The Use of the 308-nm Excimer Laser for the Treatment of Vitiligo

SUHAIL M. HADI, MD, MPHIL, JAMES M. SPENCER, MD, MS, AND MARK LEBWOHL, MD

Department of Dermatology, Mount Sinai School of Medicine, New York

BACKGROUND. **Recent reports show that 308-nm excimer laser may be an effective and safe method for the treatment of vitiligo, which is usually resistant to other available treatment methods.**

OBJECTIVE. **The objective was to study the effectiveness of the new 308-nm excimer laser for the treatment of vitiligo.**

METHODS. **A retrospective chart review of thirty-two patients with 55 spots of vitiligo were enrolled; a population-based sample was studied that included men and women, adults and children, with different ethnic backgrounds. The treatment was started with the lowest dose, which is 100 mJ/cm^2 (comparable to one minimal erythema dose value and one multiplier). Depending on Fitzpatrick skin type, the dose was raised gradually in a stepwise fashion. In skin types I to II, the same does was repeated twice before going up to avoid burns. Patients were treated for 30 sessions, or 75% repigmentation, whichever comes first.**

RESULTS. **Overall 55 spots were treated: 29 (52.8%) had 75% pigmentation or greater, and 35 (63.7%) had 50% pigmentation or greater. The best results were on the face: of the 21 spots treated 15 (71.5%) had 75% pigmentation, and 16 (76.2%) had 50% pigmentation or greater. Other areas (neck, extremities, trunk, and genitals) had moderate response in comparison to the face. The least response was on the hands and feet; of the 5 spots treated only 20% showed 50% pigmentation or more.**

CONCLUSION. **Slightly more than 50% of the patients tested showed 75% or more pigmentation of their lesions, after 30 treatments or less; most of the responders had Fitzpatrick skin type III and above. All the untreated patches (controls) remained unchanged. This demonstrates that the 308-nm excimer laser is an effective method of treatment for vitiligo.**

SUHAIL M. HADI, MD, MPHIL, AND MARK LEBWOHL, MD HAVE INDICATED NO SIGNIFICANT INTEREST WITH COMMERCIAL SUPPORTERS. JAMES M. SPENCER, MD, MS IS ON THE MEDICAL ADVISORY BOARD OF PHOTOMEDEX, AND HE AND MOUNT SINAI HAVE APPLIED FOR A USE PATENT ON THE 308-NM EXCIMER LASER FOR THE TREATMENT OF VITILIGO.

VITILIGO IS a common, acquired, idiopathic disorder of skin pigmentation characterized by well-demarcated, white skin patches. It affects 1% to 3% of the general population. It has no predilection for race, age, or sex. Association with other autoimmune diseases is documented, such as thyroid disease, Addison's disease, diabetes mellitus, alopecia areata, and pernicious anemia. Vitiligo skin is more susceptible to sunburn. Approximately one-third of patients have a family history of vitiligo. The disease may be the cause of severe psychological suffering and, conversely, it might be induced by any stressful event.[1] Clinically, vitiligo may be localized, segmental, mucosal, or generalized.

Treatment of vitiligo is challenging. The use of cover-up cosmetics (camouflage products) can be cosmetically acceptable. Treatment modalities include potent topical corticosteroids,[2] psoralen with long-wave ultraviolet (UV) radiation (topical and oral),[3] and UVB (broadband and narrowband), which has fewer side effects.[4,5] Reported success rates for repigmentation are in the range of 50% to 60% after months to years of therapy. Topical application of pseudocatalase and calcium in combination with UVB has also been used.[6] Various grafting methods have been used effectively for treatment of vitiligo: tissue grafts include full-thickness graft (punch graft), split-thickness graft, and suction blister graft.[7–10] Cellular grafts consisting of cultured melanocytes or noncultured melanocytes/keratinocutes have been used with promising results.[11,12] Psoralen with long-wave UV radiation after autologous skin graft can enhance pigmentation. Tissue-engineered skin applied to dermabraded vitiligo skin followed by psoralen with long-wave UV radiation was shown to be highly effective in repigmenting vitiligo lesions in five patients.[13] Despite the above potential treatments, a fast, easy, effective treatment is still needed. Recently, the 308-nm excimer laser has been shown to be promising for the treatment of localized vitiligo.[14,15]

Patients and Methods

The 308-nm excimer laser (Photomedex, Radnor, PA) generates single-wavelength UVB radiation with a spot size of 2×2 cm and a pulse repetition rate up to

Address correspondence and reprint requests to: Suhail M. Hadi, MD, MPhil, Department of Dermatology, Mount Sinai School of Medicine, One Gustave L. Levy Place, Box 1048, New York, NY 10029, or e-mail: smhadi@Dr.com.

