Skin Rejuvenation With the SkinStation®

Henri P. Gaboriau, MD

Nonablative skin rejuvenation is gaining popularity among patients because it requires little to no downtime and carries a very low risk of any permanent complications. This technique can address a wide variety of issues, such as acne, uneven skin tone and texture, pigmented lesions, and vascular irregularities. Some skin-rejuvenation techniques currently available are radio frequency, intense pulsed light, and lasers. However, lasers and intense pulsed light devices require large and expensive systems that necessitate high fluences that could be detrimental to the epidermis. The SkinStation®, with its proprietary light and heat energy, enables the use of low fluences coupled with heat to achieve the desired skin rejuvenation effect without risk to the epidermis. We have been using the SkinStation for the treatment of acne vulgaris, pigmented lesions, telangiectasia, and rosacea with positive results. The recent adjunct of 5-aminolevulinic acid with the SkinStation as photodynamic therapy has enabled us to achieve faster and better results with minimal downtime and lower risk.

Our center sees patients with a wide variety of skin issues, including acne, vascular lesions, pigmented lesions, and facial rhytides. Some patients are seen in our medical spa by a licensed skin care specialist, whereas others seek a higher level of medical consultation with the physician. Our challenge, therefore, has been to find a technique that would mutually satisfy the needs of both types of patient. After a lengthy search, we settled on the SkinStation®, which combines light and heat energy (LHE™) to achieve the desired effects on the skin.

MATERIALS AND METHODS

The SkinStation is a tabletop device that uses proprietary technology to combine broad-spectrum pulsed light and directly applied heat. It comes with a Clear Touch™ system consisting of 2 flashlamps with a wavelength range of 430 to 1100 nm for acne phototherapy and a range of 400 to 1200 nm for treatment of pigmented and vascular lesions. First, pulsed light (generated through the light unit assembly), triggers selective photothermolysis using fluences up to 10 J/cm^2. The lamp-generated heat then quickly conducts to the target, raising its temperature to therapeutic levels without overheating the epidermis. Acting together, these 2 pathways deliver effective fluences up to 65 J/cm^2 to treat the target tissue. The SkinStation comes with 2 hand pieces: one for skin rejuvenation and rosacea, the other for acne treatment and hair removal.

TREATMENT OF ACNE

Acne is a disease affecting the sebaceous glands of the face, back, and chest. It is mainly characterized by the presence of *Propionibacterium acnes* in the follicular canal.[1] *P acnes* produces porphyrin, a compound that becomes chemically active when exposed to the visible light. The porphyrin induces a photodynamic reaction that results in the destruction of the bacteria in the sebaceous gland.[2] On absorption of photons, the porphyrin molecules transition to an excited state, resulting in the formation of singlet oxygen that is toxic to *P acnes*. The SkinStation, which has received Food and Drug Administration

Dr. Gaboriau is Director, Sammamish Center for Facial Plastic and Reconstructive Surgery, Sammamish, Washington.

The author reports no actual or potential conflict of interest in relation to this article.

Figure 1. A 68-year-old female patient being treated for fine wrinkles and rough skin texture before (A) and after (B) 4 light and heat energy treatments of the face.

clearance for the treatment of acne vulgaris, including pustular inflammatory acne, combines light energy and heat. Blue light is the most effective visible wavelength for photoactivation of the endogenous porphyrin component of *P acnes* because it matches the strongest porphyrin photoactivation band. However, blue light has a skin-penetration depth of less than 0.25 mm. Other lower excitation coefficients of porphyrin are in the green and red bands with a skin-penetration range of a few millimeters. Considering that the depth of follicles on the face is up to 3 mm, the green and red bands are more suitable for acne phototherapy. When applied over the acne lesions, the green light causes the porphyrin molecules to release the singlet oxygen that attacks the cell membrane of *P acnes* and destroys the bacteria.[3,4]

Based on the Arrhenius equation, a chemical reaction is directly dependent on the temperature at which it occurs. Therefore, the higher the temperature, the faster the chemical reaction will proceed.[4] With the SkinStation, the concomitant heat that is released by the light unit assembly helps increase the speed of the chemical reaction, resulting in faster and better treatment of acne lesions. The usual treatment protocol requires 2 weekly sessions for 4 consecutive weeks (8 treatments total). Results may be seen after as few as 4 treatments, but it is important to emphasize that the full 8-treatment protocol must be completed to achieve the desired result. First treatments are typically performed at power level 30, equivalent to 5 J/cm^2 of light and 28.3 J/cm^2 of heat for a total of 33.3 J/cm^2. If a patient tolerates the first treatment well, we might increase the power in subsequent treatments.

