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The Efficacy of IPL in Periorbital Skin Rejuvenation: An Open-Label Study

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Abstract

Introduction: Intense pulsed light (IPL) is one of the effective methods used to treat the signs of facial aging. However, its efficacy in improving the appearance of periorbital wrinkles has always been evaluated in the context of whole-face rejuvenation and not studied in its own right. Therefore, in this study, we sought to examine the effectiveness and side effects of IPL in periorbital skin rejuvenation.

Methods: In this uncontrolled, open-label clinical trial, 38 patients referred to the Behrooz professional skin clinic for signs of periorbital skin aging were recruited. The patients underwent three treatment sessions with IPL at one-month intervals and were evaluated for treatment side effects after each session. Six months after the final IPL session, patients were examined to assess the level of symptom improvement. The patients were photographed at each treatment session and on the 6-month follow-up visit. Before and after treatment, the patient images were evaluated by two dermatologists unaffiliated with the study to determine the extent of improvement in the appearance of wrinkles and skin texture.

Results: Six months' post-treatment, excellent improvement was observed in 3 patients (9.1%), considerable improvement in 7 patients (21.2%), moderate improvement in 9 patients (27.3%), mild improvement in 9 patients (27.3%), and finally little or no improvement in 5 patients (15.1%). A comparison of improvement scores based on the Fitzpatrick skin phenotype did not show significant differences (P=0.674). Four patients (12.1%) were dissatisfied with the treatment, whilst 17 patients (51.5%) reported moderate to considerable satisfaction with IPL rejuvenation.

Conclusion: During facial rejuvenation, IPL can be used to improve periorbital skin aging.

Keywords: Intense Pulsed Light; Laser; Periorbital; Rejuvenation; Wrinkles.

Introduction

Skin aging is a complex and dynamic process with various manifestations such as wrinkles and atrophy, with the periorbital region the first area to be affected. Due to its unique properties such as reduced epidermis and dermis thickness and the functional sensitivity of its components, periorbital skin requires specialised rejuvenating treatments.

The intense pulsed light (IPL) system is a high-intensity light source that emits non-coherent and polychromic light in the broad wavelength range of 515-1200 nm. Owing to this property, IPL is used to treat different skin problems in a variety of skin types.[1] This system was initially employed to treat vascular lesions.[2] Using various optical filters, it was also shown to be effective in skin rejuvenation and reduction of wrinkles and unwanted pigmentation.[3,4]

Although many studies have endorsed the use of IPL in facial skin rejuvenation, to the best of our knowledge there have been little studies to specifically examine the effect of IPL therapy on periorbital skin rejuvenation.[5] IPL rejuvenation has not been simultaneously adopted for the eyelid area and periorbital region due to existing precautions such as the need to use eye shields. Thus the present study was conducted with the aim of specifically examining the efficacy and side effects of IPL therapy in periorbital skin rejuvenation.

Methods

In the format of an open-label study, 38 patients (5 males and 33 female) seeking treatment for periorbital skin aging at the Shohada-e-Tajrish hospital between March 2013 and March 2014 were recruited. Exclusion criteria included photosensitivity, ill health, use of photosensitizing medications, chemical peeling treatments or tanning within one month prior to the study, and use of topical periorbital rejuvenation therapies in the 3 months prior to the study. During treatment and in the 6-month period post-treatment, the patients were instructed to use no topical preparations apart from

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moisturizer and sunscreen.

Full details of the study procedure were presented to the patients and written consent was obtained from all subjects.

The patients underwent 3 treatment sessions with IPL at 1-month intervals. Depending on the patient's skin type, the wavelength selected in this project was 572 nm with an energy range of 20 to 35 J and pulse duration of 45 to 70 milliseconds.

Before each IPL session, the patient's face was washed with water and soap, and it was photographed before marking out the treatment area with a white pencil. This area included the lower eyelid and periorbit up to a 2 cm margin outside the orbital rim. A metal eye shield was placed on the eyes following the administration of anaesthetic tetracaine drops and gentamycin ophthalmic ointment. A thick layer of transparent gel was then applied to the area for optical index-matching and a single pass of IPL was carried out over the entire treatment area on both sides of the face. Cooling was accomplished in 2 ways: the contact cooling tip of the hand-piece and contact cooling after the procedure using an ice pack on the treated area for 15 minutes. The patients were instructed to use zinc oxide ointment 3 times a day for 5 days after treatment. They were photographed before and after each treatment session and on the 6-month follow-up visit using the Visioface imaging system (Khazaka Electronic GmbH, Germany) which enables imaging under identical settings (e.g. illumination conditions and lighting angles). In addition, within 24-48 hours after each treatment session, the patients were questioned over the phone regarding prolonged erythema and blistering. In case of problems occurring post-treatment, the patients would visit the clinic and they were treated. The number of downtime days was also recorded.

