Non-Ablative Skin Therapy with CoolGlide Vantage Sub-Millisecond 1064 nm Laser Treatments

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Non-ablative laser skin therapy is becoming an increasingly popular alternative to ablative laser therapy to reverse some of the adverse effects of sun damage and resultant photoaging. This can be achieved without epidermal damage and patient down time. The most commonly used lasers for these treatments fall into two groups. One group is pulsed dye lasers which target hemoglobin in the microvasculature for heating. This is thought to cause the release of inflammatory mediators that stimulate fibroblasts, resulting in remodeling and enhanced new collagen production[1]. The other group of lasers have wavelengths that target water, producing non-specific heating of the upper dermis with the aim of stimulating the production of new collagen.[2]

We have found millisecond Nd:YAG (1064 nm) laser systems to be effective for the treatment of vascular lesions. With the appropriate selection of parameters, such as spot size, pulse duration, and fluence, a wide range of vessel sizes can be treated. A broad range of available pulse durations allows us to match the thermal relaxation times of vessels ranging from capillaries to reticular veins.

Since 1064 nm lasers are used to target hemoglobin, the appropriate combination of parameters may allow preferential targeting of microvasculature while also providing general heating of the upper dermis. A relatively short pulse duration of 300 microseconds (0.3 milliseconds) should provide for preferential heating of the microvasculature. In addition to any impact this might have on fibroblast stimulation, short-duration pulses may provide the required selectivity to treat the very small vascular components that cause diffuse erythema. In order to provide heating of the upper dermis, these short duration laser bursts could be applied in a repetitive fashion with a relatively small spot size to gradually heat the upper dermis. Heat will be generated at the locations of light absorption, such as the papillary dermal plexus, and spread to surrounding tissue. A target epidermal temperature of 43 to 48 degrees C should maintain epidermal safety and patient comfort while reflecting a higher temperature in the dermis. The goal of this dermal heating is to stimulate remodeling and new collagen production.

The objective of these treatments was to evaluate the CoolGlide Vantage 1064 nm laser system, manufactured by Cutera, using treatment parameters described above, for non-ablative skin therapy on a wide range of patients.

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[1] Bjerring P, Clement M, Heickendorff L, et al. Selective non-ablative wrinkle reduction by laser. J Cut Las Ther 2000; 2:9-15.
[2] Goldberg D. Full face nonablative dermal remodeling with a 1320 nm Nd:YAG laser.Dermatol Surg 2000; 26:915-918.

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Materials and Methods

A two center, prospective study was conducted to evaluate the CoolGlide Vantage laser system for non-ablative skin therapy. Fifteen female patients were initially enrolled, with fourteen patients, 7 at each clinical site, completing the study. One patient was removed for attendance non-compliance. The patients had Fitzpatrick skin phototypes I-IV and received a series of six treatments each. The age range of the patients was 33 to 67 (mean of 53) years. These patients had varying degrees of photoaging, including diffuse erythema, facial telangiectasia, dyschromia, enlarged pores, fine lines, wrinkles, irregular skin texture and acne scarring.

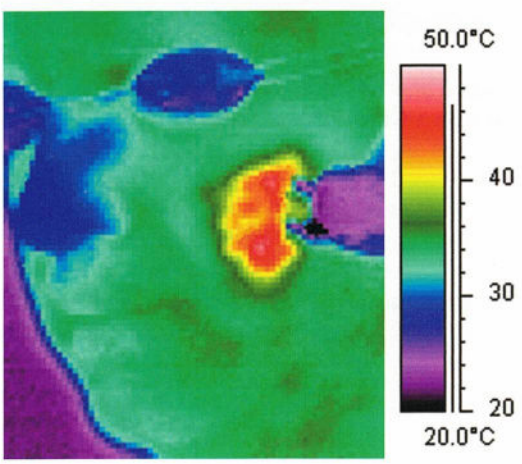
Each patient was photographed bilaterally with a standardized digital photography system prior to the initial treatment and at each subsequent visit. Prior to treatment all cosmetics were removed. No topical anesthesia or gel was used. Protective metal eyewear was used for all patients.

