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ORIGINAL RESEARCH REPORT

Successful removal of freckles with the bipolar radiofrequency and optical energy

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ABSTRACT

Objectives: Freckles are melanocytic lesions frequently seen on the face with red or blond hair. We aim to determine the effectiveness of combined bipolar radiofrequency (RF) and optical energy. **Methods:** Thirty patients with facial freckles received four treatment at 3-week intervals with RF and optical energy, combination of broadband light (580–980 nm) + bipolar RF energy 100 J/cm³. The improvement of the freckles was evaluated using the Freckles Area and Severity Index (FASI), and physician and patient assessment at the end of the sessions, at Months 3 and 12 after the treatment. **Results:** By the end of the study, assessment of results by physician for 83% at Week 12 and by patients for 70% at Week 52 was excellent or good. On the other hand, 88% at Week 12 and 76% at Week 52 of the patients reported that they were extremely or very satisfied. FASI was noted to be 65.15 at pre-treatment, 25.60 at 12th week, and 27.40 at the end of the follow-up (one year). Mean improvement rate ($n = 30$), as determined from the difference in mean FASI score, was 70% at 3 months and 66% at 12 months. **Conclusion:** Bipolar radiofrequency and optical energy can be accepted as an alternative treatment modality for the therapy of freckles with few adverse effects and high satisfaction levels.

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KEYWORDS

Bipolar radiofrequency;
freckles; optical energy

Freckles are caused by an increase in melanin pigment in the melanocytes especially on sun-exposed area in young people with fair skin. Most common sites are nose, malar area, and forehead (1,2). Facial freckles are a really cosmetic concern to especially young females. Different treatment modalities for freckles have been used such as chemicals like α -hydroxy acids, cryotherapy, trichloroacetic acid, Q-switched alexandrite laser, CO₂ laser, and intense pulsed light (IPL) for a long time (3,4). But except laser treatment, all these methods have not proved to completely satisfactory and risk of post-inflammatory hyperpigmentation. Radiofrequency (RF) technology has become a standard treatment in aesthetic medicine with many indications due to its versatility, efficacy, and safety. electric light optical synergy (ELOS) technology combines pulsed light optical energy and bipolar RF electrical energy in a way that is very efficient and safe (5,6). There is no clinical study on the treatment for freckles using with RF technology. Therefore, in this retrospective clinical study, we want to investigate the efficacy and safety of this treatment modality on facial freckles.

Patients and methods

This study was carried out for a two-year period, from April 2012 to April 2014. The study group was composed of 30 patients (11 males, 19 females). The mean age 24.2 years (20–45 SD \pm 7.8). All patients had Fitzpatrick skin types I–III. Informed written consent was obtained from all subjects. The treatment areas were photographed and identified before the treatment. The

patients were advised to stop all other topical treatments, to use only sunscreens regularly and to avoid to sun exposure. All subjects were evaluated and did not have any photosensitivity, history of keloid scarring, use of topical retinoid in last 3 months, and isotretinoin within the last year. Two energies are applied to the skin using the handpiece (size 8 \times 12 mm). The skin surface is cooled to 5°C by means of a contact cooling system. Contact gel was used to the skin before the application.

The treatment protocol included the total of four treatment sessions with three week intervals. Each treatment consisted of one passes over the treatment area using ELOS parameter that were determined by the patients' skin phenotype and distribution of target chromophores. The physician's assessment consists of an estimate of percentage improvement as follows: excellent, 76–100%; good, 51–75%; fair, 26–50%; and poor, 0–25%. The patient assessment is as follows: extremely satisfied, very satisfied, satisfied, slightly satisfied, and not satisfied. All patients completed a questionnaire using a grading system. Freckles area and severity index (FASI) scales were used for the objective assessment of the lesions using the contrast, area, and density of freckles. Contrast is mean regarding the darkness of the freckles assessed on a five-point gray scale (0, 1, 2, 3, 4) based on comparison with the shade of different parts of the face using the regular photography. Area explains the extension and distribution of freckles was defined within nine different facial areas [forehead (2), eye (2), cheek (2), nose (1), lips (1), and chin (1)]. Also density expresses number of the macules on the face per square centimeter regarding cheek (right and left) and nose area

