology slices stained explicitly for detection of connective tissue, the preliminary analysis showed increased amounts of collagen and elastin content posttreatment. At 1- and 3-month follow-ups, collagen increased by 21.1% and 27.7% compared to baseline. Elastin content increased by 76.1% and 129.5% after 1 and 3 months in comparison to the baseline. The levels of collagen and elastin tissue in the control subject remained unchanged throughout the study. Furthermore, the digital photographs showed the improved facial appearance of treated subjects. The therapy was safe and perceived as comfortable.

Conclusion: Histological analysis of the human skin tissue showed increased production of connective tissue structural proteins after simultaneous, noninvasive radiofrequency and facial muscle stimulation treatments. Alongside, a noticeable improvement in facial appearance was seen in digital photographs, underlining the histology findings.

SUBMISSION TITLE: SIMULTANEOUS TREATMENT FOR ACTIVE ACNE AND ACNE SCAR WITH COMPLEMENTARY STRATEGY USING FRACTIONATED PULSED RADIOFREQUENCY AND PICOSECOND ALEXANDRITE LASER

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Background: Acne is a major skin problem that bothers patients both physically and psychiatrically. Since it leaves scars, including post inflammatory pigmentation in the epidermis and dermal degeneration. it is critical to treat active acne and acne scars at the same time with a multilayered approach to promote early recovery and prevent further damage to skin tissues. This study aimed to evaluate the safety and efficacy of complementary treatment using fractionated pulsed radiofrequency and picosecond alexandrite lasers for total acne treatment.

Study Design/Materials and Method: A total of 32 patients (30 females and 2 males, aged 35.5 ± 12.1 years) who have active acne and acne scars were enrolled. in this study. All subjects had Fitzpatrick skin types III or IV. They received three sessions of treatment consisting of fractionated pulsed RF irradiation with infusion tips immediately after applying tranexamic acid solution on the dermal damaged area, followed by picosecond alexandrite laser irradiation on postinflammatory hyperpigmentation (PIH) and inflammatory regions with 550 picoseconds, 1.31–1.70 J/cm^2, and 1–2 stack shots on each region, and 550 picoseconds, 0.21–0.33 J/cm^2, and 1 pass for full face. The treatment interval was 6 weeks. Digital photographs and ultraviolet images were taken at baseline with a skin analyzer at each treatment visit and 6 weeks after the final treatment to evaluate the efficacy by an independent evaluator using the global aesthetic improvement scale (GAIS). A patient satisfaction questionnaire was completed by each patient at the last visit.

Results: The inflammatory regions improved after the first treatment session, and PIH, pore size, and skin texture improved after the second and third sessions. The GAIS rating at 6 weeks after the final treatment was as follows: 7 (22%) Excess improvement, 17 (54%) Very improved, 7 (22%) Improved, 0 (0%) Unaltered, and 0 (0%) Worsened. 78% of the patients reported their satisfaction as very satisfied or satisfied on a 5-point Likert scale. Downtime after each treatment included erythema, edematous erythema, and skin roughness, all of which resolved within 48 hours. No severe adverse reactions, such as scarring or vitiligo, were observed.

Conclusion: The complementary treatment with fractionated pulsed RF and picosecond alexandrite laser is safe and effective in treating active acne and acne scars at the same time.

SUBMISSION TITLE: SOLUTION FOR THE TOUGHEST ACNE SCAR: NASAL ICE PICK SCAR

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Background: Nasal ice pick scars are a type of scarring on the nose, typically due to acne vulgaris. They can also present due to self-picking and physical extraction of comedones or hair follicles. These scars are small and deep, often resembling the shape of an ice pick. Icepick scars are notoriously known as the hardest acne scar to treat. Trichloroacetic acid (TCA) Chemical Reconstruction of Skin Scars (CROSS) technique and punch excision are currently considered the best treatment options for nasal ice pick scars. TCA CROSS involves the application of TCA to the scar, which helps to resurface the skin and improve the appearance of the scar. However, this technique can be limited by the curvature of the nose, as the acid can accidentally affect surrounding healthy skin. Punch excision involves the use of a small, circular tool to remove the scar tissue and close the wound with sutures. This technique can be effective for small, individual icepick scars but may not be suitable for multiple-grouped scars. Additionally, the relatively small size of the nose can make it challenging to perform punch excision without causing anatomical distortion.

Study Design/Materials and Method: Five patients participated in this cases series. Fractional ablative CO_2 Laser was used to focally treat individual nasal ice pick scars while sparing the rest of the face. A total of three treatments were done every 4 weeks, with follow up at Week 16. Images were taken before treatment and during each follow up.

