Rejuvenation of Photoaged Skin: 5 Years Results with Intense Pulsed Light of the Face, Neck, and Chest

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BACKGROUND. Photorejuvenation involves the use of lasers or light sources to reverse signs of photoaging. Multiple devices have been shown to be effective over the short-term.

OBJECTIVE. To investigate the long-term clinical results on the face, neck and chest at 4 years using filtered flashlamp intense pulsed light (IPL) for treatment of photoaging changes of telangiectasias, dyspigmentation, and rough skin texture.

METHODS. A chart review of 80 randomly selected patients with skin types I-IV who were treated by IPL during 1996 and 1997 was performed. Photos and patient self-assessment were graded for features of textural smoothness, telangiectasia severity, and blotchy pigmentation into four categories of worse, no change, slightly better (less than 50% improvement) and much better (greater than 50% improvement).

RESULTS. At 4 years following initial treatment, skin textural improvement was noted in 83% of the subjects. Telangiectasias were improved in 82% of subjects, while pigmentation remained improved in 79%. The median number of treatments was 3. The face responded slightly better than the chest or neck. Most common side-effects included temporary mild crusting (19%), erythema (15%) and purpura (6%).

CONCLUSION. Signs of photoaging including telangiectasias and mottled pigmentation of the face, neck, and chest, can be improved by IPL with a long-lasting result. Minimal or no downtime with minimal adverse effects can be achieved with the settings reported. Skin textural smoothing, although not easily quantified, is an additional benefit observed long-term.

THIS STUDY WAS PRESENTED IN PART AT THE 2000 ASDS ANNUAL MEETING IN DENVER. THE AUTHORS ARE CONSULTANTS AND PRECEPTORS FOR LUMENIS. THE DEVICES USED IN THIS STUDY WERE PURCHASED AT A DISCOUNT. NO DIRECT FUNDING WAS PROVIDED FOR THIS STUDY.

THE APPEARANCE of aging skin due to chronic exposure to ultraviolet light can be distinguished from chronologically or intrinsically aging skin.[1] Photoaging, resulting from chronic exposure to UV light, includes wrinkling of the skin, rough texture, dyspigmentation, and loss of elasticity.[2,3] These findings are explained by histologic evidence of epidermal thinning but more importantly, dermal changes of disorganized collagen bundles and clumping of elastic fibers. Changes within the matrix of the dermis and at the dermal-epidermal junction include reductions in procollagens I and III, collagen VII, and the fibrillin-rich microfibrillar apparatus at the dermo-epidermal junction.[4] Photoaged skin displays prominent alterations in the cellular component and the extracellular matrix of the connective tissue with an accumulation of disorganized elastin and a severe loss of interstitial collagens.[5] Similar changes may also affect superficial capillaries which can become skin surface telangiectasias.

A variety of treatments to reverse this photodamage aging process have been employed. On one side of the therapeutic spectrum, keratinocytes and fibroblasts can be stimulated by topical agents such as tretinoin, vitamin C (l-ascorbic acid), vitamin E and alpha-hydroxy acids.[6–10] More aggressive treatments ablate the epidermis and/or dermis in order to generate new dermal matrix proteins and replace keratinocytes with completely new ones. These treatments such as Erbium YAG laser resurfacing, CO2 laser resurfacing, dermabrasion and deeper chemical peels, although effective, may have a prolonged recovery period, significant periods of altered pigmentation, infection and significant risks of scarring.[11–15]

In order to circumvent the prolonged healing and side-effects yet stimulate new collagen and improved skin texture, lasers and light sources have been employed which do not ablate the epidermis yet stimulate collagen production and cause proliferation of the epidermis.[16–25] These devices include the pulsed dye laser, Q-switched Nd:YAG laser, and long pulsed Nd:YAG emitting at 1320 nm.[26] An additional device is a broadband light source or intense pulsed light device which emits a continuous spectrum in the range of 515 nm to 1200 nm. Low end cut off filters are used to eliminate shorter wavelengths depending on the application. The IPL device has been shown to be effective for vascular lesions such as telangiectasias,