Two patients with mild pustular acne underwent 8 LHE treatments (2 treatments per week for 4 weeks). The average power was 48 for one patient and 50 for the other. One patient was on an oral antibiotic prior to the LHE treatment. Both patients had impressive results, with lesion clearance of approximately 80% after the last treatment (at 2 months).

A patient with severe acne (cystic and pustular) underwent 6 LHE treatments and 4 photodynamic therapy (PDT) treatments. (PDT will be discussed in further detail in the "Photodynamic Therapy" section.) She was previously treated with several rounds of oral and topical antibiotic with little relief. The LHE treatments were performed at a power level of 45 with 2 passes. Following the LHE treatments, we decided to use PDT on the patient because of the severity of her acne.

One more patient had mild acne localized to the chin and nose areas. She underwent 2 LHE treatments (power level of 45 with 2 passes) at an interval of 6 months (1 treatment after each breakout) with total clearance in each case.

TREATMENT OF FINE WRINKLES AND PIGMENTED LESIONS

Approximately 40% of our consultations are for the effects of aging skin, such as pigmented lesions, rough skin texture, uneven pigmentation, and fine lines and wrinkles (Figure 1). We offer a variety of procedures that are tailored to the needs of each patient and the severity of their conditions. Treatments include microdermabrasion, glycolic peels, medium chemical peels, and Visage® (Coblation® skin resurfacing). Unlike chemical peels and Visage (or any other ablative laser techniques), photorejuvenation with the SkinStation enables patients to have noticeable results with almost no downtime and with minimal risk of adverse reactions. Photorejuvenation works by combining selective photothermolysis with neocollagenesis that occurs in response to thermal trauma at the level of the dermis.[5-8] The LHE works by combining light with heat. First, the light is absorbed by the melanin in the pigmented lesions. The heat that follows the light pulse then coagulates sunspots by heating the entire area and accumulatively reaching the required coagulation temperature (70°C–75°C).[3] This leads to coagulation necrosis of the pigmented lesion with subsequent sloughing. The combined effect results in a darkening of the pigmented lesions, which then peel off, typically within 1 week.[9,10] The effect on skin texture is due to the stimulation of neocollagenesis as a result of a mild thermal insult to dermal collagen. Visible wavelengths are absorbed by discrete chromophores in the dermis and at the dermal-epidermal junction, whereas the near-infrared and midinfrared wavelengths are directly absorbed by intracellular and extracellular water. The resulting thermal injury leads to fibroblast activation and synthesis of the new collagen, which occur over a period of months. This wound-healing process results in improved skin texture and, to a certain extent, an improvement in fine lines and wrinkles.[11,12] It should be noted that as far as wrinkles are concerned, the results of photorejuvenation are subtler than those achieved with more aggressive ablative techniques.

Photorejuvenation treatments are performed with the skin-rejuvenation hand piece. It uses a low-fluence flashlamp that emits light at wavelengths of 400 to 1200 nm. This broad-spectrum light is readily absorbed by hemoglobin, oxyhemoglobin, melanin, and water. The skin-rejuvenation hand piece is quite easy to use. A simple control knob allows the light-energy fluence to be adjusted within the range of 5 to 10 J/cm^2 with a corresponding heat range of 28.3 to 71 J/cm^2 (power level range, 30–90). The pulse duration of the light is set to 10 ms; the power level is set according to the patient's skin type and indication. Treatments are repeated at 3- to 4-week intervals for a total of 6 treatments. We usually perform the first treatment at the recommended settings for skin type and indication. If well tolerated, we then increase the power level in subsequent sessions. Two passes are performed during each session. Diffused mild erythema (not purpura), slight edema, and darkening of brown spots should appear within 3 minutes of the light pulse. On the neck, chest, and hands, lower fluences are recommended. Results may be seen as early as after the second treatment. For long-lasting results, however, patients are strongly encouraged to complete the full treatment regimen. It is also important for patients to avoid sun exposure during the treatment period and to apply a sun-protective agent.

Although the technique of using the SkinStation is quite easy to master, there are 2 important steps to follow. First, make sure to overlap each pass to avoid "striping." Second, at the end of each treatment, some feathering is needed to avoid a sharp demarcation. We usually do the feathering at a lower setting. The pretreatment and posttreatment protocol that we have instituted at our center is fairly uniform. First, the area to be treated is cleaned with a gentle cleanser, and then a light microdermabrasion is performed, followed by the treatment at settings according to the indication. No topical anesthetic is used because the treatment is fairly painless. If the patient complains of a mild burning sensation, we apply cool compresses to the treated area for a few minutes. At the end of the procedure, a moisturizer and a sunblock with a sun protection factor (SPF) of 30 are applied over the area.