The patient images obtained before, during and 6 months after the last therapy session were evaluated by 2 dermatologists independent of the project, and the level of improvement in wrinkles and skin texture was assessed using a 5-point scoring system as follows: excellent improvement (>75%), considerable improvement (50%-75%), moderate improvement (25%-50%), mild improvement (<25%) and a worsening of the symptoms. The lowest improvement score derived from the evaluation of the 2 dermatologists was taken as the final value in subsequent analyses.

On the 6-month follow-up visit, the patients were asked to rate their satisfaction with IPL treatment, using a 4-point scoring system as follows: dissatisfied, mildly satisfied, moderately satisfied and considerably satisfied. The patients were also questioned regarding discomfort levels during and after the procedure and whether they would recommend IPL therapy to others.

All statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS) software (version 22.0, SPSS Inc., Chicago, IL, USA). To compare [likelihood] ratios, a chi-square test was performed and a type I error was considered equivalent to 0.05 in all statistical tests.

Results

Of the 38 patients who were originally enrolled, 33 patients completed the study. Discontinuation was due to patient failure to follow the treatment (2 patients) and treatment side effects (3 patients) including 2 cases of blistering and 1 case of prolonged erythema. Blistering was treated with Zinc sulphate solution (1:1000) applied 3 times a day and topical skin repair (zinc oxide cream) and lesions healed without scarring. In addition, a topical corticosteroid with emollient was used to treat patients' erythema.

The results from the 33 patients who completed the study (3 males and 30 female) were analyzed. The patients' average age was 47 years, ranging from 21 to 65 years with a standard deviation of 11 years. According to the Fitzpatrick scale, 12 patients (36.4%) had type II skin, whilst 16 patients (48.5%) had type III and 5 patients (15.2%) had type IV skin. The average energy used during IPL therapy was 25 J with a standard deviation of 3 J whilst the average pulse duration was 55 milliseconds with a standard deviation of 3 milliseconds.

The overall degree of improvement was determined by 2 dermatologists independent of the project. Thus, no or slight improvement was observed in 5 patients (15.1%), mild improvement in 9 patients (27.3%), moderate improvement in 9 patients (27.3%), considerable improvement in 7 patients (21.2%) and excellent improvement in 3 patients (9.1%).

Comparison of the patients' improvement levels according to the Fitzpatrick skin phenotype showed that 8 patients from the type II group (66.7%), 8 from the type III group (50%) and 3 from the type IV group (60%) had moderate to considerable improvement. Chi-square analysis did not reveal a statistically significant difference between the 3 groups ($P=0.672$).

The patients were asked to rate their satisfaction with IPL treatment on the 6-month follow-up visit, whereupon it was found that 4 patients (12.1%) were dissatisfied with the treatment, 10 patients (30.3%) had mild satisfaction, 9 (27.3%) had moderate satisfaction and 8 (24.2%) had considerable satisfaction with IPL skin rejuvenation. Twenty-five patients (75.7%) would recommend IPL treatment for periorbital skin rejuvenation to others. Seven patients (18.4%) experienced discomfort during the procedure, but apart from the 2 patients who suffered blistering, no patient downtime was reported.

Discussion

Increasing demand for staying young has spurred efforts to develop new treatment modalities. Great interest has recently been shown in the use of IPL in facial rejuvenation[2] due to its broad range of applications in treating various sun-induced skin problems such

as wrinkles, laxity, pigmentation and telangiectasia. Periorbital skin is one of the first and most severely affected areas, which undergoes aging and is difficult to treat due to the characteristics of the eyelids and the periorbit. The present study showed that IPL can be effective in treating the signs of periorbital skin aging and more than 50% of our patients had favourable (moderate and considerable) improvement. Though we could not find a similar study which specifically addresses the treatment of the eyelid and the periorbit with IPL, Bitter[3] noted some degree of improvement in periorbital skin in more than 50% of the patients treated with IPL, with 18% reporting considerable improvement. Interestingly, the patients treated by Sadick had lighter skin types, permitting the use of higher fluencies with pulse stacking.[6] In contrast, Negishi and colleagues[7] demonstrated the effectiveness of IPL in patients with skin phenotypes IV-VI, with no increase in the incidence of complications. 15% of the patients in our study also had skin type IV. Despite problems in treating darker skin types, our study also showed similar levels of improvement in patients with type II and IV skin, which is promising for the application of IPL in treating periorbital wrinkles in this group of patients. However, in a study by Kligman and Zhen,[8] IPL did not result in significant changes in periorbital wrinkles, though this treatment was well-tolerated in most patients and recommended by patients.