At one clinical site the six treatments were performed at a spacing of 3 to 6 weeks (average of 4 weeks), and at the other site the six treatments were performed at a spacing of 2 to 3 weeks (average of 2.2 weeks). Thirteen of the fourteen patients completed all six treatment visits, while one patient received five treatments.

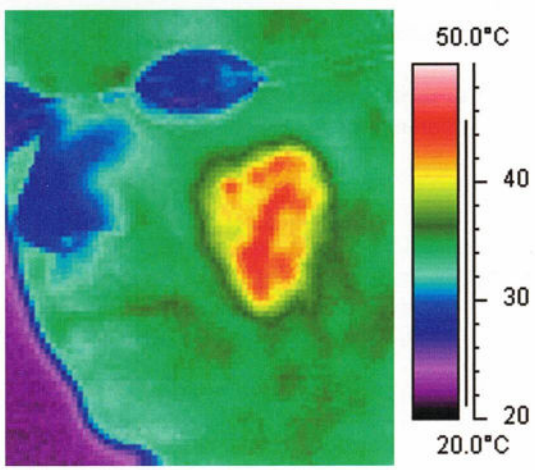
With the exception of the initial treatments at one site, all of the treatments were performed at a pulse duration of 0.30 milliseconds to target the very small vasculature. A relatively small spot size of 5 mm was used to induce targeted heating of the upper dermis with a repetition rate of 5 pulses per second. Most treatments started at a fluence of 13 J/cm^2 to allow for delivery of laser energy sufficient to provide heating while maintaining patient comfort. As patients grew comfortable with successive treatments, some were treated with increased fluences (from 13 to 20 J/cm^2). Discrete facial telangiectasia, if any, were treated separately using a 3 mm spot size and standard telangiectasia parameters (usually a fluence between 120 and 170 J/cm^2 and a pulse duration of 15 or 20 ms).

The treatments were performed with approximately 7,000 pulses applied over the entire face, avoiding areas within the orbital rim. The treatment was performed in smaller sections of approximately 4 cm by 5 cm, with the handpiece held 1 to 2 cm over the skin and kept in motion to evenly cover the area being treated for approximately 500 pulses. No epidermal cooling or gel were used. At one clinical site, the skin was lightly misted with water prior to treatment and once during the treatment. This mist was found to be pleasant for the patients. No special post-operative care was required.

The thermal images below show the temperature profile in an area being treated at half way through the treatment of that area (left image) and immediately after the treatment of that area (right image). Five hundred pulses were applied in one hundred seconds. The surface of the area being treated was brought to a temperature in the low to mid 40s (degrees C) and maintained at that temperature for about 60 seconds.



Thermal profile half way through treatment.

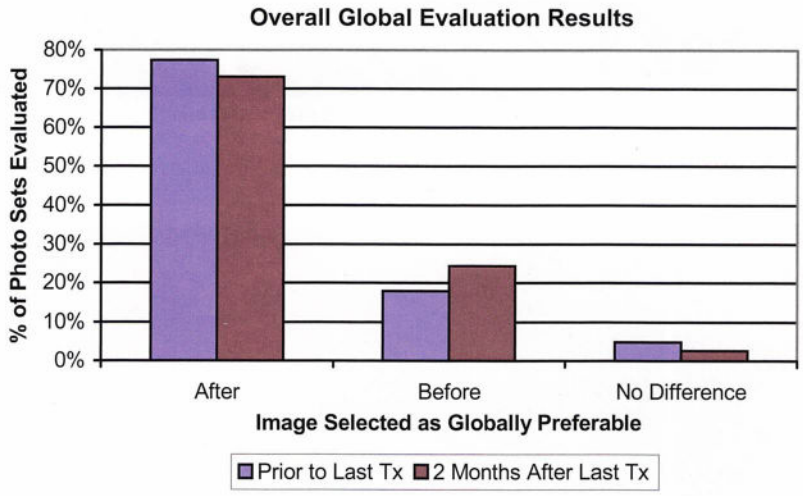


Thermal profile immediately after 100-second treatment period.

