Journal of Clinical & Experimental Dermatology Research

Elmelegy and Sakka, J Clin Exp Dermatol Res
2015, 6:4
DOI: 10.4172/2155-9554.10000296

Research Article Open Access

Intensive Pulsed Light, Radiofrequency and Cooling in Aesthetic Treatment of Unpleasant Facial Scars

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Received date: May 17, 2015; **Accepted date:** Jun 21, 2015; **Published date:** Jun 28, 2015

Abstract

Background: With the advent of non-ablative devices to treat various aesthetic demands, promising results appeared and are set to become a safe, efficient, and reliable method for scar treatment. In this work, we are going to study the effect of E light (IPL+ RF+ cooling) in treatment of facial scars.

Patients and Methods: This study included forty eight patients with persistent post-surgically corrected old and recent facial scars. E light was used, using different filters, according to the skin color. The IPL fluence varied between 38-42 J. RF fluencies varied between 6 and 10 J, and the spot diameter was 8 × 32 mm. Pulse durations of 2-7 ms, and pulse delays of 15–30 ms were used on all patients.

Results: Six cases were evaluated as excellent, 34 cases were evaluated as good, and eight cases were evaluated as fair, but all patients stressed that their wounds have been improved.

Conclusions: E light induced significant overall clinical improvement in facial scars, particularly in textural smoothing, pliability and scar color. E light was found to give better results when applied early after surgery.

Keywords: Facial scar; IPL; Radiofrequency; Aesthetic outcome

Introduction

Along the human history, facial scars represent a problem, where most of solutions are unsatisfactory. The search for a more successful method with long term better results at different skin types remains the main challenge facing plastic surgeons [1].

The synergistic effect of combining radiofrequency (RF) and optical energy allows for lower optical fluencies to be utilized that can be used for a safe treatment of darker skin types [2].

The RF field for the bipolar system depends on the impedance properties of the tissue; the current will flow to the area of minimal impedance between the two electrodes [3].

The resultant energy of light creates a preheated area inside the tissue, and directs the RF field into this preheated area versus the surrounding tissue. As the pulse durations are usually initiated at the same time, the RF pulse is set at a longer duration versus that of the light energy to preheat the target and so increases RF selectivity [4].

This heat profile created is distributed to both the epidermis and more to the dermis giving better results with minimal risk to the surrounding tissue [5].

Current treatment options for scars include topical or intralesional corticosteroid injections, intralesional bleomycin, or 5-fluorouracil, silicone gel sheets, pressure therapy, radiotherapy, cryotherapy, laser, and surgery. Other strategies, including the use of transforming growth factor-b, collagen synthesis inhibitors, non-steroidal anti-inflammatory agents, minocycline, angiotensin-converting enzyme inhibitors, and gene therapy, are still under study [6]. These methods vary in efficacy and their use is limited by high recurrence rates and side effects including pigmentary changes, skin atrophy and induces pain [7].

Because of the limited results of currently available treatments, other options such as, long-pulsed dye laser (LPDL) and short-pulsed dye laser (SPDL) have been used. Their use improved the appearance of hypertrophic scars [8,9]. Nouri et al reported that, the flash lamp-PDL was found to be the best treatment to achieve long-term improvement in the appearance of hypertrophic scars [10].

Also intensive pulsed light (IPL) treatment has been extensively used for photo rejuvenation [11], treatment of vascular skin lesions [12], and hair removal [13]. However, its use on hypertrophic or keloid scars has been reported in only a few studies [14,15].

To the best of our knowledge, there are no reports about using E light (IPL+ RF+ Cooling) in facial scars. In this work, we are going to study the effect of E light in treatment of persistent post surgically corrected facial scars.

Patients and Methods

This study was done in El Menofia and Tanta university hospitals, plastic surgery departments, in the period from March 2011 to March 2015.

This study included forty eight patients with unpleasant post surgically corrected old and recent facial scars. Ethical committee

approval was obtained prior to study initiation and all subjects signed an informed consent form. Scars appeared concave, serrated edges, hyper pigmented, sometimes erythematous or with stitch marks. The durations of scars were of 1-120 weeks (the average was 16 weeks). The ages of patients varied between 2-56 years old (the average was 23 years old). 34 were males, and 14 were females. Twelve scars were located at forehead, four at the lateral side of the upper face, and 32 scars at mid face, six of them extend to the lower face with Skin type : 9 Type II, 29 type III and 10 type IV.

Inclusion criteria: all patients with post traumatic scar, either early or late.

