Retrospective Evaluation of the Long-term Antiaging Effects of BroadBand Light Therapy

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BroadBand Light (BBL), which utilizes visible and infrared light (400–1400 nm) delivered for phototherapy, is a nonablative treatment designed to rejuvenate the skin on the face, chest, neck, forearms, legs, and hands. The objective of this retrospective study was to evaluate if participants who underwent regular treatment with BBL over a period of 5 to 11 years looked noticeably younger than their actual age.

Fifteen participants aged 38 to 69 years (median, 46.0 years; interquartile range, 19.7 years) with Fitzpatrick skin types I to IV received at least 1 full-face treatment per year with a BBL device (BBL, Sciton, Inc) during the study period. Blinded evaluators (N=491) analyzed clinical photographs taken before the first treatment and after the last treatment to estimate pretreatment and posttreatment ages of participants over 5 to 11 years.

Before treatment, the median estimated age of participants was slightly lower than the median actual age, but the difference was not significant. The median estimated age at the end of the study period, which varied from 5 to 11 years depending on the participant, was significantly lower than the corresponding median actual age (P=.0084). Although treated skin actually aged a median of 9 years, participants appeared to have aged a median of −2 years.

Results from our study indicate that patients who maintain a regular annual or biannual regimen of BBL treatments over 5 to 11 years can reduce and delay the long-term signs of skin aging such as photodamage, telangiectases, fine lines and wrinkles, and skin laxity in a natural-looking way.

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Long-term exposure to UV radiation results in photodamage of human skin that is characterized by reduced epidermal and dermal thickness, wrinkles, dyspigmentation, telangiectases, coarse skin texture, and in some cases actinic keratosis and epidermal malignancies.[1] Although they can be effective, ablative treatments require long recovery periods, may result in scarring, and are not always a desirable option for patients.[2,3] BroadBand Light (BBL) offers a more gentle approach to treat skin aging and can provide impressive results, as demonstrated in this study.

After almost 2 decades of using BBL, our experience has shown that patients appear younger than their actual age following long-term treatment and routine maintenance with BBL. This retrospective study includes blinded evaluations of clinical pretreatment and posttreatment photographs by physicians and nonphysicians, including members of the public with no aesthetic experience.

Photorejuvenation refers to the visible improvement of photodamaged skin using a laser or other light source.[1] When used for phototherapy, BBL (visible and infrared light, 400–1400 nm) allows for targeted treatment of many skin types and conditions. This range of light has emerged as a nonablative modality to rejuvenate the skin on the face, chest, neck, forearms, legs, and hands.[1,4-6] BroadBand Light devices consist of a noncoherent, filtered, multiwavelength light source. After BBL originally was marketed to treat telangiectases of the legs, users soon recognized that, unlike pulsed dye lasers, this treatment option caused minimal purpura.[7] BroadBand Light also has been shown to improve wrinkles, coarseness, pigmentation abnormalities, and pore size with minimal downtime and no scarring.[1,4,8,9] Clinical results are supported by pretreatment and posttreatment pathology studies that show new collagen formation[1,10-13] and strong staining for types I and III procollagen[14]; however, El-Domyati et al[15] reported only slight insignificant histologic changes 3 months after treatment.

An advantage of BBL versus laser devices is that it permits large spot sizes, which allows physicians to treat large areas, such as the extremities, with rapid results and minimal discomfort for the patient.[6] BroadBand Light has been widely used as a skin rejuvenation technique in Asian countries because treatment is effective and does not result in persistent hyperemia, hyperpigmentation, scarring, or other complications that typically are associated with ablative lasers.[10,14,16] Recommendations for physician training, indications, patient information, documentation, diagnosis, and test treatment have been reported.[17]

Weiss et al[18] previously reported 4-year results in 80 participants who were treated with visible and infrared light (520–1200 nm) from 1996 to 1997. Participants received a median of 3 treatments and results were evaluated 4 years later. Four years following initial treatment, 83% of participants showed improvement in skin texture, 82% showed improvement in telangiectases, and 79% showed improvement in pigmentation.[18]

The objective of our retrospective study was to determine if regular maintenance treatments with BBL over 5 to 11 years results in sustained improvements in skin quality as well as noticeable effects in the actual versus estimated ages of participants as determined by a panel of blinded evaluators.

