

The Use of Low-Level Light Therapy of Different Wavelengths to Improve Wound Healing after Micro-Needling Skin Rejuvenation and after Facelift Surgery: A Split-Face Randomized Study

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Background and Objective: Low-level light therapy (LLLT) by light emitting diodes (LED) has been shown to improve skin rejuvenation as a stand-alone treatment¹⁻². To date, no split-face studies have been done to validate whether LLLT therapy enhances skin healing after micro-needling for skin rejuvenation or after facelift surgery. This pilot study investigated the therapeutic benefit of a spectra of LED wavelengths on skin treated by micro-needling or skin adjusted after facelift surgery.

Study Design/Materials and Methods: After completion of a detailed consultation and consent forms in all Study Group I and II patients, standardized photography, VISIA (CANFIELD Imaging Systems, Parsippany, NJ), and Cortex Skin Analyses (Hadsund, Denmark) were obtained at baseline and six weeks after treatment. Anti-viral medication was begun two days before and continued for six days after treatment. Two independent medical assistants in the skin care center, who were not involved in the Pilot Studies, evaluated changes from standardize photographs at baseline and six weeks, using the validated Investigator Global Aesthetic Improvement Scale (IGAIS) scored as: 1 = very much improved; 2 = much improved; 3 = improved; 4 = no change; 5 = worse). Patients were asked to assess their own perceived changes from their standardized photographs at baseline and six weeks, using the validated Subject Global Aesthetic Improvement Scale (SGAIS), scored as: 1 = very much improved; 2 = much improved; 3 = improved; 4 = no change; 5 = worse).

In Study Group I, ten healthy female patients (49.0 average age; range 30-62 years; Fitzpatrick 2-4) underwent full face 1.0-1.5mm micro-needling (DermaPen®, Dermapen World, Terry Hills NSW 2084 Australia) with three passes in the vertical, horizontal and oblique directions. The Dermapen® tip consisted of a disposable, spring-loaded piston with an array of eleven 33-gauge needles protruding from the end that is attached to the motorized hand-piece. Each needle was about 0.02mm (200 microns) in diameter and arranged in a fractional pattern design. The piston stroke speed frequency was selected at the non-working end of the hand-piece at Level 7 (90Hz). Five patients with odd registration numbers were randomized to receive multi-spectral LLLT treatments (LightStim®, Irvine, CA 92606) to their right hemi-face, while five patients with even registration numbers were treated only to their left hemi-face. The treated hemi-face received fifteen minutes of LED exposure twice weekly for six weeks. The untreated hemi-face was protected from LED exposure during treatments by tin foil and wet towel coverage. The LightStim® system consisted of two articulated hinged panels, emitting 4-5 separate wavelengths between 455nm and 945nm from a total of 1,130 LEDs. The panels were adjusted about one inch from the face with the patient supine with protective eyewear.

In Study Group II, ten healthy female patients (60.0 average age; range 55-68 years; Fitzpatrick 2-4) underwent a limited submuscular aponeurotic system (SMAS) facelift by the author. Five patients with odd registration numbers were randomized to receive multi-spectral LLLT treatments to their right hemi-face, while five patients with even registration numbers were treated only to their left hemi-face. The treated hemi-face received fifteen minutes of LED exposure twice weekly for six weeks. The untreated hemi-face was protected from LED exposure during treatments by tin foil and wet towel coverage.

Results:

Investigator (IGAIS) and patient (SGAIS) satisfaction scores, based on the Visual Analogue Scale, are listed in Table 1 at the sixth week follow up period.

Group I Patients: The micro-needled and LED treated hemi-faces received satisfaction ratings of “Improved-Much Improved” by IGAIS (2.5 ± 0.8) and “Much Improved-Very Much Improved” by SGAIS (1.6 ± 0.8) at six weeks. In contrast, the micro-needled hemi-faces were assessed ratings of “Improved” by IGAIS (3.0 ± 0.8) and “Improved” by SGAIS at six weeks, as shown in Figure 1. The mean percent scores by VISIA Skin Analyses for wrinkles improvement after micro-needling and LED ($22.4 \pm 2.1\%$) was significantly higher than after micro-needling alone ($9.5 \pm 3.8\%$), while mean percent elasticity scores by Cortex Skin Analyses was statistically non-significantly higher ($12.4 \pm 1.5\%$) after micro-needling and LED than that observed after micro-needling alone ($11.4 \pm 1.5\%$).

