614 Laser-treatment of Hypertrophic Scar Induces Change to Epidermal Histoarchitecture Correlating to Improved Epidermal Barrier Function

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Introduction: Mechanisms and timing of hypertrophic scar (HTS) improvement with laser therapy are incompletely understood. Epidermal keratinocytes influence HTS through paracrine signaling, yet they are understudied compared to fibroblasts. It was hypothesized that fractional ablative CO_2 laser scar revision (FLSR) would change the fibrotic histoarchitecture of the epidermis in HTS.
Methods: Duroc pigs (n=4 FLSR and n=4 controls) were injured and allowed to form HTS. HTS and normal skin (NS) were assessed weekly by non-invasive skin probes measuring trans-epidermal water loss (TEWL) and biopsy collection. There were 4 weekly FLSR treatments. Early laser treatment began on day 49, and late began on day 77. Punch biopsies from NS and HTS were processed and stained with H&E. Image J was used to obtain epidermal thickness and rete ridge ratios (RRR). Gene and protein expression of involucrin (IVL) was examined through qRT-PCR and immunofluorescent (IF) staining.
Results: After treatment, peeling sheets of stratum corneum were apparent which were not present in the controls. TEWL was increased in HTS vs. NS at day 49 indicating decreased barrier function (42.2±8.0 vs. 22.0±4.62g/m^{2}h, p=0.05). In the early group, TEWL was significantly decreased at week 4 to 16.4±3.5 g/m^{2}h (p< 0.05). The late group was not significantly altered from NS at the pre-laser timepoint (day 77=12.1±1.99 g/m^{2}h). Hence, there was no decrease in TEWL post-FLSR. After 4 sessions, epidermal thickness was significantly increased in treated scars in both FLSR groups (early:pre=85.6±6.8 vs. week 4=115.2±12.0 µm, p< 0.01) and (late:pre=75.2±6.6 vs. week 4=125.7±12.0 µm p< 0.001, n=8 scars,). There was no increase in controls. Late intervention significantly increased RRR (pre=1.3±0.1 vs. week 4=1.9±0.1, n=8 scars, p< 0.05***),*** and early treatment trended towards increase (pre=1.17±0.05 vs. week 4=1.4 + 0.1). There was no increase in controls. There was increased IVL gene expression in HTS vs. NS that decreased after FLSR. Eight scars had up-regulated gene expression of IVL vs. NS levels pre-treatment (FC >1.5) compared to 4 scars at week 4. This was confirmed by IF where IVL staining decreased at week 4.
Conclusions: Changes in epidermal HTS histoarchitecture and expression levels of epidermal differentiation markers were induced by FLSR. The timing of laser intervention contributed to differences in TEWL, epidermal thickness, and RRR.

615 Evaluation of Topical Off-The-Shelf Therapies to Improve Burn Wound Healing During Prolonged Field Care

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Introduction: Burns are common injuries in the battlefield. Given austere environments, prolonged field care (PFC) is often necessary. Delays in surgical debridement create a risk of infection and deranged healing for burn patients. As such, this study attempts to identify the best commercially available off-the-shelf (OTS) dressings with field-deployable potential.
Methods: Deep-partial thickness burns (1" diameter) were created on the dorsum of 3 anesthetized pigs utilizing a thermocoupled burn device at 100°C for 15s. Non-surgical debridement was done 1-h post-burn creation and either an OTS dressing or standard-of-care (SOC) treatment (Silver Sulfadiazine) was applied to the wound in order to simulate a PFC environment. OTS dressings were randomized and included irradiated sterile human skin allograft (ISHSA), alloplastic absorbable skin substitute (AASS), and synthetic polyurethane dermal matrix (SPDM). Wounds were serially assessed on post-burn days 3, 7, 14, 21, and 28. Assessments were conducted using a combination of photographs, histology, and quantitative bacteriology. Endpoints included burn wound progression, re-epithelialization, wound contraction, scar elevation index (SEI), and colony forming units (CFU).
Results: No statistically significant differences in burn wound progression were seen on days 3 and 7 for the ISHSA or SPDM and the SOC. The differences between the AASS and the SOC were statistically significant on both days ($p \leq 0.05$). Day 21 re-epithelialization results for the ISHSA, AASS, SPDM and SOC treated wounds were 30%, 85%, 95%, and 78% re-epithelialized, respectively. The difference between the AASS and the SOC was statistically significant ($p \leq 0.05$). Results showed that by day 28, wound contraction for the ISHSA, AASS, SPDM and SOC treated wounds were 65%, 80%, 82%, and 78%, respectively. No statistically significant differences in wound contraction were seen for any of the OTS dressings and the SOC. SEI showed no statistically significant difference in scar hypertrophy between the OTS dressings and the SOC on day 28. CFU results showed no statistically significant differences between the OTS dressings and the SOC on days 3 and 7.
Conclusions: Three OTS dressings were compared to the SOC for use in the PFC setting. Generally, all the dressings performed well when compared to the SOC in terms of burn