METHODS

Participants

Fifteen participants (3 males; 12 females) aged 38 to 69 years (median, 46.0 years; interquartile range, 19.7 years) with Fitzpatrick skin types I to IV were included in this retrospective study. All of the participants meeting the minimum criterion of having undergone BBL treatments for a minimum of 5 years were included in the study. Participants had presented with varying degrees of photodamage. All participants provided signed informed consent to treatment and use of photographs.

Study Design

Each participant received a series of full-face treatments with a BBL device (BBL, Sciton, Inc) for skin rejuvenation during the 5- to 11-year study period. Pregnancy and current use of retinoids and photosensitizing medication were grounds for exclusion. Participants were allowed to use tretinoin during the study period, but cosmetic surgery, laser treatment, and chemical peels were not permitted. Each participant followed their own skin care regimen throughout the study period. All treatments were administered by the investigators. Participants underwent at least 1 BBL treatment per year after the initial series and did not undergo facial aesthetic surgery or laser resurfacing during the study period. Photographs obtained before and after the final treatment were analyzed by 491 blinded evaluators (51 [10.4%] dermatologists; 122 [24.8%] aesthetic physicians; 44 [9.0%] other physicians; 177 [36.0%] physician extenders; and 97 [19.8%] public, non–medically oriented individuals [did not work in the medical or aesthetic industry]). Survey participants were asked to estimate the ages of the participants before and after BBL treatment. Pretreatment photographs were taken with a Polaroid (Polaroid Macro 5 SLR, Polaroid Corporation) camera; posttreatment photographs were taken with a digital camera (EOS Rebel T3i, Canon USA, Inc). Pretreatment and posttreatment photographs were taken from a standardized position. Polaroid photographs were stored away from heat and light until they were digitally scanned and stored. As a control, photographs of non–sun-exposed and untreated skin from the participants were included in the survey. Aesthetic physicians who were blinded evaluators included plastic surgeons and other nondermatologists who considered aesthetic medicine their primary focus, while other physicians were nondermatologists who did not consider aesthetic medicine their primary focus.

Procedure

Treatment settings for BBL therapy usually followed manufacturer recommendations for skin rejuvenation

and skin type.[19] Cooling gel was used in all treatments, while contact cooling was used only in later treatments as the technology advanced.

Filter selection depended on skin type and severity of photodamage. The treatments consisted of a multiple of 2 to 4 BBL passes using the 515-, 560-, or 590-nm filter; a fluence of 8 to 12 J/cm^2; a 10- to 20-millisecond pulse duration; a large 45×15-mm spot size; and cooling of 10°C to 20°C for the first and second passes. The forehead was routinely treated with the square 15×15-mm adaptor and a 1 to 2 J higher fluence. The third and fourth passes were made using the 560- or 590-nm filter, a fluence of 15 to 18 J/cm^2, a 15- to 20-millisecond pulse duration, and the square 15×15-mm adaptor. These passes were localized to the cheeks, chin, nose, and perioral areas. Pretreatment care was limited to application of a topical anesthetic and sunscreen; posttreatment care included regular use of sunblock and the participant's skin care regimen. No other aesthetic procedures were performed during the duration of the study period.

Data Collection

Using only the photographs of skin, which were presented randomly via standard online survey software (SurveyMonkey), evaluators estimated the pretreatment and posttreatment ages of each participant. Photographs were cropped to focus only on the treated skin to avoid showing other signs of aging (eg, graying hair). Posttreatment photographs were obtained 5 to 11 years following initial BBL treatment. Actual ages of the participants both before and after treatment were compared with the blinded evaluators' estimated ages at these same time points.

