CASE REPORT

Periorbital skin tightening with a broadband infrared device: Preliminary study results

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Abstract
Periorbital rhytids are often the first signs of aging skin for which young patients seek a non-invasive, no downtime treatment. Recently, several skin-tightening modalities based on deep dermal heating with various energy sources, such as monopolar and bipolar radiofrequency, as well as laser and broadband infrared light sources, have been introduced to treat mild wrinkles and skin laxity. This report presents preliminary study results using a new infrared device for the treatment of periorbital rhytids on 11 volunteer patients.

Key Words: Infrared, rhytids, skin tightening, wrinkles

Introduction
Signs of aging in facial appearance can be significantly ameliorated by a reduction of periorbital rhytids and skin laxity. Use of broadband infrared (IR) light to induce skin tightening has been reported (1). This effect is achieved by utilizing tissue water as a chromophore for dermal heating, consequently enabling shrinkage and neocollagenesis. This report presents preliminary clinical results achieved with a new IR light device specifically developed for aesthetic skin tightening by Radiancy Inc.

Materials and methods
A single-site, open, clinical study was undertaken to assess the safety and efficacy of the new IR skin-tightening handpiece for the treatment of skin textural changes primarily in the periorbital area. Eleven subjects were recruited to participate in the study. The participants were screened for inclusion and exclusion criteria and signed an informed consent form. Exclusion criteria included medications that could affect the characteristics of the skin, photosensitive medications, a sun tan in the treatment area, a history of keloid formation, pregnancy, epilepsy and use of Accutane within the past 6 months.

Treatment was performed with the new IR handpiece attached to Radiancy’s Mistral light and heat energy (LHE™) system. The handpiece consists of a 780–1800-nm broadband, filtered, IR halogen light source which emits a maximum fluence of 25 J/cm². Spot size adaptors enable a choice of different treatment areas ranging from 13 × 12 mm to 50 × 25 mm. IR light energy is emitted from the handpiece in a proprietary, multi-pulse algorithm of 30 seconds total duration, which provides optimal deep dermal heating while preventing epidermal over-heating. This broadband IR light allows a penetration depth of 1–3 mm, targeting the reticular dermis. The dermal temperature is raised to 50–60°C, while the temperature of the epidermis is maintained below 40–42°C to minimize pain and avoid any potential side effects.

A series of 10 biweekly treatments were administered and followed-up for a period of 3 months. Photographs were taken with a VISIA Complexion Analysis system (Canfield, OH, USA) at baseline, after five treatments, at the end of the treatment sessions and during each monthly follow-up visit. Photography was carefully standardized since it is known (2) that skin textural changes tend to be subtle and may go undetected.

Treatments were administered with an average fluence of 17–18 J/cm². Treatment included two to four passes on the treatment area. An ArTek Spot Cooler (ThermoTek Inc., Flower Mound, TX, USA) was used to cool the epidermis before and after IR...
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The fl uence applied was determined based on the patient’s feedback and immediate skin temperature measurement using a MiniTemp MT6 (Raytek Corp., Santa Cruz, CA, USA) non-contact thermometer. The maximum skin temperature allowed was 42°C, which assures skin safety and patient comfort. No anesthesia was necessary for the performance of this procedure.

The result was evaluated clinically and by comparing the photographs obtained. Evaluation was scored according to the following scale: 1 = no improvement; 2 = slight improvement; 3 = good improvement; 4 = very good improvement.

During treatment the patient was requested to grade the discomfort level on a four-point scale (1 = no discomfort or pain; 2 = slight warmth; 3 = discomfort; 4 = intolerable heat or pain). This scale has been reported to be an effective method to guide treatment (3).

Histological analysis of the specimens was performed using H&E. Patient self-assessment of the clinical improvement was also recorded throughout the trial period using a similar visual analog scale (VAS) score. Patients were also asked to complete a patient questionnaire at the end of the treatment period.

Finally, biopsy specimens were taken from two patients prior to treatment and at the 3-month follow-up visit for staining.

Results

Eleven volunteers were recruited for this study; all females aged 38–66 years with skin types II–V. All the participants completed the full treatment and follow-up regimen. An immediate heating and skin tightening effect was noted by all patients, though pain and discomfort were maintained at a low to moderate level (pain score 1–2). Visible changes could be observed as soon as the fifth treatment (week 3). Textural changes persisted throughout the treatment and follow-up periods. Changes consisted of a smoothing of periorbital wrinkles and a more radiant skin tone which produced an overall rejuvenated ‘new natural look’.

At the end of treatments the average investigator VAS score was 3 (= ‘good improvement’) based on VISIA photographic evaluation, while patient self-assessment was rated to be ‘slight improvement’ by four patients (36.4%), ‘good improvement’ by six patients (54.5%) and ‘very good improvement’ by one patient (9.1%).

At 3 months’ follow-up the average investigator VAS score was reduced to 2.7 (‘slight improvement’ in four patients, ‘good improvement’ in six patients and ‘very good improvement’ in one patient) while the patients’ average VAS score increased to 3 (‘slight improvement’ in three patients, ‘good improvement’ in five patients and ‘very good improvement’ in three patients).

Projected heat from the treated area was felt for a few minutes following treatment administration. Local erythema and slight edema persisted for up to 2 hours. No other side effects were recorded. There was no need for analgesia.