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200 Hz.The pulse width is 30 nsec. The fluence is 3 mJ/cm^2 delivered through a sophisticated fiber-optic hand piece. Exposure time is varied by changing a setting on the laser termed minimal erythema dose. Thirty-two patients (male:female 20:12) with stable vitiligo were treated with the 308-nm excimer laser (Table 1). Their ages ranged from 4 to 71 years. The treatment was fully explained to patients, regarding how much improvement they might expect and possible side effects (burn), and informed consent was obtained from each patient. Treatment was started with one minimal erythema dose (equivalent to 100 mJ/cm^2), which was repeated twice (in skin type I or if the skin burned easily). Then the treatment was increased in a stepwise fashion by one-half minimal erythema dose (approximately 50 mJ/cm^2) until redness developed, in which case the dose was reduced by one-half minimal erythema dose or skipped (if burning or blistering developed). Treatment was given twice weekly (never on two consecutive days). The eyes were protected with UV protective goggles. In 11 patients, one or more lesions were left untreated and served as controls.

Results

We studied 32 patients with vitiligo, 20 were males and 12 were females, for 30 treatments or 75% repigmentation, whichever came first. Their ages ranged from 4 to 71 years. Fifty-five patches of vitiligo were treated with stepwise increases in the dose of 308-nm excimer laser until redness developed, when the dose was either reduced or continued at the same level and the erythematous areas were avoided. If burning or blistering occurred, a treatment was held until the skin healed. Treatment resumed at one-half minimal erythema dose less than the blistering dose. Treatment was given twice weekly. The endpoint was 30 treatments or 75% pigmentation or more, which ever came first. Twenty-nine of 55 (52.8%) of the treated lesions achieved 75% pigmentation or greater. The average

Table 1. Demographic Data for Patients with Vitiligo

Number	*Age (Years)*	*Skin Type*	*Sites*	*Duration (Months)*	*No. of Treatments*	*% Improvement*
1	15	III–IV	Elbows, legs	24	30	80
2	40	II	Face, arms	180	30	75
3	18	III	Face	60	28	75
4	38	V–VI	Face, trunk	36	30	85
5	15	I	Face, limbs, trunk	72	30	30
6	48	II	Right breast	3	11	100
7	31	I	Elbows, arms, feet	228	30	40
8	71	VI	Scalp, face	12	30	85
9	45	IV	Hands, feet	72	30	60
10	56	II	Face, neck	48	30	75
11	36	VI	Left wrist	1	17	100
12	33	VI	Chin	36	14	75
13	24	VI	Lips	48	10	80
14	43	III	Face, limbs	180	30	75
15	37	VI	Left arm	6	8	100
16	20	VI	Neck, genital	36	30	60
17	33	V	Forehead	48	18	90
18	16	VI	Face	18	18	100
19	22	III	Right upper arm	12	8	90
20	60	IV	Face	4	18	95
21	55	III–IV	Face, legs, genital	84	30	100
22	4.5	V	Around eyes	6	30	80
23	32	IV	Limbs	24	30	100
24	43	I	Face, trunk, limbs	360	30	20
25	26	II–III	Face	132	30	60
26	10	I	Limbs	84	30	30
27	6	IV	Limbs	5	30	85
28	70	VI	Face, scalp	36	30	40
29	40	II	Face, hands, genital	24	30	85
30	38	I	Face, trunk	12	30	40
31	39	I	Face, groin, hands	24	30	40
32	17	II–III	Neck, perioral	48	25	90

number of treatments required to achieve this is 23. Six (18.75%) of these patients had 100% pigmentation of their patches after an average of 19 sessions, most of whom had skin type III and above. Thirty-five of 55 (63.7%) of treated lesions achieved 50% pigmentation or greater. Lesions on the face tended to respond significantly better than lesions located elsewhere on the body. Fifteen of 21 (71.5%) of the facial lesions treated had 75% pigmentation or greater (Figures 1 and 2). Sixteen of 21 (76.2%) of treated facial lesions developed 50% pigmentation or greater. Our study showed that lesions on the neck or scalp were also responsive to treatment but less so than those located on the face. Three of 5 (60%) of treated lesions had 75% pigmentation or greater. Four of 5 (80%) had 50% or more pigmentation. Lesions located on the genitals showed a favorable response to treatment but not as much as lesions on the neck and scalp. Two of 4 (50%) of genital lesions had 75% pigmentation or greater; 3 of 4 (75%) had 50% pigmentation or greater. Lesions on the extremities responded less: 7 of 15 (46.7%) of treated lesions had 75% pigmentation or greater and 9 of 15 (60%) had 50% pigmentation or greater. Lesions on the trunk responded unfavorably: 2 of 5 (40%) had 75% pigmentation or more and 2 of 5 (40%) had 50% pigmentation or more. The least responsive lesions were on the hands and feet. None of the 5 patches treated developed 75% pigmentation or more, whereas only 1 of 5 (20%) had 50% pigmentation or more (Table 2).