Data Analysis

Nonparametric statistics were used because the data were not continuous and were not normally distributed as shown by the Shapiro-Wilk test. The median estimated ages before and after treatment were calculated and compared to the median actual ages according to the Wilcoxon signed rank test. The difference between the median estimated posttreatment age and the median actual pretreatment age also was calculated and tested for a statistically significant difference.

RESULTS

The actual ages of all participants before and after BBL treatment are presented in Table 1. The median actual posttreatment age (55 years) was significantly higher ($P<.0001$) than the median actual pretreatment age (46 years). The median difference was 8 years.

Before treatment, the median estimated age was slightly lower than the median actual age, but the difference was not significant. The median estimated age at the end of the study period (45 years) was significantly lower than the corresponding median actual age (55 years)($P=.0084$) (Table 2). Clinical examples are presented in Figures 1 through 4.

The median estimated posttreatment age (45 years) was slightly lower than the actual pretreatment age (46 years), but the difference was not significant (Table 2).

Photographs of non–sun-exposed and untreated skin for all participants also were included in the blinded evaluation; evaluators estimated the ages correctly (data not shown).

COMMENT

To our knowledge, our study is the longest blinded evaluation of visual skin quality and rejuvenative effects resulting from BBL treatment in the current literature. Although the participants' skin actually aged a median of 9 years during the study period, treated skin appeared to have aged a median of −2 years (Table 2). This value is the median difference between the estimated posttreatment ages and the actual pretreatment ages.

In 2002, Weiss et al[18] conducted a retrospective chart review of 80 randomly selected participants at 4 years following initial treatment with visible and infrared light (520–1200 nm)(median, 3 treatments). The face, neck, and chest areas were treated for conditions that included poikiloderma, telangiectasia, and mottled hyperpigmentation. Ninety-seven percent of participants also applied a daily regimen of various topical agents, including sun protection, during the 4-year study period. Results were evaluated using 2 methods: (1) comparison of pretreatment and posttreatment photographs by an independent nontreating physician graded on a 4-point scale (worse; no change; slightly better [less than 50% improvement]; much better [more than 50% improvement]); and (2) participant self-assessment of improvement in textural smoothness, telangiectasia severity, and blotchy pigmentation. Self-assessment scores were based on the participant's memory of baseline severity. At 4 years following initial treatment, 83% of participants showed improvement in skin texture, 82% showed improvement in telangiectases, and 79% showed improvement in pigmentation.[18]

Their study focused on the 4-year effects of a series of several initial BBL treatments without regular follow-up treatments other than a topical skin care regimen and sun protection,[18] whereas our study targeted changes in perceived age for up to 11 years after a series of initial treatments followed by maintenance treatments at least once per year. Concerning their 4-year results, the authors reported that the longer-lasting effects were likely the

TABLE 1
Participant Actual Ages and Age Differences Before and After Treatment[a]

	Actual Age, y		
Participant No.	Pretreatment	Posttreatment	Difference[b]
1	46	51	5
2	60	67	7
3	65	75	10
4	46	54	8
5	47	57	10
6	61	71	10
7	46	56	10
8	38	49	11
9	39	50	11
10	39	49	10
11	53	61	8
12	69	75	6
13	38	46	8
14	50	55	5
15	40	48	8

[a]Median (interquartile range): pretreatment, 46.0 (19.7) years; posttreatment, 55.0 (16.8) years; difference, 8.0 (2.8) years. The interquartile range is a measure of dispersion (75th to 25th percentile). The difference was significant ($P<.0001$).
[b]Posttreatment age − pretreatment age.

