CO_2 laser. A single burn rehabilitation therapist conducted all pre- and post-procedure scar evaluations, which included the Patient and Observer Scar Assessment Scale (POSAS), Vancouver Scar Scale (VSS), Institutional Scar Comparison Scale (SCS), durometry, and active range of motion (AROM) measurements.
Results: From September 2018 to September 2019, 25 patients began the LSR program and underwent at least two treatments with post-laser scar assessments for each intervention. Patients underwent an average of 3±1 LSR sessions during the time period for a total of 84 sessions among the group. Patients averaged 51 ± 14 years old (range: 26–80), with all Fitzpatrick skin types represented (mode Type 5). Average HTS age was 14 ± 19 months post-injury (range: 3–98 months post injury). After one session of LSR, 91% of patients improved in at least 1 scar assessment metric (average 3 ± 1.4 areas). After two sessions, all patients showed improvement in at least one metric (average 3.6 ± 1.2 areas). One LSR session was associated with a $10.8 \pm 31.9\%$ improvement in AROM of a HTS-affected joint, and this increased to $38.1 \pm 41.4\%$ after five LSR treatments ($p = 0.0002$). Durometry readings demonstrated decreasing scar hardness compared with a baseline of uninjured skin in 90% of patients, and 96% of patients experienced improvements in POSAS, VSS, and SCS scores during a treatment course.
Conclusion: Improvements in burn HTS can be achieved with fractional ablative laser therapy in a wide range of scar ages and skin types, as early as the first LSR session. These continue to increase as additional sessions are performed. This work suggests necessary baseline evaluation components for patients undergoing LSR, as well as a timeline for expected clinical improvements. These data may inform conversations with burn survivors and providers when considering laser therapy for symptomatic HTS.

Clinical Applications A – Skin Cancer

CLINICAL ASSESSMENT OF A REAL TIME, HIGH PERFORMANCE SKIN CANCER DIAGNOSTIC DEVICE BASED ON LASER INDUCED PLASMA SPECTROSCOPY AND DEEP LEARNING ALGORITHM

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Background: There have been several optical-based techniques for *in vivo* skin cancer detection and screening such as multispectral imaging and Raman spectroscopy. However, they adopt high cost lasers and imaging sources and have relatively insufficient accuracies for actual clinical use. In this study, a real time, non-invasive, *in vivo* skin cancer diagnostic device has been developed with high diagnostic accuracy based on non-discrete molecular laser induced plasma spectroscopy (LIPS) and convolutional neural network.
Study Design/Materials and Method: A Multi-centre study was designed to evaluate the effectiveness and safety of the aforementioned diagnostic device. A conventional Q-switched 1064 nm laser incorporated in the device was used to induce micro plasma from the suspicious skin lesion. Real-time analysis was performed on the plasma light spectrally, to extract elemental and molecular information of the suspicious lesions. The device was pre-calibrated using an algorithm constructed by convolution neural network (CNN) trained with the total 6962 emission spectra of cancerous and benign lesions. The CNN-based diagnostic algorithm was validated by assessing emission spectra of 42 skin cancers and 58 benign lesions collected from 50 subjects.
Results: The device provides a numeric result, implying the similarity of spectral data of the suspicious lesion to those of cancerous skin lesion collected and stored in the spectral database. The accuracy validation of the diagnostic algorithm was performed by comparing the device results with the histopathology results. Analysis achieved a sensitivity of 95.2% and specificity of 89.7% in discriminating skin cancers from benign lesions in a blind setting.
Conclusion: A novel skin cancer diagnostic device based on non-discrete molecular LIPS and CNN-based diagnostic algorithm demonstrated to be a promising tool for the detection of skin cancers with superior diagnostic accuracy compared with other previous optical-based diagnostic techniques.

COMPARISON OF SAFETY AND EFFICACY BETWEEN CONVENTIONAL AND DAYLIGHT PHOTODYNAMIC THERAPY IN THE TREATMENT OF ACTINIC KERATOSIS

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Background: Natural sunlight can be used to activate protoporphyrin IX (PPIX) in actinic keratosis (AK) lesions, a novel technique more commonly known as daylight photodynamic therapy (dPDT) [1]. In dPDT, methyl aminolevulinate (MAL) or 5-aminolevulinic acid (ALA) is applied to the pre-cancerous lesions after which patients receive natural sunlight for around 2 hours. Studies comparing dPDT with conventional PDT (cPDT) using an in-office red or blue light have been published. We performed a meta-analysis of these studies to investigate the effectiveness of dPDT versus cPDT.
Study Design/Materials and Method: We extracted relevant literature from PubMed, Embase, Web of Science, and the Cochrane Library using search terms for dPDT and cPDT, skin cancer, and actinic keratosis. All studies in English that examine the application of dPDT versus cPDT (or dPDT alone) were included in the analysis. From each study, we extracted the percent difference in AK clearance between cPDT and dPDT with 95% CI. Meta-analyses were performed using the random-effects model. The I^2 statistic was used to measure heterogeneity between studies. Forest plots were calculated to calculate a pooled percent difference for the outcomes of interest, and funnel plots were additionally constructed to assess for publication bias.
Results: Two thousand and twenty-eight records identified through the database search. Of these, 104 were assessed for eligibility; four studies were included in the qualitative analysis. An additional four studies were included in the meta-analysis for a total of 2581 and 2559 AKs treated with dPDT and cPDT, respectively. Analysis demonstrated that dPDT non-inferior to cPDT at 3 months for clearance of AKs (pooled percent difference, –3.75; 95% CI –4.49 to –3.01). The I^2 value of 0% ($p = 0.914$) demonstrated no significant heterogeneity among the studies.
Conclusion: Daylight photodynamic therapy is a safe, reliable, and non-inferior method for the treatment of AKs when compared to conventional photodynamic therapy.

PROSPECTIVE LONG-TERM FOLLOW-UP OUTCOMES AFTER 1064 nm Nd:YAG LASER TREATMENT OF BASAL CELL CARCINOMA

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