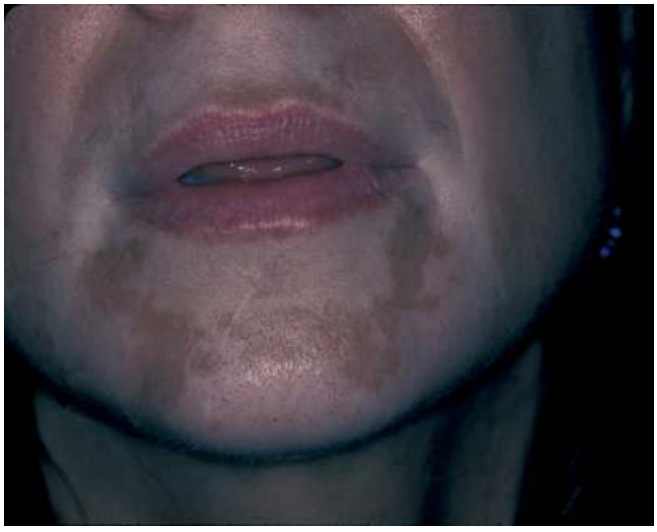

Figure 1. Prelaser photo of a patient with vitiligo (before).

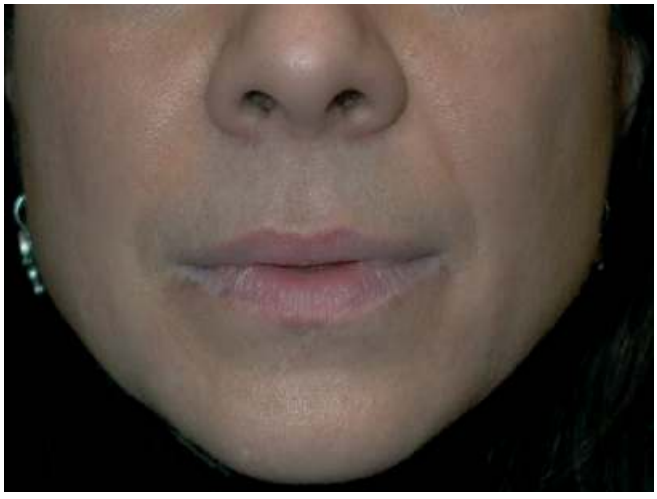

Figure 2. Pigmentation after 25 sessions of treatment with the 308-nm excimer laser (after).

Skin type played an important role in patient response. Of those patients who developed 75% pigmentation or more, none of them were skin type I. Five of 32 (15.6%) were skin type II, 8 of 32 (25%) were skin type III–IV, and 9 of 32 (28%) were skin type V to VI. Seventeen of 32 (53%) were skin type III and above. Of those who developed 50% pigmentation, none were skin type I. Five of 32 (15.6%) were skin type II and 20 of 32 (65.5%) were skin type III and above (Table 3). It appears that age of patients, sex, and duration of disease had no significant role in determining the response to this treatment. Patients with small to medium-sized lesions tended to respond better than those with larger lesions. Family history of vitiligo or presence of other autoimmune diseases had no effect on response to treatment. All the untreated control patches from 11 patients remained unchanged.

Table 2. Response to Treatment in Different Body Locations

Region	*No. of Lesions Treated*	*75% Response (%)*	*50% Response (%)*
Face	21	15 (71.5)	16 (76.2)
Neck/scalp	5	3 (60)	4 (80)
Trunk	5	2 (40)	2 (40)
Genitals	4	2 (50)	3 (75)
Extremities	15	7 (46.7)	9 (60)
Hands and feet	5	0 (0)	1 (20)
Overall	55	29 (52.8)	35 (63.7)

Table 3. Response to Treatment According to Skin Type

Skin Type	*75% Response (%)*	*50% Response (%)*
I	0 (0)	0 (0)
II	5 (15.6)	5 (15.6)
III and above	17 (53)	20 (65.5)

