Commercial Tanning Bed Treatment Is an Effective Psoriasis Treatment: Results from an Uncontrolled Clinical Trial

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Phototherapy is highly effective in the therapy of psoriasis, but patient access to phototherapeutic facilities is not universal. Commercial tanning facilities are universal, but their efficacy in psoriasis treatment is unestablished. Our purpose was to conduct a study to assess the effect of a commercial tanning unit outfitted with nonprescription lamps on psoriasis. We conducted a 6-wk open study of 20 adult patients with stable psoriasis vulgaris. Clinical response was defined as a decrease in the Psoriasis Area Severity Index (PASI) or the Self-Administered PASI (SAPASI) by ≥10%. There were 16 men and 4 women who participated with a mean (±SD) age of 43.0 ± 14.8 y. Initial and final health-related quality of life information collected included the following instruments: the Brief Symptom Inventory (BSI), the Psoriasis-Related Stressor Scale (PRSS), and the Psoriasis Disability Scale (PDS). Side effects of tanning therapy were closely monitored. Fifteen subjects completed the entire 6-wk trial, and exit data on all subjects were used for analysis. The mean number of tanning sessions was 19 ± 7.6 with a median of 19 and range of 3 to 29. Analysis of all 20 enrolled subjects found that 16 (80%) showed clinical response as measured by PASI, whereas 17 (85%) showed SAPASI response. Initial and final PASI scores decreased ($p = 0.0001$) from 7.96 ± 1.77 to 5.04 ± 2.5, and SAPASI scores also decreased ($p = 0.02$) from 11.8 ± 4.4 to 7.9 ± 7.7. When controlled for age and sex, a dose-response relationship was demonstrated with the PASI and SAPASI ($p < 0.02$). Decreases in the mean BSI and PRSS scales were demonstrated ($p < 0.02$), confirming the clinical significance of the reductions in disease severity scores. Episodes of mild burning occurred in 7 of 20 (35%) participants. Three subjects reported itching after one or two tanning sessions. This study showed that a tested commercial nonprescription tanning unit improved both psoriasis severity and health-related quality of life. Commercial tanning bed treatments may be a useful approach in patients unable to obtain office-based ultraviolet treatments. *Key words: phototherapy/ultraviolet A and B. J Invest Dermatol 109:170–174, 1997*

Phototherapy with artificial light sources represents one of the most important therapeutic advances in psoriasis treatment in the twentieth century (Weinstein and Gottleib, 1993; Farber, 1995; Greaves and Weinstein, 1995). Unfortunately, phototherapy is often unavailable in rural areas, and expense precludes some patients from visiting these facilities. By contrast, commercial tanning facilities are universal. In 1992 it was estimated that one million Americans visited tanning salons on any given day (DeLeo, 1994)

It is traditionally taught that tanning bed or solarium light is ineffective for psoriasis treatment. Studies have demonstrated that ultraviolet A (UVA) does not add to the known benefits of ultraviolet B (UVB) phototherapy (Boer *et al*, 1981; Diette *et al*, 1984). Accordingly, dermatologists admonish their patients that nonprescription tanning devices are of no benefit in psoriasis therapy. Lowe (1992) summarized the traditional thinking in his statement: "The use of UVA tanning salon treatments in the therapy of psoriasis is usually unsuccessful. . . ."

Parish (1977) found that UVA treatment of psoriasis sites (4 × 5 cm) led to clinical improvement in 9 of 10 patients treated. Diffey (1986), in his survey of tanning salon patrons, reported that of 22 clients who employed indoor tanning to treat their psoriasis, 17 (77%) were completely satisfied and 5 (23%) were partially satisfied with this therapeutic modality. Moreover, in a recent survey of 318 psoriasis patients, we found that 68% of those who had tried nonprescription tanning bed therapy believed this modality was effective (Fleischer *et al* 1996a). To test the hypothesis that nonprescription tanning beds can be an effective modality in the treatment of moderate severity psoriasis, we designed and conducted a clinical trial.

