

Clinical Effectiveness of Broad-band Infrared Light Therapy for Wrinkles and Skin Laxity of the Face

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Abstract

Background: Infrared light therapy, as a nonablative phototherapy, is known to improve wrinkles and skin laxity.

Objectives: To investigate the efficacy and tolerability of broad-band infrared light therapy in patients with wrinkles and skin laxity of the face.

Methods: We performed an open study in 29 patients who received broad-band infrared light therapy with one-month interval up to 5 times.

Results: Twenty-one percent of patients had marked improvement, 30% had moderate improvement, and 28% had slight improvement in wrinkles at the corners of the eyes, while 21% unchanged. Wrinkle grades in the tested area significantly reduced more than pre-treatment ($p < 0.005$). Thirty-one percent of patients had marked improvement, 31% had moderate improvement, and 28% had slight improvement in laxity of the cheek skin, while 10% unchanged. No patients discontinued due to adverse effects and no patients showed hyperpigmentation or scarring after the treatments. Patient's satisfaction revealed satisfied to very satisfied rates in 76% of subjects.

Conclusion: Phototherapy using this broad-band infrared light source was effective and well tolerated in the patients, suggesting that this phototherapy may be a new modality for the treatment of wrinkles and tightening of the face.

Keywords: Photoaging; Wrinkle; Skin laxity; Phototherapy, Broad-band infrared light; Efficacy; Safety

Introduction

The improvement of laxity of the face and neck without surgical procedures has been a great concern. Various treatment modalities such as laser and light-based treatments are known to be effective for wrinkles and skin laxity. Fractional CO₂ and Neodymium:Yttrium-Aluminum-Garnet (Nd:YAG) (1064, 1320, and 1440 nm) lasers, broad-band infrared, radiofrequency and intense focused ultrasound, have been used [1-5].

A broad-band infrared (1100 to 1800 nm) light device was introduced in 2006 and some studies using this device and topical anesthesia showed improvements of skin laxity of the face and neck [6]. This therapy has been a non-ablative method after modification of exposure method [6]. However, more effective and safe treatments using infrared light are necessary. In this study we report clinical effectiveness and tolerability of a novel light source emitting infrared broad-band light (800-1400 nm) on wrinkles and skin laxity of the face.

Patients and Methods

Twenty-nine Japanese female patients with wrinkles and skin laxity of the face participated in this study that was conducted from May

2011 to June 2013. The average age was 60.2 years (range 40-74). A noncoherent, filtered broad-band pulsed flash lamp emitting in the range of 800-1400 nm (SkinTyte™, Sciton Inc., Palo Alto, CA, USA) was used for all treatments. Each patient received three to five treatments. Each treatment, given at 4-5 week intervals, was administered on the face. 'Motion technique' (Sciton Inc.) was used as a condition. Irradiance was 12 W/cm². Treatment fluences ranged from 120 to 150 J/cm² that made the skin surface temperature to be 42°C measured by Fluke 62 MAX thermometer (Fluke Corp., Everett, WA, USA). Multiple passes were applied by moving the handpiece back and forth in the direction shown in figure 1. No topical or general anesthesia for the treatment was used.



Figure 1: Motion technique: multiple passes were applied by moving the handpiece back and forth in the direction shown.

Evaluation of wrinkles and skin laxity

Evaluation was conducted by the combination of observation and photographs with three investigators who had similar skills and clinical experiences in this technique. The physician's overall assessments of the extent of improvement/worsening were graded into one of five categories: "worsened", "no change", "slight improvement" (approximately 25% improvement), "moderate" (approximately 50% improvement), marked (approximately 75% improvement), and "almost complete" (approximately 90% improvement). Additionally, grades of wrinkles were decided based on the guideline of Japan Cosmetic Industry association (JCIA) [7]. This guideline classifies conditions of wrinkles as 8 grades, 0 to 7. Mean of wrinkle grades in the tested area were compared with those in pre-treatment area. Subjects were asked to evaluate degree of satisfaction for treatments.

Results

All the patients completed the study. Results of the physicians' overall assessments were summarized in Table 1.

Rating	Wrinkles		Skin laxity	
	No. of patients	Percentage	No. of patients	Percentage
Worsened	0	0	0	0
No changed	6	21	3	10
Slight (1-25%)	8	28	8	28
Moderate (26-50%)	12	30	9	31
Marked (51-75%)	6	21	9	31
Almost complete (76-90%)	0	0	0	0

Table 1: Physicians' overall ratings for the response of skin lesions

Twenty-one percent of patients had marked improvement, 30% had moderate improvement, and 28% had slight improvement in wrinkles at the corners of the eyes, while 21% unchanged. Wrinkle grades in the tested (2.34 ± 0.63) area significantly reduced more than pre-treatment (3.10 ± 0.76) ($p < 0.005$). The representative case with marked response was shown in Figure 2.