(7). The severity of freckling and improvement after radiofrequency treatment can be measured objectively using the FASI scores. All of the participants were evaluated before and after the therapy and twelve months after the last session using the FASI scores, and physician and patient assessments. For first sessions, RF energy was set at 20 J/cm² and optical energy was set at 15 J/cm². If we did not observe any side effects such as permanent erythema and hyperpigmentation on applied area, we increased the doses 25 J/cm² for RF and 20 J/cm² for optical energy for the other three sessions. ISL/ISM was 30/0 for all sessions. (eMax, "SR" handpiece by Syneron). Short pulse was applied. For the periorbital region, we kept a distance of about 1 cm from the eyelid as the RF energy to prevent side effects. For eye protection, we applied plastic eye-shields to the eyes. We recorded datum for pain using a numerical analogue scale (NAS) ranging from 0 (no pain) to 5 (maximal pain). For the side effects, we recorded erythema, edema, and dysesthesia after each session. Photographic evaluation was carried out before the sessions and three and twelve months after the last sessions using the EOS 400D (Canon USA, Inc, NY, USA). The pictures of the patients were standardized using the same camera, ring flash, and ambient light.

Results

A total of 30 subjects completed the treatment course and answered the self-questionnaire. By the end of the study, physician assessed the results for 83% at Week 12 and 70% at Week 52 of the subjects as excellent or good (Table 1). On the other hand, 88% at Week 12 and 76% at Week 52 of the patients reported that they were extremely or very satisfied (Table 2). FASI was noted 65.15 at pre-treatment, 25.60 at 12th week, and 27.40 at the end of the follow-up (one year). Mean improvement rate, as determined from the difference in mean FASI score, was 70% at 12 weeks and 66% at 12 months. Figure 1 shows the picture of one patient before treatment and Figure 2 shows 12 months after treatment. During the all treatment sessions, we did not observe any severe side effects such as blistering, crusting and pigmentary changes. As an adverse effects, we detected transient erythema in two patients (6%), transient edema in one patient (3%), and burning sensation for a maximum 6 h in two patients (6%). With regard to pain, 24 (80%) patients declared no pain and 6 patients (20%) with minimal pain. The average pain score was 0.2.

Discussion

Freckles, can be used for ephelides and lentigines, are important pigmentation characteristics of localized face and upper

Table 2. Graduation of freckles improvement assessed by patients (*n* = 30).

Grade and percent clearance	Number of patient (%) at 12 weeks	Number of patient (%) at 52 weeks
Extremely satisfied	16 (53%)	13 (43%)
Very satisfied	10 (33%)	10 (33%)
Satisfied	2 (7%)	3 (10%)
Slightly satisfied	2 (7%)	2 (7%)
Not satisfied	0 (0%)	2 (7%)

extremities. Ephelides are largely genetically determined but induced by sunlight, whereas lentigines are induced by sun exposure and photodamage of the skin. However, despite being commonly observed, we know very little about them. Freckles may vary somewhat in color—they may be reddish, yellow, tan, light brown, brown, or black but they are basically slightly darker than the surrounding skin. Most freckles on a skin are usually uniform in color (1–3). They tend to become darker and more apparent after sun exposure and lighten in the winter months. Freckles are due to an increase in the amount of dark pigment called melanin and are not due to an increase in the total number of pigment producing cells called melanocytes. Unlike solar lentigines, freckles usually present in early childhood (2–4). Solar lentigines are considered as a sign of photodamage while ephelides are associated with fair skin type and red hair. The FASI is used to evaluate the severity of the freckles, based on the three important features of the freckles. These parameters based on the darkness of the freckles, the extension and distribution of the macules, and density of the freckles (7).

The treatment of the freckles is a challenge and also may be requested for cosmetic reasons. Many treatment modalities have been used for the freckles but postinflammatory hyperpigmentation still remain a main problem after the therapy. But, in the past decade, freckles have been lightened and cleared with different types of lasers and IPL system (8–14). Four different types of laser were used for the treatment of the freckles such as long pulsed dye laser, alexandrite laser, Q-switched Nd:YAG laser, and potassium-titanyl-phosphate (KTP) laser. They found that long pulsed dye laser, Q-switched Nd:YAG laser, and KTP laser were effective in the treatment of the freckles. But no significant improvement was found after alexandrite laser treatment (11). Carbon dioxide laser was applied for freckles as a single session in Egyptian patients. It was found to be an effective and safe treatment option in skin phototypes II–IV (12). IPL was found an effective and safe method with relatively few adverse effects and high satisfaction levels for face in Asian skin (12,13). Freckles showed good response almost completely to all types of therapies including laser and IPL. But, pain, postoperative punctate bleeding, purpura, and postinflammatory hyperpigmentation were reported as adverse effects (8–13).