Results: Follow up at week 16 revealed that four patients had clinical improvement of 76%–100%, 1 had clinical improvement of 51%–75%, and none had minimal or no improvements. No severe adverse effects were reported.

Conclusion: We propose a novel method to treat nasal icepick scar by utilizing fractional ablative carbon dioxide (CO_2) Laser to focally treat individual nasal icepick scars. This novel method allowed us to achieve near complete clearance of nasal icepick scars while minimizing downtime and risk of adverse effects.

SUBMISSION TITLE: SUCCESSFUL TREATMENT OF HERPES ZOSTER SCARS USING ABLATIVE FRACTIONAL LASER-ASSISTED DELIVERY OF TOPICAL POLY-L-LACTIC ACID

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Background: Affecting more than 1.2 million patients in the United States annually, herpes zoster is a painful, blistering, dermatomal rash caused by reactivation of the varicella zoster virus (VZV). One of the lesser reported, presumably overlooked consequences of herpes zoster is cutaneous scarring, which may manifest as atrophy, hypertrophy, or pigmentary alterations. Atrophic scars can be exceedingly difficult to treat. While most of the literature has focused on the treatment of atrophic scars as a sequela of acne, there is a paucity of data on the application of these treatments in herpes zoster related scars, which are morphologically distinct due to their viral etiology and the notable epidermal involvement that occurs during virus reactivation. Herein, we report a case of atrophic scarring secondary to herpes zoster successfully treated with ablative fractional carbon dioxide (CO_2) laser-assisted delivery of topical poly-L-lactic acid (PLLA).

Study Design/Materials and Method: A 28-year-old man (Fitzpatrick skin type III) presented with two atrophic scars on the forehead and glabella, measuring 1–1.2 cm, that arose following herpes zoster infection 6 months prior. He had not treated the scars previously.

Treatment with laser-assisted delivery of topical poly-L-lactic acid (PLLA) was implemented. First, topical anesthetic cream containing 23% lidocaine and 7% tetracaine was applied for 30 minutes prior to treatment. Subsequently, the atrophic scars were treated with fractional ablative carbon dioxide (CO_2) laser (Lumenis Ultra Pulse) immediately followed by topical PLLA (Sculptra; Galderma) application with a dilution of 9 cc of sterile water. Parameters for the CO_2 laser were set to 25 mJ, 10% density, and 1 pass.

Results: Appropriate post-procedural erythema was noted, and no unanticipated adverse effects were observed. Postoperative care included application of petrolatum ointment three to four times daily for 5 days following treatment and strict sun protection. The patient underwent two treatments at 6-week intervals. At 4 weeks post-second treatment, the patient demonstrated significant improvement in the depressed scars; they were noticeably less shallow and the transition between the scars and the surrounding unaffected skin was improved. The patient was satisfied with the results after two treatments.

Conclusion: Given its success in our patient, we present this case to demonstrate same-session ablative fractional CO_2 laser-assisted delivery of PLLA may provide a safe and efficacious treatment option for atrophic scars caused by herpes zoster or primary VZV infection.

SUBMISSION TITLE: SUCCESSFUL TREATMENT OF SOLAR LENTIGENES IN THE ASIAN SKIN USING PULSED DYE LASER WITH COMPRESSION

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Background: Solar lentigines are a common cause of hyperpigmentation that can cause significant distress, especially if they occur on the face. Risk of developing solar lentigines correlates directly with increasing age and sun exposure. Traditionally, Quality-switched (Q-switched) lasers have been used for removal of pigmented lesions, while pulsed dye laser is used for cutaneous vascular lesions. Pulsed dye laser therapy with skin compression removes blood from the treatment area, thus eliminating haemoglobin as a competing target chromophore against melanin, the target in pigmented lesions. This minimises the risk of purpura formation and increases effectiveness of targeted laser therapy.

Study Design/Materials and Method: We report two cases of successful treatment of solar lentigines using pulsed dye laser with compression.

Results: A 63-year-old Chinese female underwent pulsed dye laser therapy for a left upper cheek solar lentigo. She received a total of two treatments two months apart. Both sessions of pulsed dye laser therapy were performed with 7 mm spot size with compression convex handpiece, pulse duration of 1.5 milliseconds, fluence of 9 J/cm^2, with two stacked pulses separated by 1 second each. The endpoints were transient pigment darkening and redness. There was resolution of the solar lentigo with minimal side effects experienced post procedure, namely temporary crusting (Subject 1).

A 51-year-old Chinese male underwent pulsed dye laser therapy for three right cheek solar lentigines which had been present for 2 years. He received a total of three treatments at 2-month intervals. All treatments were done with 7 mm spot size, compression convex handpiece, and pulse duration of 1.5ms. Fluence ranged from 9 to 10 J/cm^2, with two stacked pulses. The endpoint was transient pigment darkening. There was resolution of all three solar lentigines. Side effects experienced were erythema, peeling and crusting which all resolved within a week (Subject 2).