Following that protocol, we have treated a total of 35 patients for a combination of indications (sunspots, large pores, and uneven skin texture): full-face LHE treatment, 25 patients; treatment of the hands, 4 patients; treatment of the face and hands, 2 patients; treatment of the neck and chest, 1 patient; treatment of the face, neck, chest, back, and hands, 2 patients; and treatment of the face and neck, 1 patient. The number of LHE treatments per patient was 4 for the face, neck, chest, and back, and 2 for the hands. The power level used per treatment varied from 20 to 67 depending on the Fitzpatrick classification of the patient's skin and the area treated. The most common side effect encountered was redness and some blistering that lasted for 1 to 2 days. Of the 25 patients treated for facial pigmentation, 2 patients achieved no visible results. One patient had some erythema on her chest that lasted for 8 weeks after the first treatment. The subjective satisfaction rating was very high, with 90% of the patients seeing improvement in the texture and pigmentation of their skin. Forty percent rated their results as "excellent," with 80% of their sunspots gone, and 50% rated their results as "good," with 50% of their sunspots gone. Ten percent of patients rated their results as "fair," with 20% of their sunspots gone.

TREATMENT OF TELANGIECTASIA AND ROSACEA

Treatment of telangiectasia and rosacea has always been challenging. A permanent cure has yet to be found, and oral medications and creams have produced mixed results. Over the years, we have tried several combinations of vascular lasers with different creams and serums. The addition of the SkinStation to our armamentarium has helped us achieve better control of rosacea. Broadband intense pulsed light sources emitting visible wavelengths target hemoglobin in the microvasculature of the upper dermis as well as in any vascular irregularities present, such as telangiectasia or rosacea.[13,14] Light energy absorbed in these vessels is converted to heat, resulting in both coagulation of the vessels and in mild heating of the dermal collagen. Furthermore, the light is absorbed in the red blood cells and then diffuses throughout the circumference of the vessel to facilitate effective coagulation, resulting in vessel destruction. The protocol that we have designed combines the use of the SkinStation with a vascular laser (Palomar SLP1000™) associated with home use of either Cutanix® cream, Neova® Calming Green Tea Serum, or Pro-Heal Serum. The protocol consists of 2 treatments with the LHE at 1- to 2-week intervals, followed by 2 treatments with the vascular laser at 2-week intervals. The power setting for the LHE is 60 (total fluence, 59 J/cm^2), and 2 passes are performed. The power setting for the vascular laser (4-mm hand piece) is 75 W, for a fluence of 202 to 260 J/cm^2. Depending on their skin condition, patients are given either Cutanix (for more severe rosacea) or Neova (for mild rosacea). The LHE is combined with the vascular laser because the LHE has limited success on large telangiectasias, although it is quite successful at reducing the overall redness of the rosacea. Generally, after the first 2 treatments, one can see a reduction in the redness of at least 50%. Most of the patients require 1 to 2 LHE maintenance treatments every 6 to 8 months.

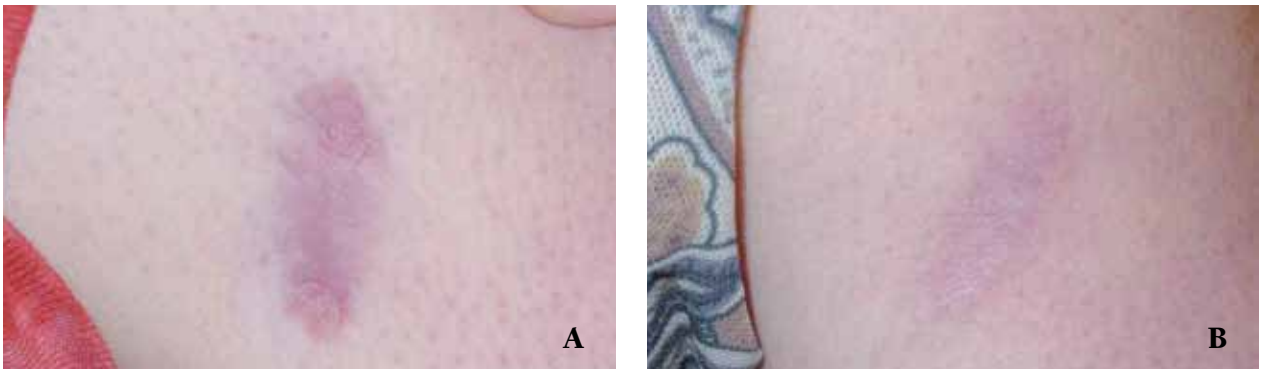

Figure 2. Keloid scar on left arm of a patient (1 year postexcision of a tumor) before (A) and after (B) 4 light and heat energy treatments.