Results

The treatments were well tolerated by the patients and no anesthetic was used. The typical response to the treatments was transient erythema and a feeling of warmth. There were no reports of side effects such as purpura, blistering, scarring, hypopigmentation or hyperpigmentation

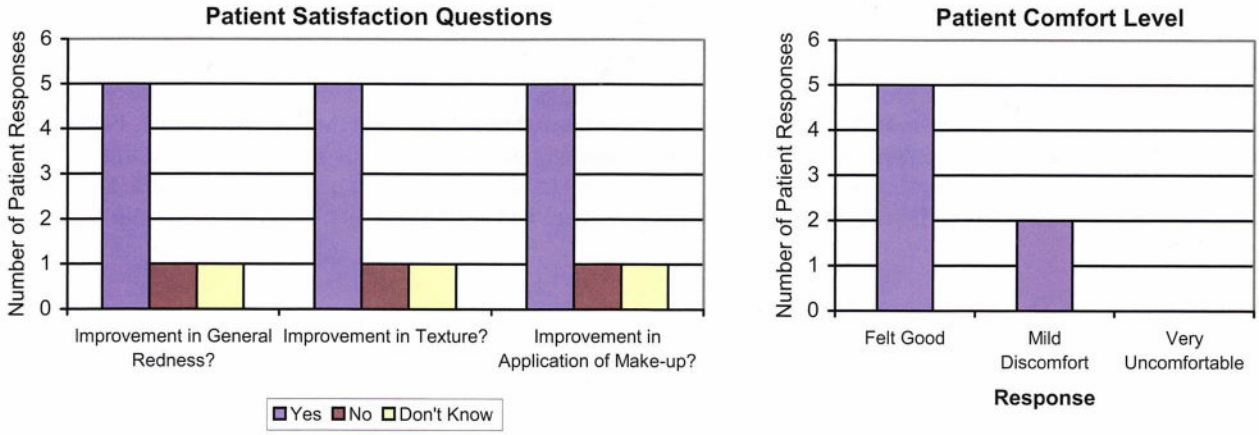
A challenge for all non-ablative procedures has been to correlate the photographic records to the generally high satisfaction expressed by patients. For analysis of these results, printed images of the before and after high-resolution digital photographs were evaluated by blinded evaluators. Evaluations were performed for two points in time. The first evaluation was the blinded comparison of the initial pre-op photographs to the final treatment pre-op photographs. The second evaluation was a blinded comparison of the initial pre-op photographs to the photographs taken at the follow-up visit an average of 8 weeks after the final treatment. The before and after images were printed at the same time and on the same paper to avoid effects from printer variability. The position of the before and after photos on the page were randomized to eliminate evaluator bias. Each image was printed at two different magnifications to aid the evaluators.



The blinded evaluators (two physicians and one nurse from a dermatology practice unrelated to the study) were asked to perform a global assessment from the facial images based on factors such as redness and pigment variations, skin texture, pore size and general appearance of skin tone. Evaluations were based on 28 sets of images (left and right side of each of the 14 patients) for the initial evaluation period and 26 sets of images for the final evaluation period. One patient was not available for the final evaluation visit. At each of the evaluation periods, the "after" pictures were preferred to a much greater degree (77% and 73%) than the "before" pictures (see figure on left).

Results of blinded evaluation, showing which, if either, photo was preferred in the global assessment. The first set of results compare the photos taken just prior to the final treatment to the initial pre-op photos. The second set of results compare the photos taken an average of 8 weeks after the final treatment to the initial pre-op photos.

At the final treatment visit, the seven patients from one clinical site were questioned regarding the treatments. The results (see below) show a favorable response to improvement in general redness, texture, and the application of make-up.



Patient response to questions of improvement and level of discomfort during treatment. All of the patients provided a "yes" response to at least one of the patient satisfaction questions on the left.