RED LIGHT-EMITTING DIODE (LED) THERAPY-ASSISTED HEALING IMPROVES RESULTS OF FACIAL SKIN FRACTIONAL RESURFACING

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INTRODUCTION

Laser ablative resurfacing is an effective method for rejuvenating photo- damaged facial skin but it is often associated with several weeks of burn-related sequelae. When ablative resurfacing is practised in the so-called fractional mode, the Er:YAG recovery time is shortened and there are fewer post-operative complications. Light-emitting diode (LED) phototherapy is a new; proven method for the accelerated healing of wounds, post surgery (1). These beneficial effects may help to further shorten the post operative downtime after ablative fractional laser. This study looks at the effects of LED therapy on the rate of recovery time, post fractional Er:YAG resurfacing.

MATERIALS & METHOD

Patients

Forty females mean age 52 years were treated, (4 full face, 10 periocular and 26 perioral). Skin phototypes were: 5, type II; 29, type III and 6, type IV. All patients were treated in the fractional mode with the Er:YAG laser for skin resurfacing. Forty patients, matched for age, skin type and treatment location, who had previously undergone the same fractional Er:YAG laser ablative resurfacing methodology, but without using LED therapy post operatively, were retrospectively selected for comparison. Details of the treatment were explained to all patients and all signed a form of consent for surgery and use of clinical photography. Patients in the retrospective group were already covered by written informed consent. The Ethics Committee of the Antoni de Gimbernat Foundation approved the treatment protocol and method of collection of data.

Er:YAG laser for fractional resurfacing

The Er:YAG Pixel laser system (Alma Laser™, Israel) is equipped with a lens splitter to divide the Er:YAG 2940 nm beam into various microbeams. The area of treatment is an 11 x 11 mm square which produces 49 to 81 microbeams defining the treatment beam density. The energy programme is based on pulse length, delivering from 800 mJ/cm^2 to 1400 mJ/cm^2 at short and long pulse duration, respectively. Treatment can be given without the use of anaesthesia and repeated laser passes leads to heat accumulation in tissue, which is directly correlated to pain sensation experienced at the time of laser shots. Therefore, the use of topical anaesthesia is recommended for higher energy densities or when various laser passes are planned for treatment. Long pulse programme and 8 passes were used for those skins presenting grade III wrinkles (more RTD to trigger new collagen formation), compared to between 800 mJ/cm^2 and 4 passes, or 1000 mJ/cm^2 and 6 passes for those presenting with grades I & II, wrinkles respectively.

Phototherapy Unit

Both groups were treated with the same protocol with the Er:YAG laser in fractional mode but, in one group only, patients were treated after resurfacing with the Omnilux LED based phototherapy system (Photo Therapeutics Ltd., Fazeley, Tamworth, UK) which consists of a base unit fitted with interchangeable LED array-treatment heads of different wavelengths. The panels on the head are articulated to allow the head to follow the contours of the face. Following Er:YAG laser fractional ablative resurfacing, light at 830 +/- 5 nm (near infrared) and at 633 +/- 3 nm (visible red) was alternately delivered from interchangeable heads (Omnilux plus™ and Omnilux revive™). In total 5 treatments were delivered daily, on days 1-3 and days 5 & 7.

RESULTS

Tissues healing time and post operative symptoms were recorded using an analogue scale. The scale (a standard scale used by the **Instituto Medico Vilafortuny**) was identical to that used in the prospective study. Healing time in the LED treatment group post Er:YAG fractional resurfacing was around 60% faster and symptoms were less apparent compared with the reference group. At the moment of skin healing, skin surface aspect was better in the LED treated group with a more natural appearance, according to the opinion given by personnel involved in and familiar with this type of treatment.