TABLE 2
Median Ages and *P* Values

Pretreatment Age, y (IQR)				Posttreatment Age, y (IQR)				Final Difference, y (IQR)[c]	*P* Value[d]
Actual	Estimated	Difference[a]	*P* Value[b]	Actual	Estimated	Difference[a]	*P* Value[b]		
46.0 (19.7)	45.0 (11.0)	−1.0 (10.7)	.5416[e]	55.0 (16.8)	45.0 (11.0)	−11.0 (12.3)	.0084[f]	−2.0 (13.7)	.4361[e]

Abbreviation: IQR, interquartile range.
[a]Estimated age − actual age.
[b]Estimated age vs actual age (Wilcoxon signed rank test).
[c]Estimated posttreatment age − actual pretreatment age.
[d]Estimated posttreatment age vs actual pretreatment age.
[e]Not significant.
[f]Significant.

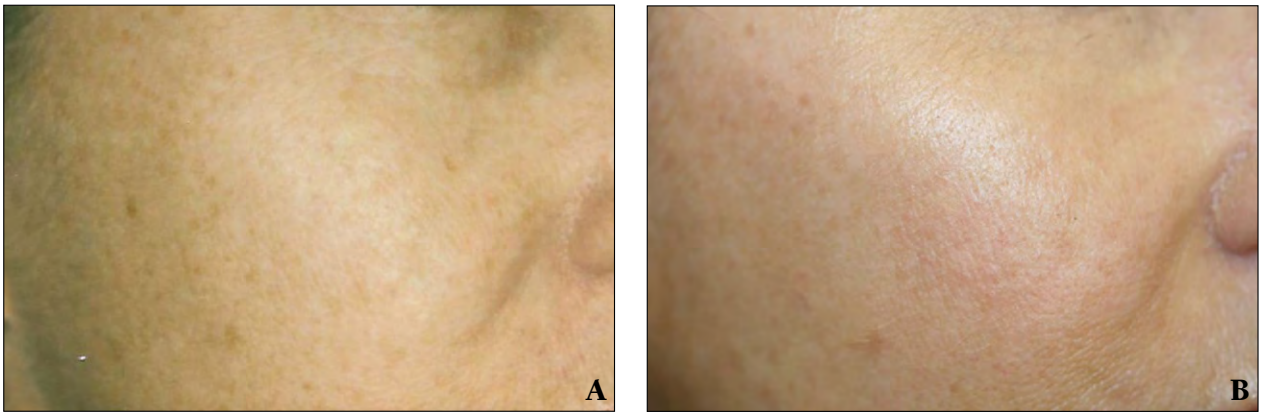

Figure 1. A 46-year-old woman before (A) and 5 years after treatment of the right cheek with BroadBand Light therapy at least once per year (B).

Figure 2. A 39-year-old man before (A) and 11 years after treatment of the right lateral neck with BroadBand Light therapy at least once per year (B).

Figure 3. A 38-year-old woman before (A) and 8 years after treatment of the left cheek with BroadBand Light therapy at least once per year (B).

result of the patients' use of topical retinoids and ascorbic acid; however, they stated that the continued absence of telangiectases indicateed that the light source had a notable effect.[18] Participants in our study also used a variety of skin care regimens that undoubtedly contributed to the long-lasting treatment effects.

One of the authors (P.B.) recommended in a prior report that optimal results can be obtained with a series of