Conclusion: We observe from our two cases that pulsed dye laser therapy with compression can be used effectively for the treatment of solar lentigines with minimal transient side effects and no postinflammatory hyperpigmentation. This provides an attractive alternative to the traditional use of Q-switched laser therapy for pigmented lesions in the Asian skin.

SUBMISSION TITLE: SYNCHRONIZED RADIOFREQUENCY WITH HIFES PROCEDURE WORKS IN SYNERGY TO REJUVENATE FACIAL TISSUES: AN OVERVIEW OF TECHNICAL AND CLINICAL ASPECTS

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Background: Café-au-lait macules (CALM) are benign birthmarks presenting as uniformly pigmented, well demarcated, brown patches that can be distressing to patients, especially when located in cosmetically sensitive areas. CALMs have traditionally been treated with a variety of lasers, including picosecond and Q-switched 755-nm alexandrite, 532-nm Nd:YAG, and 1064-nm Nd:YAG lasers and the nonablative fractional 1550-nm erbium-doped fiber laser, with variable success rates. Here, we present the first case series, to our knowledge, characterizing treatment parameters and clinical outcomes utilizing a novel 730-nm picosecond titanium sapphire laser for the treatment of CALMs.

Study Design/Materials and Method: We performed a retrospective review of patients treated at a single institution between April 2021 and January 2023. Clinical photographs were graded by three board-certified dermatologists using a 5-point visual analog scale.

Results: Twelve patients (age range: 10 months–66 years, mean age: 27.2 years, Fitzpatrick skin types III–VI) were treated for CALM on the face (9) or off the face (3). On average, patients received 3.1 treatments, with treatment intervals ranging from 5 to 40 weeks. Treatment remains ongoing with the 730-nm picosecond laser for eight patients. Overall, patients were rated to have a mean improvement of 26%–50%. Two patients (FST III and VI) achieved 100% clearance after four to five treatment sessions. Of note, three patients treated had smooth-bordered "Coast of California" type CALM, with a mean improvement rating of only 1%–25%.

Of the patients treated, one patient experienced mild postinflammatory hyperpigmentation and another experienced mild postinflammatory hypopigmentation.

Conclusion: The novel 730-nm picosecond titanium sapphire laser is a safe and efficacious treatment option, in the right morphologic setting, in improving the cosmetic appearance of CALMs in a wide range of ages and skin types. To our knowledge, this is the first reported treatment of CALMs with picosecond lasers in FST VI patients. Our study also supports prior studies which have found that CALM with smooth-bordered "coast of California" morphology have a poor response to laser therapy as compared to those with jagged or ill-defined bordered "coast of Maine" morphology. To better understand efficacy, durability and optimal treatment parameters, further studies are needed and are currently being conducted at our treatment center.

SUBMISSION TITLE: TARGETING PAPILLARY AND RETICULAR DERMIS AT THE SAME TIME: PROOF OF CONCEPT STUDY OF DUAL-LENGTH MICRONEEDLE RADIOFREQUENCY-INJECTOR DEVICE USING EX VIVO HUMAN SKIN

Authors: Garam Ahn; You Na Jang; Woo Ju Kim; Woo Geon Lee; Joon Seok; Beom Joon Kim

Republic of Korea Army; Chung-Ang University; Chung-Ang University; Chung-Ang University; Chung-Ang University; Chung-Ang University

Background: A growing body of evidence indicates that the dysfunctional alteration of the papillary dermis mainly contributes to the photoaging of the skin. Recently, a novel dual-length microneedle radiofrequency-injector device (DLRI), of which microneedles with two different lengths were designed to simultaneously coagulate two compartments of the dermis (papillary and reticular dermis), was proven to have good efficacy and safety on photoaged faces in a split-face clinical trial report. The present study aimed to visualize and evaluate the spatial distribution of the coagulation effect of the DLRI in human skin.

Study Design/Materials and Method: The ex vivo human skin samples were obtained from five patients who underwent face-lifting surgery (bilateral rhytidectomy of the lateral face). Histologic analysis was performed on skin samples treated with hematoxylin & eosin stains and special stains for the dermal matrix. Gross images of the vertical section were obtained with a digital microscope.

Results: The histologic analysis proved that the dual-level RF needle made independent coagulated zones at the papillary and reticular dermis. The gross images were relevant to the histological data.

Conclusion: As designed, the dual-length microneedles can deliver RF energy at the papillary and reticular dermis at the same time. This property is expected to regenerate the dermis of photoaged human skin and to support the efficacy data of the previously reported clinical study.