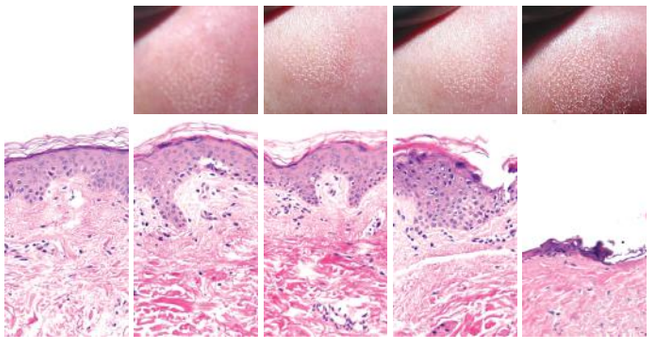
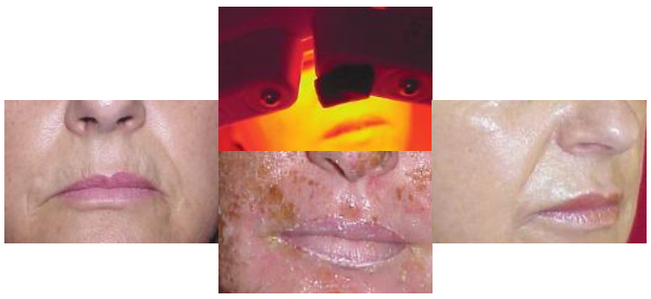


Figure 1 Demonstrating histological and skin aspect changes after progressive passes of fractional Er:YAG laser. Notice progressive epidermal elimination, which increasingly produces more RTD as demonstrated in figures corresponding to 6 passes.

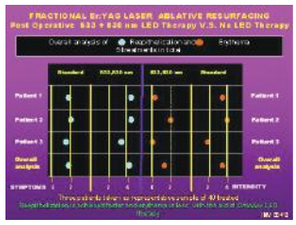
Before and 5 days after Fractional Er:YAG resurfacing LED therapy. Central image, 1 day post surgery, clearly showing RTD appearing as a yellowish aspect of the skin's surface. 5 day image demonstrates complete healing after exposure to LED therapy.

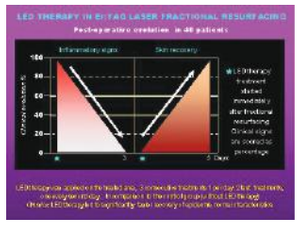


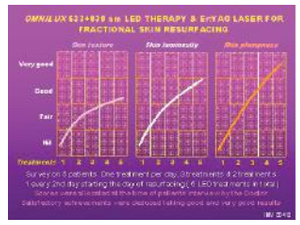
Full face Fractional Er:YAG resurfacing LED therapy. Central image clearly shows extensive scabbing 3 days post surgery as a result of various laser passes which result in dermal RTD. 6 day image clearly demonstrates complete healing and practically no residual erythema after exposure to LED therapy.

DISCUSSION

Combined LED therapy with Er:YAG fractional resurfacing significantly reduces healing time, decreases pain and discomfort and enhances quality of skin aspect of fractional resurfaced photoaged facial skin. Fractional resurfacing stimulates collagen formation through the primary effects of RTD. RTD results in a wound repair process with repercussions on fibroblast activity and hence fibre formation. This primary effect, added to epidermis renewal due to Er:YAG fractional ablation, is enhanced by LED therapy. Combinations of quasi monochromatic light at 633 and 830 nm, have been shown to stimulate collagen formation, stimulate fibroblast and T homing cell activity and improve global skin parameters (2- 4). Accelerated wound healing using Low incident doses of laser energy, (LLLT) has been well documented (5-7), its tranformation to LEDs, although a novel approach is becoming an exciting new application. (6).







CONCLUSIONS

LED therapy after Er:YAG laser fractional resurfacing accelerates skin healing controlling side effects such as pain, discomfort, fine scabbing and oedema. Erythema and skin condition seem to also benefit from this LED therapy following Er:YAG laser fractional ablative resurfacing of photoaged skin.

ACKNOWLEDGEMENTS

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