Discussion

Vitiligo is a difficult disease to treat, and most of the currently available treatment modalities are either slightly effective or associated with significant side effects. The best results are achieved with the surgical methods: split-thickness skin graft and epidermal blister grafting, melanocyte transplantation, or tissue-engineered skin (87%–95%)[2,13] especially if followed by psoralen with long-wave UV radiation therapy. Nevertheless, textural changes may be noticeable. Of the nonsurgical repigmentation methods, narrow-band UVB gave the best results (63%), followed by broad-band UVB (57%), topical class 3 and 4 corticosteroids (56%), and psoralen with long-wave UV radiation (51%).[2,5] But most of these treatments are unfavorable because of the need for long-term treatment (months to years) and the associated significant side effects: gastrointestinal side effects (nausea and vomiting), phototoxicity with psoralen and long-wave UV radiation and skin atrophy, striae, and telangiectasia with corticosteroids. UVB is associated with the least adverse side effects, but long-term treatment is required to have desirable results, although Scherschun et al.[4] reported a faster response to narrowband UV-B in a small number of patients: five patients (dark skinned patients with facial lesions) who had the disease for 13 months achieved more than 75% pigmentation after 19 sessions.[4] Recently, the 308-nm excimer laser has been shown to be very effective in repigmenting vitiliginous patches with a small number of treatments in a relatively short period of time.[14,15] With this treatment, pigmentation can start after only five sessions and increase with continuation of treatment.[15] Stimulation of the remaining or nearby melanocytes and subsequent migration to the vitiliginous areas might explain the repigmentation achieved with this modality of treatment. Our findings are in agreement with others.[14,15] 52.8% of treated patches achieved 75% or more pigmentation within 30 sessions or less (2–3 months). It is hoped that more pigmentation develops with continued treatment. All of the untreated control patches from 11 patients remained unchanged, which means no spontaneous repigmentation occurred. None of the responders lost the pigmentation achieved during treatment. Four of our patients were followed up to 18 months and they still retain the pigment. Of particular interest, some of these patients noticed continued pigment formation on treated areas after stopping the treatment, which may be explained by the stimulating effect of the cumulative dose of the UV light on the melanocytes. This modality of treatment may be safer than psoralen with long-wave UV radiation or conventional UVB phototherapy in regard to skin aging and carcinogenesis because uninvolved skin is not targeted with this treatment unlike phototherapy, in which both involved and uninvolved skin are exposed to UV radiation.[16] Our results show that this method of treatment for vitiligo is effective and relatively safe and more convenient compared to other available modalities of treatment.

References

1. Agarwal G. Vitiligo: an under-estimated problem. Fam Pract 1998;15(Suppl 1):S19–23.
2. Njoo MD, Westerhoff W, Bos JD, Bossuyt PMM. The development of guidelines for the treatment of vitiligo. Arch Dermatol 1999;135: 1514–21.
3. Handa S, Pandhi R, Kaur I. Vitiligo: a retrospective comparative analysis of treatment modalities in 500 patients. J Dermatol 2001;28: 461–6.
4. Scherschun L, Kim JJ, Lim HW. Narrow-band ultraviolet B is a useful and well-tolerated treatment for vitiligo. J Am Acad Dermatol 2001;44:999–1003.
5. Njoo MD, Bos JD, Westerhoff W. Treatment of generalized vitiligo in children with narrow-band (TL-01) UVB radiation therapy. J Am Acad Dermatol 2000;42:245–53.
6. Schallrenter KU, Wood JM, Remke KR, Levening C. Treatment of vitiligo with a topical application of pseudocatalase and calcium in combination with short-term UV-B exposure: a case study on 33 patients. Dermatology 1995;190:223–9.
7. Sachdev M, Shankar DS. Dermatologic surgery: YAG Laser-assisted autologus epidermal punch grafting in vitiligo. Int J Dermatol 2000; 39:868–71.
8. Sachdev M, Shankar DS. Suction blister grafting for stable vitiligo using pulsed erbium: YAG laser ablasion for recipient site. Int J Dermatol 2000;39:471–3.
9. Gupta S, Jain VK, Saraswat PK. Suction blister epidermal grafting versus punch graft in recalcitrant and stable vitiligo. Dermatol Surg 1999;25:955–8.
10. Lee AY, Jang JH. Autologus epidermal grafting with PUVA-irradiated donor skin for the treatment of vitiligo. Int J Dermatol 1998;37: 551–4.
11. Van Geel N, Ongenae K, De Mil M, Naeyaert JM. Modified technique of autologus noncultured epidermal cell transplantation for repigmenting vitiligo: a pilot study. Dermatol Surg 2001;27:873–6.
12. Chen YF, Chang JS, Yang PY, et al. Transplant of cultured autologus pure melanocytes after laser-abrasion for the treatment of segmental vitiligo. J Dermatol 2000;27:434–9.
13. Arenberger P, Broz L, Vesely P, Havlickova B, Matouskova E. Tissue-engineered skin in the treatment of vitiligo lesions. Folia Biolo 2000;46:157–60.
14. Baltas E, Nagy P, Bonis B, et al. Repigmentation of localized vitiligo with the xenon chloride laser. Br J Dermatol 2001;144:1266–7.
15. Spencer JM, Nossa R, Ajmeri J. Treatment of vitiligo with the 308-nm excimer laser: a pilot study. J Am Acad Dermatol 2002;46: 727–31.
16. Asawanonda P, Anderson RR, Chang Y, Taylor CR. 308-nm excimer laser for the treatment of psoriasis: a dose–response study. Arch Dermatol 2000;136:619–24.