SUBMISSION TITLE: TIKTOK AS A SOURCE OF MEDICAL INFORMATION: PORT WINE STAIN BIRTHMARKS AND TREATMENT USING VASCULAR LASERS

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Background: As social media usage grows, an increasing number of patients are turning to various platforms to gain and share medical information. One platform, TikTok, has become immensely popular, with over one billion users. Despite its potential use as an educational tool, there are significant concerns about using this platform as patients' primary source of medical advice and information.

Study Design/Materials and Method: Using algorithm naïve TikTok profiles, we recorded key variables in TikTok videos about PWS treatment, including the source of information, the tone of the video, the description of adverse events and risks, and the mention of pathogenesis, definition, or etiology of the vascular birthmark. The first 200 videos that contained the hashtags #portwinestainlaser and #portwinestaintreatment were included.

Results: Our results showed that of 200 videos analyzed, 62% of videos were recorded by patients, 21% by parents, 9% by medical doctors, and 7.5% by other healthcare professionals. A total of 53% of videos contained at least one educational point while 47% of videos contained zero. The tone was overwhelmingly neutral in the videos analyzed, with 82% of videos taking a neutral tone when discussing port wine stains and 63% taking a neutral tone when discussing laser treatment. Risks, adverse events, and safety concerns were rarely discussed in TikTok videos (mentioned in 20% of videos). Several content creators appeared with significant frequency: 39% of all videos were produced by only four TikTok users.

Conclusion: TikTok remains an efficient and popular way to discuss treatment for dermatologic conditions. The majority (83%) of videos examined regarding the treatment of PWS with laser were published by patients and parents and the minority of posts were published by medical professionals (16.5%). Our review revealed that there is little information about risk, adverse events, and safety concerns on TikTok. TikTok is a popular information source for patients and their families with regard to PWS and laser treatment and physicians should engage with patients to determine what they understand in order to fill in knowledge gaps.

SUBMISSION TITLE: THE DERMATOLOGIST's ROLE IN REHABILITATION

Authors: Sarah Ahmed; Victoria Ricles; Lauren Xiques; Nadia Abidi; Andrew Krakowski

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Background: The introduction of fractional laser technology in the mid-2000s has revolutionized scar treatment, evolving the standard of care for rehabilitation medicine where restrictive scars are concerned. We present an uplifting case of the successful multidisciplinary treatment approach of a functionally debilitating scar with a combination of fractional ablative laser resurfacing and laser-assisted delivery of triamcinolone in combination with occupational therapy. A 65-year-old female with a history of adenoid cystic carcinoma of the right parotid gland status post parotidectomy, multiple surgeries requiring revision, and three failed skin grafts presented to the Scar Treatment and Rehabilitation (S.T.A.R.) Clinic in 2020 for a dermal "rope-like" collagenous scar that prevented her from performing specific activities of daily living. History revealed a weight loss of 30 pounds from inability to chew and limited ability to rotate her head. Ablative fractional laser resurfacing and laser-assisted delivery of triamcinolone in combination with occupational therapy was utilized in a series of treatments to decrease scar burden and improve overall quality of life.

Study Design/Materials and Method: Scar treatment with a combination of fractional ablative resurfacing and laser-assisted delivery of triamcinolone 40 mg/mL was initiated using the Ultrapulse Fractional CO_2 laser with energies up to 130 mJ and low densities in the 3%–5% range, sparing at least 95% of the treatment area. The patient was prescribed a 7-day course of acyclovir to be started 2 days before each procedure due to a history of oral herpes. The patient was referred to occupational therapy with specific goals of decreasing edema, increasing range of motion and strength, and optimizing independence of activities of daily living. A specific short-term goal of therapy was increasing range of motion by 10° in 4 weeks. A specific long-term goal was to establish more symmetrical rotation of the neck. Innovatively, we were able to utilize the facial composite score, an objective measure of lymphedema and fibrosis originally used in otolaryngology in head and neck cancer patients with post radiation complications, to chart improvement in scar reduction over time.

Results: Range of motion was recorded between March 2022 to July 2022, during which laser therapy and occupational therapy overlapped. Range of motion was improved by 35° on left rotation and 20° on right rotation. Progressive increase in lateral range of motion led to increased symmetry in lateral neck rotation. Facial composite score improved from 73 to 64 mm by August 2022. The patient's personal goals of increasing her range of motion by 10° and fibrosis reduction were met. The patient reported an overall improved quality of life following therapy, expressing ability to increase her range of motion and to be able to eat comfortably.