Exclusion criteria: included presence of active infection, heart disease or coagulation disorders , compromised immune function; previous treatment with dermabrasion, chemical peel, filler to the study areas; photosensitivity; use of oral retinoid drugs within the past 6 months; and inability to follow the treatment protocol.

Technique

Local anesthetic cream (lidocaine 2.5%) was topically applied for half an hour. All scars were treated with E light. All patients received sessions at 4-week intervals; the number of sessions varied between 4 and 8 sessions, based on the response of the patient. E light was used using different filters, 530 nm, 560 nm, 580 nm, 630 nm and 755 nm, according to the skin color to avoid complications. The IPL fluence varied between 38-42 J. RF fluencies varied between 8 and 10 J, and the spot diameter was 8 × 32 mm. Pulse durations of 2-7 min, and pulse delays of 15-30 min were used on all patients. After exposure, cold compression was applied for 10 minutes; then an antibiotic, anti-inflammatory ointment which contains panthenol, calendula extract, chlorohexidene, triclosan and paraffin oil, was applied till inflammation and or edema disappeared. Patients were instructed to use sunscreen on the treated area after the surface crusting had resolved. Avoidance of intentional sun exposure to the treated area was advised for a period of three months following the treatment. The patients were followed up every four weeks. If any residual lesion persisted, it was retreated in a similar manner once or more again. The minimum follow up after the last session was 2 months and the maximum was 3 years.

Clinical results were evaluated using the photographs from before, and the final results of the treatment. A subjective satisfaction evaluation score was done by four plastic surgeons and the patient. It was recorded as excellent, good, fair, and poor results (Table 1).

Record	Degree
Excellent	3
Good	2
Fair	1
Poor	0

Table 1: A subjective satisfaction evaluation score.

Cases in which the color tone and skin texture of the scars were not different from the surrounding normal skin was considered as excellent, Cases in which the color tone was not different from the surrounding normal skin and the surface irregularity was justified, were evaluated as good. Cases in which the color tone became near normal, but the surface irregularity remained, were evaluated as fair. Cases, in which there is neither improvement in the color tone nor the surface irregularity of the scars, were evaluated as poor results.

Results

Clinical outcomes are also summarized in Table 2:

Results	Number of patients	Percentage %
Excellent	10	(20.8%)
Good	34	(70.8%)
Fair	4	(8.4%)
Bad	0	0%

Table 2: Clinical outcomes.

Six cases were evaluated as excellent where it is so difficult to define the site of the old scar, 34 cases were evaluated as good where there is marked improvement of scar with disappearance of irregularity, and eight cases were evaluated as fair where still there is some depression and the scar still can be seen. No poor results were reported. All patients stressed that their wounds have been improved. The crusting was minimal and usually healed within three days with the aid of an antibiotic ointment. Six patients developed an immediate edema over the treated area that lasted 2-3 days, but there were no adverse effects in any of the treated patients. The translucent thin scar appeared to be thickened and the concave irregularities were flattened in 83.3%, of the patients. Skin texture and pigmentation also improved in all cases (Figures 1-9).

Figure 1: (A). Fourteen-year-old male with a linear concave, erythematous scar on the left cheek extending to the forehead. **(B).** Six months after 5 sessions, showing excellent results.

Discussion

Many medical lines of treatments have been improved in order to obtain maximum possible facial scar reduction, but the results are usually unsatisfactory [16].

To treat hypertrophic scars and keloid, pulsed dye laser has been reported to yield acceptable results in clinical use [17]. The thermal

effect results in the decrease of release of growth factors from the endothelial cells or fibroblasts, leading to the degeneration of the scar tissue [18].

Figure 2: (A). Twenty seven years old male with a linear scar on the forehead. **(B).** six months after 4 treatments showing excellent results.

Figure 3: (A). Twenty seven years old female with a linear erythematous scar at the forehead. **(B).** Six months after 5 treatments showing excellent results.

Figure 4: (A). Thirty three-year-old male with a wide concave, erythematous scar on the left cheek. **(B).**Six months after 5 treatments showing good results.

Figure 5: (A) Three-year-old male with a concave hyperpigmented scar at the left side of the mid face extending to the lower face. **(B)** Eight months after 6 treatments showing good results.

Figure 6: (A). Twenty five -year-old male with a linear erythematous scar on the left cheek. **(B).** Eight months after 5 treatments showing, good results.

Figure 7: (A). 23 -year-old male with a linear scar on right cheek. **(B).** six months after 5 treatments showing good results.