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port-wine stains, poikiloderma (telangiectasias, atrophy and dyspigmentation).[25] A recent report indicates excellent results for the specific treatment of photoaging.[16] Histologic studies confirm the production of new collagen fibers and epidermal regeneration with new rete ridges with many nonablative techniques.[17,19,27-28] All skin types may be treated as a recent study showed excellent results on Asian skin with appropriate parameters.[29]

We have treated thousands of patients for signs of photoaging including facial telangiectasias and dyspigmentation with intense pulsed light (IPL) since 1995. We could therefore perform a restrospective study to investigate the long-term clinical results at several years after using filtered flashlamp IPL for treatment of these sun-induced aging signs of the skin. Patients were followed up to 5 years post IPL treatment and results compared to pretreatment photos and records. Patients were asked to self-assess improvement not only for telangiectasias, mottled pigmentation and poikiloderma but for overall improvement in skin texture.

Materials and Methods

A chart review of from 80 randomly selected patients with skin types I-IV who were treated by IPL during 1996 and 1997 was performed. These patients had undergone treatment of the face, neck, and/or chest for actinic changes including poikiloderma, patches of telangiectasias on the cheeks and pigmentation changes consisting of primarily mottled pigmentation.

Images stored on either 35 mm (Nikon N70 Canfield system) or digital (640 × 480 nm, jpeg images) from 3 subsequent visits including one final follow-up at 4 years were graded into 4 simple categories. Simple categories were necessary since judgement of skin textural improvement is difficult from two dimensional images or patient memory. Categories included worse, no change, slightly better (less than 50% improvement) and much better (greater than 50% improvement). A nontreating independent physician examined the photos. A patient self-assessment for features of textural smoothness, telangiectasia severity, and blotchy pigmentation was performed. Scores for both photos and patient self-assessment were averaged with equal weight.

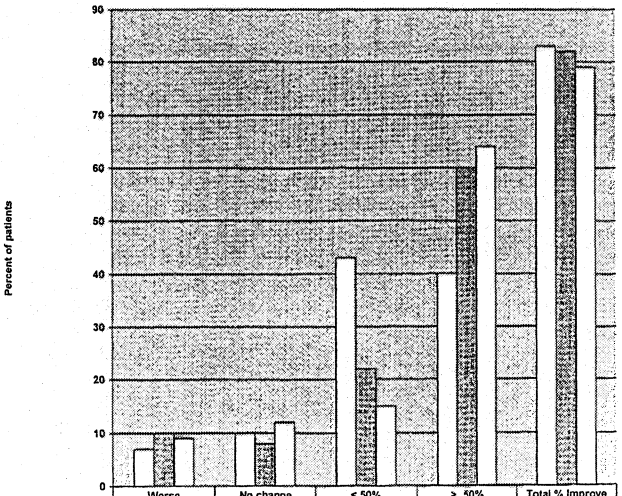
The treatment device utilized was the original Photoderm VL (Lumenis, Santa Clara, CA) with a range of parameters including low cut-off filters of 550–590 nm, although the 570 nm was the most commonly utilized. Early on in 1996 patients were treated with single pulses of 2.4–3 millisec pulse durations, but double pulses became the rule by 1997 with the most common setting of a 2.4-ms pulse, 10 millisecond delay followed by a 6.0 millisecond pulse. Double pulsing with a short and then longer pulse was employed due to less side-effects and greater efficacy which became apparent after 300 patient treatments. When pigmentation was predominant, settings of 550 nm filter, double pulse 2.4 ms, 10 millisecond delay and 4 ms pulse were most common. For telangiectasia predominant photoaging, a 570-nm filter with settings of double pulse 2.4 ms, 10 millisecond delay and 6–8 millisec coupled second pulse were most common. Fluences included 22–28 J/cm2 for a single pulse and a range of 30–44 J/cm for double pulses. The application of the crystal to the skin was always using the gel "float" technique of at least a 2-mm layer of water based gel (Lumenis coupling gel, Santa Clara, CA) between the crystal and the skin. The gel was at refrigerator temperature.

Continuous skin care regimens involving daily application of topical glycolic acid, retinol, retinoic acid or L-ascorbic acid were utilized by 97% of the patients. Sunscreen was strongly advocated and the patients in this retrospective study indicated that they utilized an SPF of 15 or higher on a daily basis.