Conclusion: Function-comprising scars can lead to significant comorbidities such as psychosocial impairment, decreased quality of life, erythema, pain, and decreased range of motion. Laser surgery leads to a favorable remodeling response by fractionating tissue vaporization and coagulation across a treatment field. Lasers combined with a multidisciplinary approach that includes occupational therapy should be initiated at the onset of scar formation as standard of care. This patient with a restrictive scar contracture treated with laser-assisted delivery of corticosteroid via an ablative microfractionated 10,600 nm laser coinciding with occupational therapy exemplifies the novel role that Dermatologists should play in rehabilitative medicine. Dermatologists should be mindful in recognizing when to integrate energy-based device treatment into the realm of rehabilitation by increasing multidisciplinary collaboration in improving quality of life.

SUBMISSION TITLE: THE USE OF 595-NM PULSED-DYE LASER VERSUS 1550-NM NONABLATIVE FRACTIONATED LASER IN THE TREATMENT OF ANETODERMA: A SPLIT-LESIONS CASE REPORT

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Background: Anetoderma (macular atrophy) is a rare benign elasticity disorder that is characterized by focal or general loss of dermal elastic fibers and is clinically characterized by soft atrophic depressions or saccular outpouchings of the skin. Anetoderma can occur either primarily through idiopathic means or secondarily due to a prior dermatosis. Currently, there is no consensus regarding its optimal treatment. The reported therapeutic modalities such as surgical excision, cryotherapy, intralesional steroids, colchicine, hydroxychloroquine, vitamin E, oral penicillin G,

epsilon-aminocaproic acid, aspirin, niacin, dapsone, and phenytoin, have demonstrated limited success.

Recently, the use of pulsed dye combined nonablative fractionated lasers have shown promising result in treating the appearance of anetoderma.

This report provides a side-by-side comparison of the use of the pulsed-dye laser (PDL) versus 1550-nm nonablative fractionated laser in treating anetoderma. PDL emits light from a rhodamine dye solution. Currently, the 595 nm PDL is the gold standard treatment for cutaneous microvascular lesions. However, the utility of PDL specifically for Anetoderma has not been well described. Furthermore, there are promising report of nonablative fractionated laser used for treating Anetoderma. Therefore, we sought to compare the efficacy of PDL and nonablative fractionated laser in treating Anetoderma.

Study Design/Materials and Method: A 39-year-old female with extensive Anetoderma distributed on the right inferior upper back, right superior medial midback, left inferior upper back, and left superior medial midback, presented to clinic for laser or light therapy for treating Anetoderma. The patient back was divided into two zones with similar distribution and densities. Zone 1 was treated with PDL and Zone 2 with nonablative fractionated laser. Test spots with varying fluences and pulse widths were completed to determine the optimal parameters. One month later, Zone 1 was treated with PDL (fluence: 6 J/cm^2, pulse width: 1.5 milliseconds, spot size: 10 mm), and Zone 2 nonablative fractionated laser (fluence: 20 J/cm^2, pulse width: 2.7 milliseconds, Pass 6). Zones were evaluated pretreatment and posttreatment with photographs and adverse reactions were recorded.

Results: Near-complete clearance was achieved in both the PDL and nonablative fractionated laser zones after three treatments. The patient experienced temporary purpura and hyperpigmentation in the PDL zone and transient erythema with a higher pain score on the nonablative fractionated laser side. At 2-month follow up, there was no significant clinical difference between the two zones.

Conclusion: These results demonstrate that both PDL and nonablative fractionated laser have the potential to significantly improve Anetoderma with only a few sessions. It is possible that nonablative fractionated laser is equally effective, and may even be preferred by patients due to lower chance of post inflammatory hyperpigmentation after three treatment sessions. Our patient's lesions showed clinical improvement in both color and texture. Further studies are needed to optimize parameters, determine maximum efficacy, and provide long-term follow-up.

SUBMISSION TITLE: TREATMENT OF MELANONYCHIA WITH THE REVLITE Q-SWITCHED ND:YAG PHOTOACOUSTIC TECHNOLOGY PULSE (PTP) LASER THERAPY

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Background: Port wine stain is a congenital vascular lesion due to hyperdilated capillaries, seen in 0.3% of newborns [1]. For 65% of patients, the lesions gradually thicken to form hypertrophy resulting in facial deformity and ocular and neurological disorders [2]. Current treatment of port wine stains is based on the theory of selective photothermolysis through the use of laser on lesion areas, including pulsed dye lasers (585 and 595 nm), potassium titanyl phosphate lasers (532 nm), Neodymium: yttrium-aluminum-garnet (Nd: YAG) lasers (1064 nm), and photodynamic therapy.