Early studies utilizing the pulsed dye laser (PDL) demonstrated improvement in the texture, erythema, pliability and thickness of hypertrophic scars [19]. Other studies have confirmed the initial reports of scar improvement [20]. However, further studies have shown a conflicting data [21].

Abergel et al. [22] studied bio-stimulation of wound healing by lasers, an experimental study in animal models and in fibroblast culture; they found that laser stimulated fibroblast proliferation and production of collagen fibers.

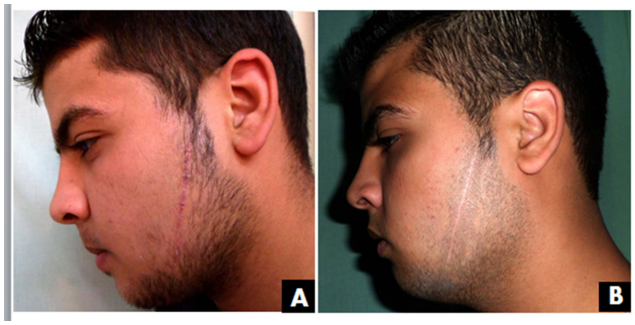

Figure 8: (A). 19 -year-old male with a linear scar on the left side of the mid face. **(B).** Seven months after 5 treatments showing fair results.

Figure 9: (A). 33-year-old female with a linear curved old scar (18 months) on the left side of the lower face. **(B).** Four months after 5 treatments showing fair results.

Yu et al. [23] found that argon laser stimulated the release of growth factors from the fibroblasts and stimulated the proliferation of the interstitial tissue cells.

In this study we noticed that in using E light a very successful improvement occurred in color and texture of the scar that reaches in some cases that it is hard to define the site of the previous scar. These results are considered to be excellent in the history of humanity, where facial scar was one of the lesions which represent a very difficult unsatisfactory treatable condition.

As the use of ordinary medical treatments failed to treat deep scar deformities, Erb: YAG laser and pulsed CO2 laser are commonly used [24,25].

Compared with E light, however, they have more serious side effects such as bleeding, pigmentation, infection and, thick scar formation [26-28]. In our study E light method is thought to be a useful method in these points mentioned above. However 2 cases (0.4%) of hyperpigmentation were encountered after the first session, which improved on follow up and mandated reduction of the used fluencies.

The PDL device is less painful than E light due to air cooling, but the addition of a topical anesthetic cream before E light treatment helped in reduction of pain, making E light tolerability comparable to that of PDL.

PDL treatment of traumatic and surgical facial scars within the first few weeks has been shown to decrease the incidence of hypertrophic scarring and improved both the cosmetic appearance and quality of surgical scars [26]. In this work we found that, the early use of E light leads to improvement the scar appearance very much; sometimes so great to the degree of nearly disappearance.

Kontoes et al. [27] reported that, with the use of IPL, reduction in the scar's size, marked improvement in pigmentation and decrease of thickness in patients with proliferative scars .They also reported that, erythema and/or edema as side effects in the treated areas lasting usually 6 h, but up to 48 h in some cases .Their results are in accordance with ours. We found that E light is very effective in post-traumatic hyperpigmented erythematous scars. But we found that E light is superior to IPL as, with the addition of radiofrequency, we can lower the fluencies and so avoid the hyperthermic complications of the high IPL fluencies.

This study demonstrates that E light can induce significant clinical improvement in facial scars because of its use of 500-1200 nm wavelengths in addition to radiofrequency and cooling. Among our patients who completed treatment, all experienced clinical improvement in the appearance of the scars (100%), with 83.3% experiencing good or excellent improvement.

We believe that it is better to use the word ELESA which is the acronym of Electric Light Energy Specific Action, than the words LASER or IPL, as most of the effects of light in medicine are through heat energy action, which results in photo-thermal, photo-chemical and photo-mechanical actions. Our hypothesis in this study was that, E light thermal action stimulated proliferation of the fibroblasts and lay down of collagen. This induced improvement of the concave deformity and resulted in the normalization of surface irregularity. This hypothesis was confirmed by the marked clinical improvement of the skin texture, and texture match with the surrounding skin.

Conclusion

E light induced significant overall clinical improvement in facial scars.

E light was found to give better results when applied early after surgery.

E light performed every 4 weeks was found to be effective on recent and old facial scars. Further studies should be conducted and longer follow up periods, are needed to validate our encouraging preliminary results.

Declaration

The authors declare that there is no conflict of interest for the manuscript. Elight (IPL+RF+ cooling) machine, was used for this work, no fund was given from any company or any one.

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