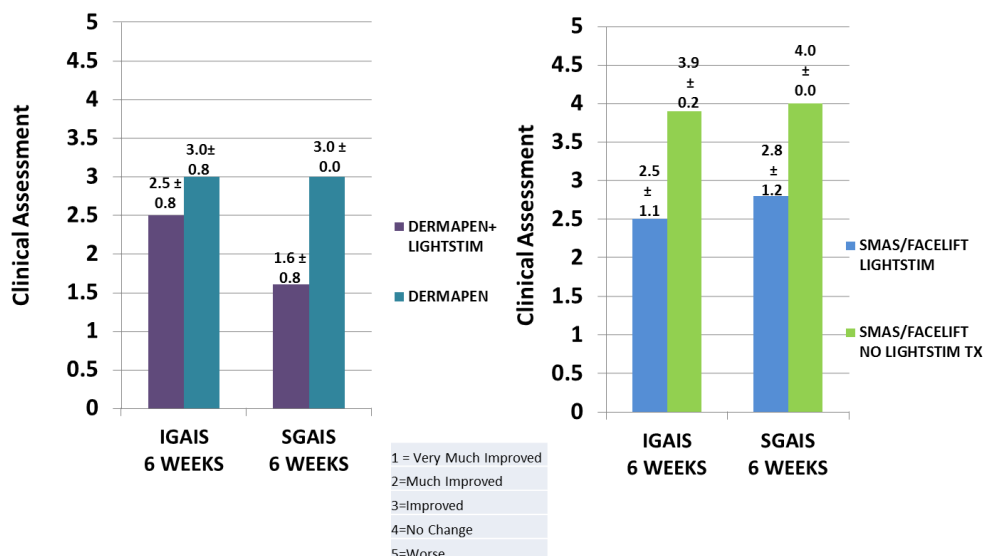
Group II Patients: The LED treated hemi-faces after facelift surgery received satisfaction ratings of “Improved-Much Improved” by IGAIS (2.5 ± 1.1) and “Improved-Much Improved” by SGAIS (2.8 ± 1.2). In contrast, the hemi-faces without LED treatments were assessed ratings of “Improved-No Change” by IGAIS (3.9 ± 0.2) and “No Change” by SGAIS (4.0 ± 0.0), as depicted in Figure 2. The mean percent scores by VISIA Skin Analyses for wrinkle improvement after SMAS-facelift and LED ($30 \pm 3.0\%$) was significantly higher after SMAS-facelift surgery alone ($16 \pm 2.0\%$), while the mean percent elasticity improvement by Cortex Skin Analyses was the same after surgery plus LED vs surgery alone.

Conclusions:

In a split-face pilot study, LightStim® low-level light therapy was observed to benefit skin appearance by six weeks as a combined treatment after a micro-needling procedure or SMAS- facelift surgery. Patients also observed less swelling, erythema, and pain on the LED-treated side than the control side. Although VISIA Skin Analyses demonstrated concomitant improvements in reduction of UV spots, porphyrin marking (bacteria), pore reduction and textural changes after LED treatments combined with micro-needling or facelift surgery, the pilot study LED treatment protocol will require further investigation to optimize results. For over fourteen years, LLLT continues to have integral role in my plastic surgical and medical skin care center as a stand-alone treatment and adjunctive therapy after surgical procedures.

1. Dungel, P.; Hartinger, J.; Chaudary, S.; et al. Low Level Light Therapy by LED of Different Wavelengths Induces Angiogenesis and Improves Ischemic Wound Healing. *Laser and Surgery Medicine* 46: 773-780; 2014.
2. Sasaki, GH; Oberg K; Tucker, B; et al. The effectiveness and safety of topical PhotoActiv phosphatidylcholine-based anti-cellulite gel and LED (red and near-infrared) light on Grade II-III thigh cellulite: A randomized, double-blinded study. *Journal of Cosmetic and Laser Therapy*, 87-96; 2007.

Satisfaction Score Assessments by Investigator and Subject Global Aesthetic Improvement Scales



Microneedling w/
LED Tx
SkinCare



6 WEEKS

Figure 1

Microneedling w/
SkinCare



6 WEEKS

Post Surgery w/
Weekly LED Tx
SkinCare



10 DAYS

6 WEEKS

Figure 2

Post Surgery No LED
Tx



10 DAYS

6 WEEKS