Following that protocol, we have treated 8 patients. Seven patients had a success rate of 80% in reduction of the overall redness of the cheeks and diminution of the telangiectasias. One patient did not respond to the treatment. The subjective satisfaction rate was quite high, with patients feeling that, in addition to the reduced redness, their skin felt smoother and tighter. The main side effect observed was redness that lasted 1 day.

TREATMENT OF KELOID SCARS

The SkinStation has demonstrated success in treating keloid scars. A keloid is an overgrowth of dense fibrous tissue that develops after healing of a skin injury (either spontaneous or iatrogenic) as a result of an inherited metabolic alteration in collagen.[15] Keloids are characterized by erythema, pruritus, dysesthesia, and the fact that they extend beyond the borders of the original wound. The mainstay treatment of keloids is a combination of topical corticosteroids and intralesional injection of corticosteroids. We started using the SkinStation primarily to treat the erythematous component of the keloid scars. We perform 4 to 6 treatments at a weekly to biweekly interval. Treatments are performed with the skin-rejuvenation hand piece at power settings ranging from 50 to 60 (total fluences, 55–59 J/cm^2). Diminution of the pruritus and some flattening of the keloid can be seen after the second treatment. After the fourth treatment, significant softening and flattening of the keloid are seen, as well as a marked diminution of the erythema (Figure 2). We have been quite impressed by the results and have recently started to use the SkinStation as our first line of therapy to treat small to moderate keloid scars.

PHOTODYNAMIC THERAPY

Recently, we have begun using the SkinStation in combination with topical 5-aminolevulinic acid (5-ALA) to treat acne and aging skin. The combination of light therapy and 5-ALA is commonly called PDT. 5-ALA is a photosensitizing agent that is applied topically. It then enters the skin and is converted to the photosensitive protoporphyrin IX component. Subsequent activation with the SkinStation leads to the formation of a cytotoxic singlet oxygen that destroys the bacterial cells responsible for the acne (*P acnes*). PDT is used to treat moderate to severe inflammatory acne vulgaris.[16]

The protocol we use to treat acne is as follows: first, the treated area is cleaned with a mild cleanser and a mild microdermabrasion is performed to maximize the penetration of 5-ALA. We use a Levulan® Kerastick® as our source for 5-ALA. The product is applied over the targeted area(s) and remains in contact with the skin for 30 minutes (short contact) before being removed with a gentle cleanser. The light activation is then accomplished with the acne hand piece of the SkinStation at power settings between 10 and 30 (total fluence, 21.3–33 J/cm^2). At the end of the treatment, a mild moisturizer and a sunblock with an SPF of 30 are applied. The procedure is repeated 4 times at 1-week intervals.

PDT is also used for the treatment of actinic keratosis lesions, Bowen's disease, and photoaging-related skin changes (eg, wrinkling, hyperpigmentation, telangiectasia; Figure 3).[16] Several split-face studies have shown the overall efficacy of PDT.[17,18] Using the Levulan Kerastick, 5-ALA is applied over the targeted area(s) and remains in contact with the skin for at least 30 minutes to a maximum of 60 minutes before being removed with a gentle cleanser. The light activation is then accomplished with the skin-rejuvenation hand piece of the SkinStation at power settings between 20 and 50 (total fluence, 42–55 J/cm^2). At the end of the treatment, a mild moisturizer and a sunblock with an SPF of 30 are applied. The procedure is repeated 3 to 4 times at 3-week intervals.

Who is a good candidate for treatment with standard LHE versus treatment with PDT? The decision to use either protocol depends on 2 factors: severity of the condition to be treated and the personal preference of the patient. Typically, the more severe the condition, the better the indication for PDT. As for the personal

Figure 3. Chest of a 44-year-old patient showing extensive sun damage before photodynamic therapy (PDT) treatment (A). Changes 1 week (B) and 3 (C) weeks after the second PDT treatment and 4 weeks after the fourth PDT treatment (D).

preference of the patient, it will depend on his or her ability to have some downtime. PDT requires patients to be out of the sun and bright light for 48 hours, since 5-ALA stays active in the skin for up to 30 hours. If patients cannot afford such downtime, we offer them the standard LHE protocol.