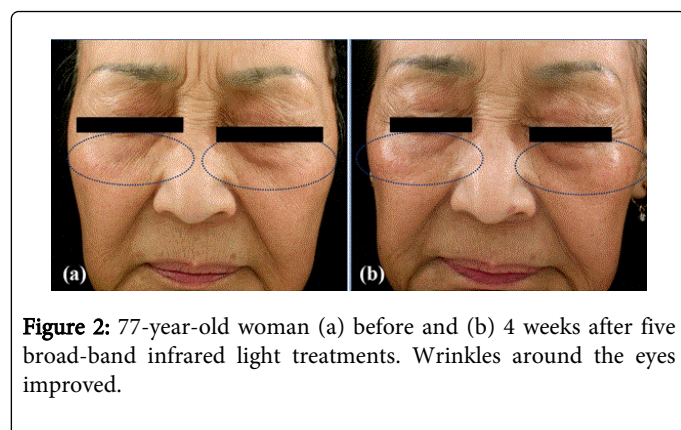


Figure 2: 77-year-old woman (a) before and (b) 4 weeks after five broad-band infrared light treatments. Wrinkles around the eyes improved.

Thirty-one percent of patients had marked improvement, 31% had moderate improvement, and 28% had slight improvement in skin

laxity of the cheek, while 10% unchanged. The representative case with marked response was shown in Figure 3.

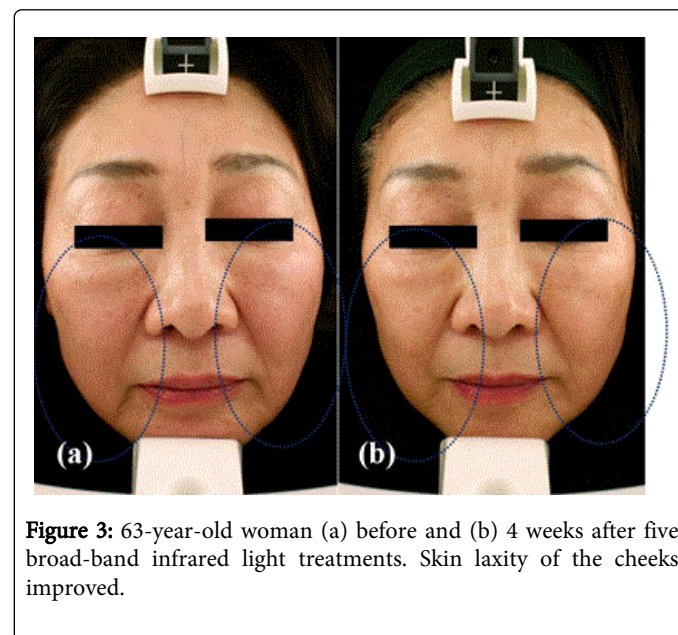


Figure 3: 63-year-old woman (a) before and (b) 4 weeks after five broad-band infrared light treatments. Skin laxity of the cheeks improved.

No patients discontinued due to adverse effects and no patients showed hyperpigmentation or scarring after the treatments. Patient's satisfaction revealed satisfied to very satisfied rates in 76% of subjects (Table 2).

Rating	No of patients	Percentage
Not satisfied	1	3
Slightly satisfied	6	21
Satisfied	9	31
Very satisfied	13	45

Table 2: Patients' overall satisfaction

Discussion

The physician's overall assessment in this preliminary study showed clinical effectiveness of broad-band infrared light therapy on wrinkles and skin laxity of the face. Moreover, a similar tendency to the improvement after this therapy was seen in the patients' satisfaction. There were no adverse responses in our treatment, indicating well tolerability. Therefore, broad-band infrared light could be a new modality for wrinkles and skin laxity of the face. Further study is necessary to achieve more effectiveness for wrinkles and skin laxity of the face in this treatment under different condition since we used one irradiation protocol.

Broad-band infrared light induces deep dermal heating, leading to the efficacy for skin laxity. A broad-band infrared (1100 to 1800 nm) light device improved skin laxity of the face and neck [6]. A larger study in 303 patients demonstrated that infrared light (1100 to 1800 nm) was effective and tolerable in the treatment of facial and body skin laxity [8]. Histological studies of the infrared 1100-nm to 1800-nm broadband light induced synthesis of collagen type I and III in rat and human skin, and elastin in human skin [9-11]. The apparatus in our

study used broad-band infrared light ranging 800 to 1400 nm that penetrates into about 3 mm depth in the dermis shallower than 1100 to 1800 nm. Then, our apparatus might be appropriate for fine wrinkles and slight laxity although histological studies using our apparatus should be needed. Surface temperature in our study was set as 40 to 42 degrees that means 55 degrees in the dermis that can have heat energy on the dermal collagen, leading to the improvement of wrinkles and laxity.

Infrared broadband (1100-1800 nm) light therapy initially caused vesiculation and blistering both in Caucasian and Asian skin [6]. A rapid heating of the dermis with topical anesthesia is usually used for the therapy of deep dermis, whereas we used a gradual warming of infrared light delivered up to 15 seconds. Bitter stated that a gradual warming is perceived by patients as being more tolerable [12]. The heating used in our study was well-tolerated without local anesthesia and showed no adverse effects. We also irradiated with 'motion technique' which can deliver the proper energy to the treated area, leading to more tolerability and greater treatment results [13]. A gradual warming method combined with motion technique may be more appropriate for Asian skin with capability of post inflammatory pigmentation and scarring after light therapy.

Phototherapy using this broad-band infrared light device was effective and well tolerated in the patients studied, suggesting that this phototherapy may be a new modality for the treatment of wrinkles and skin laxity of the face. Since the number of subjects in our study was low, we are planning future studies with increasing numbers of subjects to compare the effectiveness of this treatment to other treatments and also reveal the effectiveness, safety, and appropriate irradiation procedure of this therapy.

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