The pulsed dye laser is the gold standard treatment of port wine stains [3]. The pulsed dye laser targets the chromophores in hemoglobin, where the light is converted to thermal energy and lead to the photocoagulation and necrosis of vessels. Unfortunately, the pulsed dye laser fails to achieve the desired outcome in some patients who have hypertrophy or develop resistance after a few treatments [4]. Specifically, the efficacy of the pulsed dye laser can be reduced by vessels with larger diameters or located in deeper subcutaneous areas, a higher degree of vascular density and superimposition, or increased melanin [5] For example, some dilated vessels can be larger than 500 μm in patients with hypertrophy and deeply located up to a depth of 3.7 mm, which may not be completely photocoagulated by pulsed dye lasers due to insufficient heat production [6,7]. Although other treatments, such as photodynamic therapy, have been developed in recent years few treatments have provided an ideal solution to the management of factors that lead to resistance.

Fractional carbon dioxide (CO_2) laser can potentially provide several solutions for patients with hypertrophic port wine stains including the above factors. First, instead of targeting the melanin and hemoglobin, fractional CO_2 laser heats the water within the tissue and cells and results in "micro thermal zones," which results in regeneration and remodeling in the surrounding tissues [8]. Therefore, fractional CO_2 laser can coagulate blood vessels that are larger than 150 μm and smaller than 20 μm in diameter and multiple vascular clusters of small diameter blood vessels

that are resistant to other therapies. Second, because fractional CO_2 laser can reach much deeper layers (up to 4000 μm) than other therapies, it can coagulate blood vessels in deeper subcutaneous areas. Third, fractional CO_2 laser creates micro thermal zones evenly distributed in a matrix pattern over 15%–25% based on fractional coverage of the treatment session. This does not completely break the epidermis and instead, the micro thermal zones are surrounded by intact tissues that can promote a fast process of healing.9 Thus, the fractional CO_2 laser can reduce the likelihood of adverse effects when compared to other therapies. Moreover, because fractional CO_2 laser does not target melanin, its efficacy is not limited by the level of melanin concentration. Skin types with a high melanin concentration usually require higher power with pulsed dye laser, which may cause burning, blistering, infection, and scars [6]. Based on these advantages, this case report describes two cases on the application of fractional CO_2 laser for the treatment of patients with hypertrophic port wine stains.

Study Design/Materials and Method: This case report described two cases with hypertrophic port wine stains. Case 1 is a 23-year-old female with a port wine stain birthmark on the left side of her face, jaw, and chin, about 25 cm × 15 cm in total area with a 3 mm thickness of hypertrophy. The patient was originally treated with pulsed dye lasers for 1 year at 6 years of age. General anesthesia was applied for each treatment due to the therapy-related intense pain. Although the first treatment using pulsed dye lasers was effective, the patient developed resistance to the second and third treatments. Due to the resistance, power was increased during the fourth treatment. Unfortunately, the stronger power caused blisters and infection and resulted in facial scarring. The patient subsequently stopped pursuing any treatment due to fear of pain and the potential for additional scarring. At age 18 the patient resumed treatment using CO_2 fractional laser therapy (Kinglaser KL carbon dioxide laser therapy machine [fractional], spot size 75 μm, density 15%–25%, energy settings 50–60 MJ).

Case 2 is a 17-year-old female with a port wine stain birthmark on the right side of her face, jaw, and chin, with a total area of approximately 9 cm × 7.5 cm. A recent ultrasound examination showed a 2.9 mm thickness of hypertrophy. The patient had previously been treated by photodynamic therapy at 9 years of age and continued photodynamic treatment for 3 years, three to four times per year. The outcomes were less than ideal. The patient stopped treatment due to pain, the need to avoid light, and a less than satisfactory result. At age 12, the patient resumed treatment using CO_2 fractional laser therapy (Kinglaser KL carbon dioxide laser therapy machine [fractional], spot size 75 μm, density 15%–25%, energy settings 50–60 MJ).

Results: Case 1: During the treatment of fractional CO_2 laser, no general anesthesia was applied but topical anesthesia was used on the treatment areas 1 hour before therapy. No bleeding was reported during or immediately after the treatment process. No infection, pigmentation, discoloration, or scarring was reported after the treatment. The improvement in the facial asymmetry of both sides was reported after the second treatment. Five treatments were applied within 3 years. Using the Vancouver Scar Scale, the score decreased from 11 before the use of the CO_2 fractional laser to eight posttreatment. The patient also reported much less pain during treatment and the intention to continue treatment.