Histological analysis of biopsies taken from two patients before treatment revealed in one patient (aged 53 years) mild to moderate solar elastosis with a focus of seborrheic keratosis at one lateral margin. In the second patient (aged 57 years), severe solar elastosis was found. Analysis of biopsies taken at the 2-month follow-up visit found, in both patients, dermal edema below the solar elastosis.

Discussion

Non-ablative laser skin rejuvenation utilizing IR wavelengths such as 1064, 1320, 1440 and 1540 nm has been clinically applied for almost a decade (4) to circumvent complications and the prolonged convalescence often associated with ablative resurfacing techniques. Only recently, however, have broadband IR devices been introduced as an alternative to more costly laser systems.

Ruiz-Esparza (5) was first to report on the use of broadband IR (Titan; Cutera Inc.) to produce skin contraction leading to lifting of the eyebrows and/or improvement of lower face and neck skin laxity using fl uences below pain levels. A group of 25 patients were treated for eyebrow lifting, lower face tightening and neck skin laxity using fl uences of 20–30 J/cm². Immediate skin contraction was obtained in 22 of 25 patients and was maintained for the whole follow-up period, up to 12 months.
Taub et al. (2) confirmed these results in a retrospective, multicenter clinical study. On 42 patients treated only twice at 1-month intervals, visible skin tightening improvement was observed on more than 90% of the patients. No complications were observed and patient satisfaction was high.

Goldberg et al. (6) reported on the treatment of skin laxity of the lower face and neck in older individuals with a broad-spectrum IR light device (Titan; Cutera Inc.). Thirteen females aged 58–83 years old were treated twice at 1-month intervals. Changes were dramatic for individuals in whom the skin envelope appeared to drape separately from deeper soft tissue. Where skin stayed largely intact with subcutaneous tissue, improvement was mild to moderate. Improvement continued past the 1-month follow-up visit.

Chua et al. (7) reported on the use of broadband IR light for facial and neck skin tightening in types IV–V Asian skin. Twenty-one patients underwent three treatment sessions spaced 4 weeks apart. Final physician and patient clinical assessments were performed 6 months after treatment: 28% were assessed by the physician as significant–mild; 38% as significant–moderate; and 19% as significant–excellent. A total of 19% of patients reported mild improvement, 38% reported moderate improvement, and 43% reported good improvement. The main side effect was isolated superficial blistering.

Carniol et al. (8) reported on 10 patients who received two broadband IR treatments for facial and cervical skin tightening. The greatest tightening was found over the malar region, the upper neck and the body of the mandible. In these areas the average tightening was 10%, 10% and 20%, respectively. Patients reported 32% improvement in the appearance of their cheeks and 20% improvement in their necks, and expressed a mean overall satisfaction of 6.4 on a scale of 10.

Finally, Kameyama (9) reported on the histological and clinical effects of broadband IR treatment on human and mouse skin. In that study, 10 and 20 J/cm² IR light increased the amount of both collagen and elastin in all layers of the dermis without denaturing the collagen in human skin, while a higher dose of 30 J/cm² also increased the amount of collagen and elastin but denatured the collagen in human skin. It was concluded that there are two mechanisms of skin tightening. The first is the effect of deep heating to degenerate collagen while the second is the activation of mitochondria. Increased amounts of ATP induced by phototherapy play an important role in the synthesis of various kinds of materials such as collagen and elastin.

IR sources applied in previously reported studies employ contact skin cooling for epidermal protection. In the Radiancy IR skin tightening handpiece, contact skin cooling has been replaced with a proprietary, multi-pulse algorithm which provides optimal deep dermal heating while preventing epidermal over-heating. Our initial clinical experience with this new device seems to indicate similar safety and efficacy to previously reported broadband IR devices for skin tightening. The difference between investigator evaluations of the results and the patient self-evaluation may be due to the fact that the investigator relied on objective photographic evidence enhanced by the sensitivity of the VISIA system while patients relied on a more subjective criterion and were influenced by their expectation levels.

Our results were achieved with the utmost safety and comfort and with absolutely no downtime. IR skin tightening is a true non-ablative skin rejuvenation technique which induces a dermal healing response.
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without any injury to the epidermis. These attributes are particularly attractive for patients of all ages with busy daily schedules but may also be offered to young patients as a skin anti-aging procedure. Finally, while most IR skin rejuvenation protocols reported above utilize fewer treatments spaced 2–4 weeks apart, our protocol followed that of the Velasmooth device which affects dermal heating through a combination of broadband IR together with radiofrequency (10,11). Future studies will investigate the effect of treatment frequency and the number of treatments on the short- and long-term efficacy of this device.

Conclusion

The new broadband, IR skin tightening handpiece for Radiancy’s Mistral LHE system appears to be safe and effective for the treatment of textural signs of skin aging. The procedure is comfortable for the patient with only minimal and transient side effects and no downtime. Further clinical studies on a larger patient population and with longer follow-up are required to confirm these findings and optimize treatment protocol.

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Full verbal and written informed consent has been obtained from the patients for the publication of this manuscript with the accompanying images.

The author was a consultant for Radiancy Company Ltd who provided the device but does not have any financial interests with Radiancy Company Ltd. The treatments were made on the author’s personal patients. Dr Elman is responsible for the content of this paper.

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References