On the other hand, the most common indication for bipolar RF technology is the tightening of tissue to improve skin laxity and reduce wrinkles (5,6,14–16). The optical component is light with a wavelength of 580–980 nm and the electrical component is bipolar RF at a frequency of 1 MHz (14). The energy is applied to the skin for a duration of 20–200 milliseconds. Superficial melanin and hemoglobin absorb in

Table 1. Graduation of freckles improvement assessed by physician (*n* = 30).

Grade and percent clearance	Number of patient (%) at 12 weeks	Number of patient (%) at 52 weeks
Excellent, 76–100 %	15 (50%)	13 (43%)
Good, 51–75%	10 (33%)	8 (27%)
Fair, 26–50%	4 (14%)	6 (20%)
Poor, 0–25%	1 (3%)	3 (10%)



Figure 1. A 24-year-old woman before therapy: extensive freckles involvement on her face.

the wavelength range of 580–980 nm and target lesions such as freckles. The epidermis is cooled, increasing resistance and lowering current flow; RF energy flows from the active to the passive electrode and elevates the temperature of the target structures to a level of damage required for clearance (15). Also this system provides an impedance safety limit (ISL%) to automatically shut off the RF energy pulse to prevent tissue overheating (16).

In the present study, a novel method was used to objectively evaluate the severity of the improvement in freckling using the FASI scores. Bipolar RF has been never used in the treatment of the freckles until today. The high satisfaction rate assessment by physician and patients showed that this combination should be a new therapeutic option. In some patients, pigmentation of the freckles come back again, therefore, after the treatment avoiding the sun exposure is really essential for all patients. No local or topical anesthetic agents were needed; few side effects were observed. Transient erythema was the most common side effect and disappeared in short time duration. Also pain score was very low. The duration

of the procedure was relatively short, just only 10 min. Dark color freckles require more sessions than light color freckles instead of the this treatment protocol.

There are some limitations for this study. One of them is number of the cases. Large group of the patients can give better results than limited number. Second limitation is lack of histopathologic evaluation. It can be helpful to determine the underlying biological mechanisms in the treatment course.

As a conclusion, in this study, we found that bipolar RF and optic light therapy are very efficient regarding subjective and objective assessment. One-year follow-up is helpful to demonstrate the improvement on the freckles with therapy. Side effects were transient and tolerable. We have to emphasize that avoiding the sun exposure is the important point for patient who have the freckles especially in summer months after the all types of therapy. More RF sessions may get good results for dark color freckles. Controlled prospective study with histopathologic evaluation helps us in the optimization of the treatment parameters.

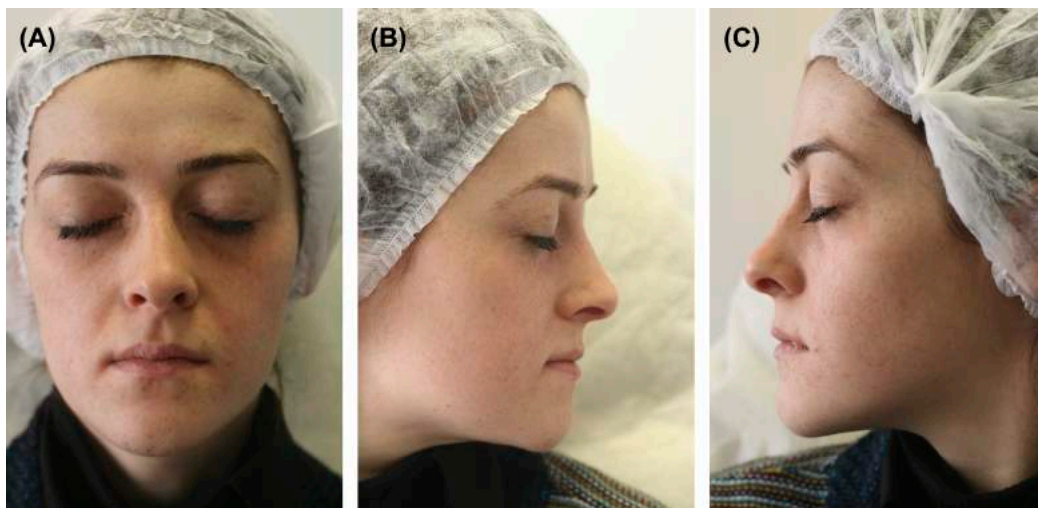


Figure 2. After one-year follow-up, excellent result observed on her face.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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