Case 2: The patient reported much less pain compared with the experience with photodynamic therapy, and no topical anesthesia was employed during the last two treatments. There were 5–10 small areas that bled during the treatment process, which was easily controlled by light pressure with a cotton swab for a few minutes. No bleeding was reported after the treatment. No infection, pigmentation, discoloration, or scarring was reported after the therapy. The improvement of the facial asymmetry on both sides was reported after the third treatment. The pliability of lesions was reported as having the most improvement. Four treatments using CO_2 fractional laser were applied over 4 years. Using the Vancouver Scar Scale, the score decreased from 12 before the use of CO_2 fractional laser treatment to 9 afterward. The patient reported satisfaction with the treatment and expects to continue treatment.

Conclusion: To our knowledge, this is the first study that reports using fractional CO_2 laser on treating patients with hypertrophic port wine stains. The positive outcomes of these two cases suggest the efficacy of fractional CO_2 laser on the management of factors that contribute to resistant treatment.

Previous studies have reported positive outcomes with the use of continuous CO_2 laser, but it significantly increased the risk of scarring due to its continuous thermal damage [10]. Laubach et al. [11] found that fractional laser can reduce telangiectatic vessels through thermal damage to the dermal vasculature. Toren and Marquart [12] used Er:YAG fractional Laser immediately after pulsed dye laser to treat patients with resistance [13]. Although researchers used a fractional laser, the Er:YAG fractional laser fails to reach the dermis. Also, it is hard to estimate the contributions of fractional Er:YAG laser to treatment outcomes. Connolly et al. (2014) reported positive outcomes of using fractional CO_2 laser in treating burn scars. Although an increase of vessel density was seen, the diameter of vessels was reduced, leading to a decrease of the blood flow and clinical erythema. This may also reduce the resistance against the treatment of pulsed dye laser. When compared to previous reports, this case report on the use of fractional CO_2 laser shows that vessels in deeper subcutaneous areas can be treated without significant issues of thermal damage, scarring, and bleeding.

A few limitations should be noted in this case report. First, only two cases were observed which limits the generalizability of the findings. Applying this therapy to more patients is needed to further explore the advantages and limitations of using fractional CO_2 laser in treating

patients with resistance. Second, the interval between treatments was longer than expected given that patients had to go to school or work. Ideally, an interval of 4–6 weeks is expected between each treatment of fractional CO_2 laser. Because each treatment can only cover up to 25% of lesion areas, multiple times of treatments are required within a short period of time to cover the entire lesion area. However, patients in this study reported positive outcomes after a few treatments within 3 or 4 years. Third, more laboratory and pathological indicators are needed to examine the changes in lesions to further determine the optimal treatment parameters and estimate long-term outcomes.

This report demonstrates that fractional CO_2 laser is a potentially effective modality for the treatment of patients with hypertrophic port wine stains. Positive outcomes were reported with no adverse effects observed. Future studies with a larger number of patients, more laboratory indicators, and longer follow-ups are needed to evaluate the efficacy and safety of fractional CO_2 laser.

SUBMISSION TITLE: TREATMENT OF SEVERE TRUNCAL ATROPHIC ACNE SCARRING WITH CARBON DIOXIDE LASER ASSISTED DRUG DELIVERY OF POLY-L-LACTIC ACID

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Background: The neck is one of the most challenging anatomic sites to treat. There are limited nonsurgical treatment options available for the neck and many patients are either not candidates for or do not desire to have surgery. Ablative lasers may cause pigmentary problems or scarring in the neck and biostimulatory agents are prone to product accumulation and nodule formation, particularly in the anterior neck. By leveraging the tissue-dispersion and tissue-integration properties of hyaluronidase, hyperdilute Calcium Hydroxylapatite (CaHA) can be delivered in a more even dispersion. By combining the CaHA with a patient's own blood products (PRP), which contain growth factors and signaling molecules we hypothesized that this combination will synergize with CaHA to induce even more robust skin tightening, collagen formation, and elastic production. Furthermore, the addition of synchronous parallel beam ultrasound (SPBU; Sofwave technology), which further stimulates fibroblast activation, we postulated that this combination treatment would potentiate even greater skin tightening than that seen with monotherapy with either agent.

Study Design/Materials and Method: We created a 1:4 dilution of CaHA with PRP and hyaluronidase (1.5 mL CaHA and 6 mL diluent, which was comprised of 5 mL PRP and 1 mL hyaluronidase, for a total final volume of 7.5 mL). After creating a homogenous suspension of product by mixing the CaHA with diluent 25 times, the final homogenous suspension was immediately used for injection. The injection was performed at Day 0 and a single session of SPBU was performed at Day 30. Baseline images were performed at Day 0, interim patient images performed at Day 30 and 60, and final patient images performed at Day 120. On Day 60 and 120 an investigator global assessment, subject global assessment, and patient satisfaction survey were performed comparing baseline and final photos. Adverse event screening was performed at Day 60 and 120.