Different lasers have been used for skin rejuvenation. Photorejuvenation was coined to address all aspects of sun damage, including changes in skin texture and consistency (characterised by wrinkles and laxity), changes in pigmentation and the density of pigment cells, and telangiectasia formation. Apart from IPL and pulsed dye laser (PDL), most optical systems cannot act on all 3 components. However, results from a study by Hsu et al[9] indicated fibroblast proliferation and production of a new collagenous zone in the papillary dermis following PDL treatment, though clinical changes were marginal, especially in the periorbital region. Further, Hardaway et al[10] observed mild to moderate periorbital wrinkle improvement in 14 patients treated by a diode laser.

Even less powerful lasers have been used in skin rejuvenation. In a study by Weiss et al,[11] 90 patients were treated by a 590 nm light emitting diode for 8 sessions with a minimum of 48 hours between each session. Wrinkle reduction was observed in 90% of the patients, though the magnitude of improvement was around 10%.

Most investigators consider ablative lasers to be more effective than non-ablative lasers, though Hantash et al[12] did not find a significant reduction in periorbital wrinkles or laxity with IPL or the Er:YAG laser. However, they considered IPL to be more effective besides higher incidence of complications and more downtime. In addition, we believe pain, injury and side effects resulting from ablative laser therapies limit their use and significantly increase downtime after treatment.

The effectiveness of IPL in treating skin wrinkles is attributed to the creation of microthermal damage in the dermis resulting in increased collagen production in a process similar to that seen in wound healing.[13,14] Pathology specimens obtained after IPL treatment show enhanced collagen and elastic fibre formation in the papillary and sub-papillary dermis, resulting in an increase in volume which in turn leads to smoothing the upper dermal layers and the increased epidermal turnover.[15,16] In an in vitro study, Wong et al[17] showed that after IPL irradiation, the number of live fibroblasts increases more than 100%. They postulated that the IPL rejuvenation effect is concurrent with an increase in extracellular matrix volume resulting from the enhanced expression of collagen III and TGF-B1 genes. In addition, the level of matrix metalloproteinases, the key proteins involved in age-related degenerative changes in extracellular matrix components, also decreases considerably after IPL illumination.[18] Taken together, these findings affirm the clinical effects of IPL on periorbital wrinkle reduction in the present study.

The ultimate goal of any cosmetic procedure is the patient's satisfaction. In our study, more than 50% of the patients had moderate to considerable satisfaction with the treatment and approximately two-thirds of the patients would recommend the use of IPL for periorbital wrinkle treatment to others. Interestingly, in a study by Hantash et al,[12] patients preferred IPL to the Er:YAG laser and chose to continue with the former in their treatment regimen despite similar clinical efficacy of the 2 procedures. Due to the non-destructive nature of IPL, most patients had no downtime, but blistering in 2 patients resulted in a total of 5 days of downtime. Therefore, it seems that the selection of appropriate laser parameters according to the skin phenotype and also using a sufficient volume of ultrasound gel will effectively prevent blistering and resulting complications. Sadick et al[6] speculate that maintaining a minimum distance of 1 mm between the skin and the light guide will probably greatly reduce purpura formation and blistering.

The advantages of IPL include larger pore size, the ability to treat various skin problems simultaneously, relative ease of use, and limited downtime after treatment, especially if the necessary parameters are skilfully chosen. This device is widely available in laser therapy clinics and treatment costs are comparatively lower than other ablative and non-ablative procedures. In agreement with the findings of Sadick et al[6] which indicated a slow but steady wrinkle improvement after IPL treatment, we also observed suitable improvement in the signs of periorbital skin aging within 6 months after 3 IPL treatment sessions. The main limitation of this study is the lack of a control group to compare the clinical effects; therefore, double-blind and split-face clinical trials are suggested for future studies. In addition, para-clinical methods to measure clinical effects more accurately will be helpful in

interpreting the results.

In conclusion, this study showed that IPL can be effectively used to treat periorbital skin aging problems, regardless of the Fitzpatrick skin type.

Ethical Considerations

The study protocol was implemented in accordance with the 1975 Helsinki guidelines and was approved by the Ethics committee of Shahid Beheshti University of Medical Sciences as well as the Institutional Review Board on Human Research.

Conflict of Interests

The authors declare no conflict of interest.

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