Results

Averaged results from photo and patient self-assessment data are summarized in Figure 1. At 4 years following initial treatment, skin textural improvement was noted in a total of 83% of the subjects. Telangiectasias were improved in a total of 82% of subjects, while pigmentation remained improved in a total of 79%. The median number of treatments was 3.

When we looked at particular regions, the face had the greatest long-term improvement with 90% having improved texture, reduced telangiectasias or more uniform pigmentation. The neck had the lowest rate with 71% and the chest was second with an improvement of 76%. Examples of good clinical results for the chest, neck and face are shown in Figure 2.



	Worse	No change	< 50%	> 50%	Total % Improve
Texture	7	10	43	40	83
Telangiectasias	10	8	22	60	82
Pigmentation	9	12	15	64	79

Figure 1. Summary of results at 4 years.

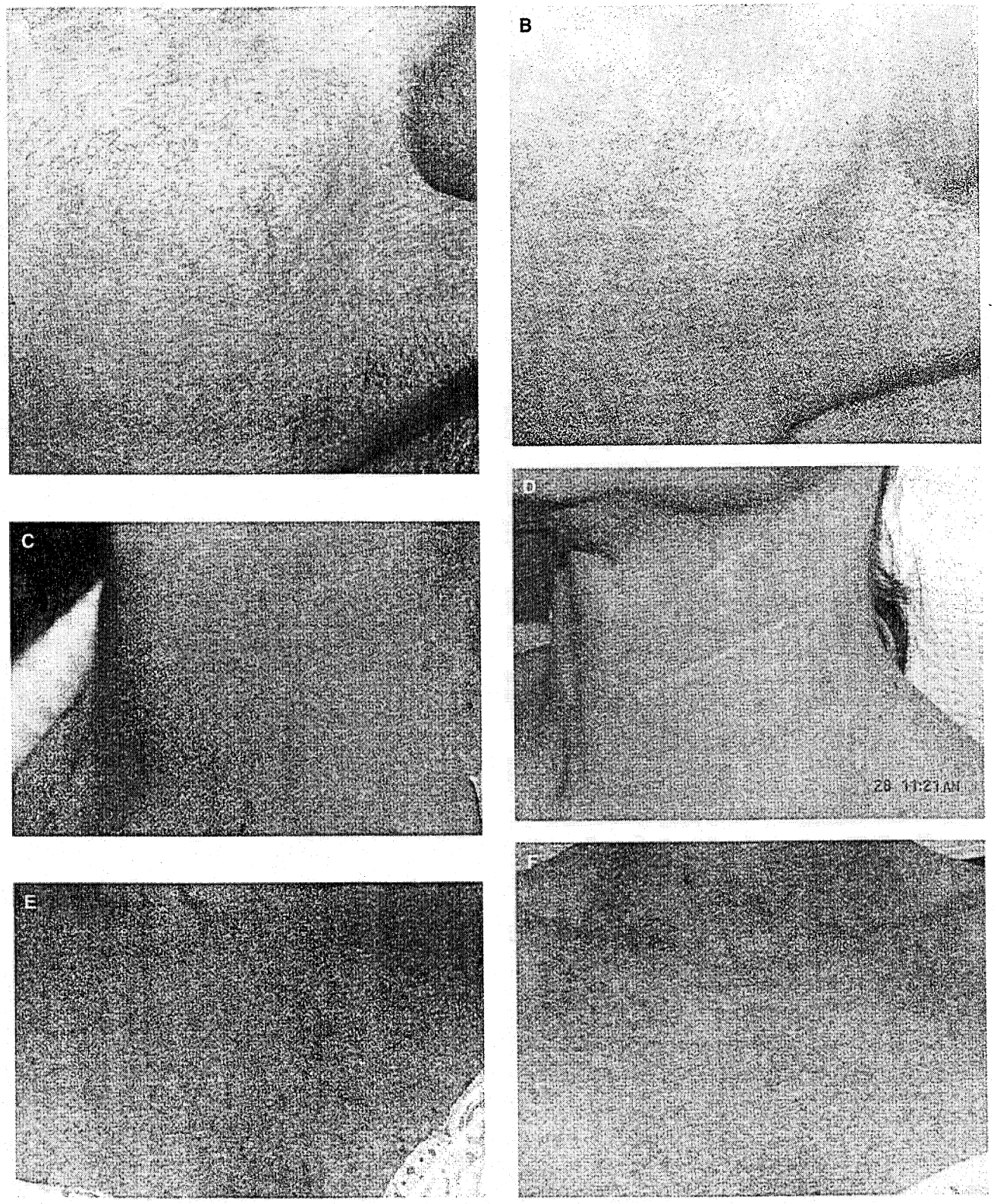


Figure 2. Clinical results. A) Face before and B) After 3 treatments using 570 nm filter with double pulse of 2.4 ms/6 ms pulse duration (10 ms delay) progressively increasing from 38 to 42 J/cm^2. C) Neck before and D) after 3 treatments using 550 nm filter with double pulse of 2.4 ms/4 ms pulse duration (15 ms delay) progressively increasing from 36 to 40 J/cm^2. E) Chest before and F) after 4 treatments using 570 nm filter with double pulse of 2.4 ms/6 ms pulse duration (10 ms delay) progressively increasing from 39 to 43 J/cm^2. Note textural improvement with reduction of lentigenes.

Side-effects included hypopigmentation (rectangular) in isolated regions, particularly the neck, lasting for 6 months to one year in 2.5%. One patient had visible evidence of hypopigmentation on the lateral neck at 4 years. A temporary mild crusting lasting one to three days after treatment was observed in 19%. Erythema for more than 4 h was seen in 15%. Mild isolated purpura was noted in 6% usually resolving within 1–5 days without subsequent hyperpigmentation. Purpura typically occurred only with isolated pulses and did not involve entire regions of treatment. Mild facial edema for 1–3 days was reported by 17%.

Discussion

Treatment of vascular and pigmented lesions by IPL relies on selective photothermal destruction of the lesions by manipulation of the lower wavelengths and pulse duration,[30] plus the effects of a broadband light source which emits wavelengths from yellow to infrared.[31] The geometry of the beam (spot size) is important in treatment of photoaging as well, as a large spot size enables effective treatment of large areas such as the chest.