Results: Both investigator and subject global assessment demonstrated improvement in neck smoothness and tightness at Day 60 and 120. Subject satisfaction survey demonstrated high satisfaction scores across all queried domains. No adverse events were reported at Day 60 or 120.

Conclusion: CaHA is an effective biostimulator that can produce new collagen and elastin thereby improving the appearance of wrinkles and produce skin tightening. However, the anterior neck typically has a high rate of product accumulation and nodule formation due to poor product dispersion. The use of hyaluronidase facilitated improved product dispersion without any AEs at the end of the study. The combination of PRP as the diluent instead of saline together with SPBU appears to provide enhanced skin tightening greater than that seen with CaHA alone. While future investigation in larger numbers of patients is necessary to evaluate this treatment regimen more thoroughly, there may be a role for this combination treatment as a safe and effective treatment for nonsurgical neck rejuvenation.

SUBMISSION TITLE: USE OF Q-SWITCHED 1064NM ND:YAG LASER (REVLITE) PHOTOACOUSTIC TECHNOLOGY PULSE (PTP) LASER THERAPY IN THE TREATMENT OF FOLLICULITIS DECALVANS

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Background: Many methodologies for epilation exist and are widely available, however, improved techniques that offer greater accessibility, better results, and more permanent solutions are needed. Treatment for most cases of excess facial hair or facial hypertrichosis include topical, cosmetic, and aesthetic treatments or general skin care recommendations. Many patients with skin of color may be affected by excess hair that they deem to be cosmetically unacceptable. The use of the Cynosure RevLite SI Q-switched Nd:YAG photoacoustic technology pulse (PTP) laser for the removal of excess facial intermediate hair in a skin of color patient with Fitzpatrick skin type IV/V is reported.

Objective:

Report a effective treatment of fine facial hairs with Cynosure RevLite SI Q-switched Nd:YAG PTP in a patient with Fitzpatrick skin phototype IV–V.

Study Design/Materials and Method: Our patient presented with hypertrichosis of the lateral face. She underwent one treatment session to the lateral face with the Q-switched Nd:YAG PTP laser (Cynosure RevLite SI ®; HOYA ConBio ®, Freemont) at a wavelength of 1064 nm with a 6-mm spot size and a fluence of 5.9 J/cm^2 and a 10 nanoseconds pulse. The patient had not received any antiandrogen treatment before the time of presentation. Photographic documentation was obtained at baseline, 1 week later and 1 year after the initial treatment.

Results: Clinical improvement was achieved in this patient without any adverse effects and results were maintained at 1 year follow-up visit. Intermediate hairs were significantly reduced based on clinical assessment 1 week after the initial, single treatment, integrated site scores revealed 80% fewer hairs. There were no adverse events observed.

Conclusion: The use of a Q-switched Nd:YAG PTP laser therapy is efficacious in reducing the density of fine dark facial hair is after one treatment session. This laser therapy is advantageous given the long-lasting results which were maintained 1 year after the initial treatment and a lack of adverse associated events.

Key words: intermediate hair; laser hair removal; Cynosure RevLite SI Q-switched Nd:YAG laser; photoacoustic technology pulse; excess hair

SUBMISSION TITLE: WHERE ARE WE WITH NONINVASIVE BODY CONTOURING TECHNIQUES AND WHAT IS NEW: AN OVERVIEW

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Background: Recently, a novel radiofrequency-injector device that has dual-length multineedles (long and hollow needles for RF and injection at the reticular dermis; and short microneedles for RF at the papillary dermis) was proven to have excellent efficacy and safety on the improvement of periorbital wrinkles in a split-face clinical trial report (Lim et al., 2021). The present study aimed to demonstrate the dermal regenerating effect of the dual-length microneedle radiofrequency hydro-injector treatment (DLRI) in human skin.

Study Design/Materials and Method: A total of 10 excised skin samples from five patients who underwent face-lifting surgery (bilateral rhytidectomy of the lateral face) were used. The patients underwent the DLRI treatment 4 weeks before the surgery on their whole face sparing an area for the negative control, one of two areas that are planned to be excised. The histology and expression level of dermal matrix proteins were compared.

Results: Reticular dermis of the DLRI-treated skin samples showed more thick, dense, and well-preserved horizontal orientation of collagen bundles compared to that in the control group. In the papillary dermis, elastin fibers were more prominent and vertically elongated in the treated group than in the control group. The in vivo analysis showed that the expression levels of dermal matrix proteins were elevated in the treated group compared with the control group.

Conclusion: The DLRI treatment seems to effectively regenerate the photoaged skin by improving the quality of the dermal matrix. The data could support the efficacy of the previously reported clinical study.