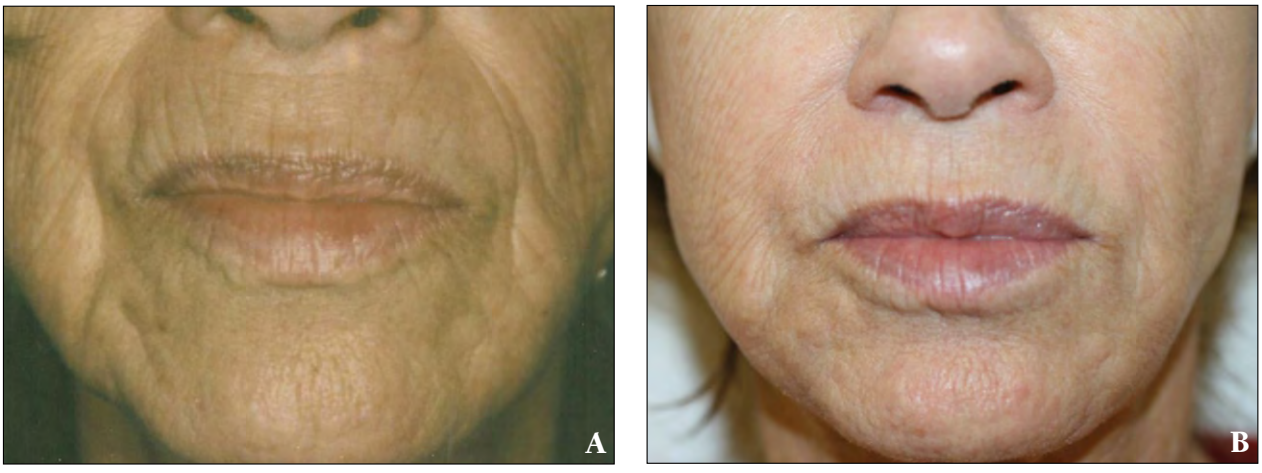

Figure 4. A 69-year-old woman before (A) and 6 years after treatment of the perioral area with BroadBand Light therapy at least once per year (B).

gentle (not painful) BBL treatments spaced several weeks apart, which produces gradual improvement, minimal adverse effects, and decreased downtime.[1] In our current study, BBL treatment effects were maintained with regular treatments (at least one per year) for 5 to 11 years, which was noted by the evaluators. Treatment intervals in our study were much longer than the several weeks of prior short-term studies, indicating that the effects of BBL treatment persist much longer than previously realized. It is not known if the widely spaced treatments also produced progressive improvements.

In 2003, Laury[20] showed that patients could expect on average a 2-year reduction in their perceived age per treatment with a visible and infrared light device in the range of 560 to 1200 nm. The study was prompted by the author's desire to answer patients who ask, "How much younger will the procedure make me look?" In this 5-patient study, initial treatment settings were based on the patient's Fitzpatrick skin type, while settings in later treatments were individualized by observing skin characteristics during and after treatment. Each patient received 5 treatments at 3-week intervals. Patients estimated their ages on a visual analog scale ranging from 0 to 100 years in 10-year increments at the beginning of the study and before each treatment. All patients showed improvement during the study period. Subjective age reductions ranged from 3.9 to 11.5 years and averaged 1.9 years per treatment over the 15-week period. Complications were not observed. No signs of aging were noted to worsen, and perceived improvements did not regress during the study period.[20]

Laury's[20] study differs from our study in several important respects; for instance, the number of patients (n=5) was smaller, the study period was much shorter, and estimated age reductions were evaluated by patients rather than blinded evaluators using photographs. The study does, however, provide data that are useful in pretreatment counseling of patients who are considering facial rejuvenation by visible and infrared light devices in the range of 520 to 1200 nm.

The limitations of our study included the small number of participants, the nonstandardization of the before and after photographs, and the lack of specific grading criteria for the evaluators. The objective of the study was to determine if blinded evaluators could estimate the ages of participants by observing treated and untreated skin; thus they were not asked to use grading criteria to assess improvement in wrinkles, pigmentation, or other signs of aging. The quality of the clinical photographs also was a limitation; pretreatment photographs were taken with a Polaroid camera, and although they were stored in ideal conditions, they were not in the same format as the posttreatment photographs, which were taken years later with a digital camera. Although the data are not shown, the blinded evaluators did estimate the ages correctly from photographs of non–sun-exposed and untreated skin that were taken pretreatment and posttreatment, indicating photograph quality did not bias their responses. The encouraging results warrant additional studies with more patients, histologic evaluations, and assessments of individual skin characteristics to determine if improvements are progressive with regular BBL treatments.

CONCLUSION

The results of this study demonstrate that patients who maintain a regular annual or biannual regimen of BBL treatment can both reduce and delay the long-term

signs of skin aging such as photodamage, telangiectases, fine lines and wrinkles, and skin laxity in a natural-looking way.

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