In order to reverse the effects of photoaging, a shift from the more invasive ablative resurfacing techniques to nonablative procedures with little or no down time has occurred. Photoaging can be treated with the pulsed dye laser, Q-switched 1064 nm Nd:YAG and millisecond domain 1320 nm Nd:YAG showing enhanced collagen production with improvement in skin appearance.[17,20,27–28] Mechanisms probably include mild thermal injury requiring repair of dermal collagen, vascular destruction with migration of lymphocytes and induction of cytokines recruiting new fibroblasts.[26]

The less invasive methods using lasers or light sources to improve the superficial erythematous telangiectatic, mottled pigmented and finely wrinkled appearance that comprise photoaging have now been termed photorejuvenation. Although we began utilizing IPL as treatment primarily for telangiectasias in 1995, we soon discovered by clinical observation that other components of photoaging such as atrophy and pigmentation were responding as well. The rationale for initial use of IPL with telangiectasias was the relative lack of purpura compared to traditional short pulsed yellow dye lasers,[32] although new longer pulsed dye lasers have greatly reduced the duration and severity of this side-effect.[33] We previously documented that the majority of patients with Poikiloderma of Civatte on the neck and chest can be treated with over 75% clearance using IPL.[34] IPL parameters used in this study led to minimal risks of hypopigmentation and scarring, with a minimal amount of discomfort.

Our data correlates well with the initial IPL rejuvenation study published by Bitter.[16] Bitter reported 100% improvement in photoaging while we find that 4 out of 5 patients benefit long-term. Goldberg also concluded that intense pulsed light could improve some but not all rhytides.[18] Our findings of overall improvement by 80% of patients correlates well with previously published data in an Asian population.[29]

In summary, IPL demonstrates excellent long-term results with the telangiectatic and pigmentation component of photoaging. While the wrinkling component is more difficult to judge by two-dimensional photography and imaging, improvement in superficial skin texture appears to accompany the improvement in telangiectases and pigmentation. This improvement holds up over several years as long as patients practice stringent sun protection. The continued use of topical retinoids and ascorbic acid most likely contributed to the longer lasting effects although the continued absence of telangiectasias indicates that the light source had a significant effect.

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