Certain precautions should be taken before undergoing treatment with the SkinStation in order to prevent any side effects or complications. Since the SkinStation uses light, any photosensitive medications should be stopped before LHE treatment. Patients who have been on systemic tretinoin should wait at least 6 months. Application of tretinoin cream or lotion should be stopped 3 days prior to treatment. After each session, patients are warned to stay out of the sun and, in the case of PDT, away from indoor bright lights as well for 48 hours. Patients are told to expect some degree of swelling, redness, possible blistering, and/or peeling.

Increasing numbers of patients are seeking nonsurgical procedures to erase traces of aging, mainly pigmented lesions, uneven skin tone and texture, telangiectasia, and fine wrinkles. The attraction of nonablative photorejuvenation techniques lies in the "no-downtime" aspect of these procedures. There are many nonablative lasers and light-emitting sources on the market, each with its own set of benefits and drawbacks. Acquiring the SkinStation helped us fill a niche for a category of our patients who were looking for something more aggressive than microdermabrasion and/or glycolic peels, but less aggressive than ablative skin-resurfacing techniques. The new LHE technology implemented by the SkinStation enables us to successfully treat acne, aging skin, keloids, and telangiectasia. The recent adjunct of 5-ALA treatment (PDT) with the SkinStation has resulted in a higher and faster rate of clearance of acne breakouts and pigmented lesions. Although the SkinStation provides only subtle improvement in fine lines and wrinkles, most patients seeking younger-looking skin without the downtime and complications associated with more aggressive ablative techniques should receive some benefit from the SkinStation.

REFERENCES

1. Cunliffe WJ. The sebaceous gland and acne—40 years on. *Dermatology.* 1998;196:9-15.
2. Webster GF. Inflammation in acne vulgaris. *J Am Acad Dermatol.* 1995;33:247-253.
3. Konig K, Ruck A, Schneckenburger H. Fluorescence detection and photodynamic activity of endogenous protoporphyrin in human skin. *Opt Eng.* 1992;31:1470-1474.
4. Mariwalla K, Rohrer T. Use of lasers and light-based therapies for treatment of acne vulgaris. *Lasers Surg Med.* 2005;37:333-342.
5. Anderson RR, Parish JA. Selective photothermolysis: precise microsurgery by selective absorption of pulse radiation. *Science.* 1983;220:524-527.

6. Goldberg DJ. New collagen formation after dermal remodeling with intense pulsed light source. *J Cutan Laser Ther.* 2000;2: 59-61.
7. Altshuler GB, Anderson RR, Manstein D, et al. Extended theory of selective photothermolysis. *Lasers Surg Med.* 2001;29:416-432.
8. Narurkar VA. The electromagnetic spectrum and laser and pulsed light tissue interactions. *Cosmet Dermatol.* 2002;15(8):65-67.
9. Kawada A, Shiraishi H, Asai M, et al. Clinical improvement of solar lentigines and ephelides with intense pulsed light source. *Dermatol Surg.* 2002;28:504-508.
10. Bjerring P, Christiansen K. Intense pulsed light source for treatments of small melanocytic nevi and solar lentigines. *J Cutan Laser Ther.* 2000;2:177-181.
11. Weiss RA, Weiss MA, Beasley KL. Rejuvenation of photoaged skin: 5 year results with intense pulsed light of the face, neck, and chest. *Dermatol Surg.* 2002;28:1115-1119.
12. Grema H, Greve B, Raulin C. Facial rhytides—subsurfacing or resurfacing? A review. *Lasers Surg Med.* 2003;32:405-412.
13. Angermeier MC. Treatment of facial vascular lesions with intense pulsed light. *J Cutan Laser Ther.* 1999;1:95-100.
14. Bjerring P, Christiansen K, Troilius AM. Intense pulsed light source for treatment of facial telangiectasias. *J Cosmet Laser Ther.* 2001;3:169-173.
15. Tredget EE, Nedelec B, Scott PG, et al. Hypertrophic scars, keloids, and contractures. The cellular and modular basis for therapy. *Surg Clin North Am.* 1997;77:701-730.
16. Gold MH, Bradshaw VL, Boring MM, et al. The use of a novel intense pulsed light and heat source and ALA-PDT in the treatment of moderate to severe inflammatory acne vulgaris. *J Drugs Dermatol.* 2004;3(6 suppl):S15-S19.
17. Dover JS, Bhatia AS, Stewart B, et al. Topical 5-aminolevulinic acid combined with intense pulsed light in the treatment of photoaging. *Arch Dermatol.* 2005;141:1247-1252.
18. Marmur ES, Phelps R, Goldberg DJ. Ultrastructural changes seen after ALA-IPL photorejuvenation: a pilot study. *J Cosmet Laser Ther.* 2005;7:21-24.