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Abbreviations: PASI, Psoriasis Area Severity Index; SAPASI, Self-Administered PASI, BSI, Brief Symptom Inventory; PRSS, Psoriasis-Related Stressor Scale; VAS, Visual Analog Scale.

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Table I. Phototherapy Schedules Used in Study

Skin Type	Treatment (min) Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
I	2	4	10	15	20	25
II	3	7	15	20	25	30
III	3	7	15	20	25	30

MATERIALS AND METHODS

Protocol The research protocol was approved by the Bowman Gray School of Medicine Clinical Research Practices Committee. Written informed consent was obtained from all participants.

Tanning Equipment and Treatments Phototherapy equipment consisted of a commercial tanning bed outfitted with Bellarium S lamps. This nonprescription lamp outputs high-intensity UVA and has 4.6% of the total output as UVB.

Data on File: Wolff Systems Technology (Atlanta, GA) Moreover, this lamp was found to be the most common lamp in commercial tanning facilities in a survey study conducted in North Carolina (Fleischer *et al*, 1993).

All phototherapy sessions were administered in a university setting by a phototherapy technician or experienced physician assistant. Subjects received three to five tanning treatments per week for 6 wk of the study. The variability in numbers of sessions per week was chosen to simulate typical community tanning bed use. Initial and subsequent phototherapy dosing was performed with a schedule based upon self-reported skin type (Weinstock, 1992) **(Table I)**. Modification of recommendations of the manufacturer were required because Wolff Technology does not recommend use for type I skin. Because dosimetry in commercial tanning facilities is not based upon UV irradiance measures and is strictly confined to timing measures, to approximate community tanning facilities, we also based treatment duration upon time. Because of the limitations of our UV light meters, we did not quantify the UVA and UVB light exposure from this unit.

To minimize the potential confounding influence of ambient solar exposure, this trial was conducted in the winter and early spring from November 1, 1995, through April 14, 1996. Fourteen patients completed the trial by January 1, 1996. Aside from emollients and coal tar that patients were using at the time of enrollment, no other psoriasis treatments were allowed.

Psoriasis Severity Assessments The Psoriasis Area Severity Index (PASI) and the Self-Administered PASI (SAPASI) were performed on all participants at the study initiation and upon weekly completion of their phototherapy sessions. Detailed descriptions of these instruments and their validity are available (Fredriksson and Pettersson, 1978; Fleischer *et al*, 1994; Fleischer and Exum, 1995; Feldman *et al*, 1996). Clinical response was defined as a decrease of $\geq$10% in the PASI or SAPASI score, and clearance was defined as a PASI or SAPASI score of zero. Subjects also completed a subjective assessment of the change in psoriasis severity by completing a 100-mm Visual Analog Scale (VAS) with the following anchors: 0 = "much worse," 50 = "no change," and 100 = "much better."

Inclusion and Exclusion Criteria Study inclusion criteria included the following: dermatologist diagnosis of psoriasis vulgaris, age $\geq$18 y, willingness to forgo changes in psoriasis therapeutic regiment, and psoriasis severity of $\geq$5 on the PASI scale. A PASI score of $\geq$5 was chosen to select for subjects with moderate to severe psoriasis (Fleischer *et al* 1996b) (Fleischer *et al* 1996a); clinically these subjects would be candidates for UV light treatments. The SAPASI score has also been defined as moderate when the score is greater than 3 (Fleischer *et al* 1996b).

Exclusion criteria included: currently pregnant or intending to become pregnant during the study; concurrent physician or home-administered UV therapy, tanning bed visits, or phototherapy in the past 3 wk; rapidly worsening psoriasis; history of herpes labialis induced by sunlight or artificial light sources; significant unrelated medical conditions or laboratory abnormalities that would prevent completion of the study or increase the risk of an adverse reaction. To reduce the possibility of bias from other therapeutic modalities, subjects were excluded if any new psoriasis therapies (including emollient therapy) were used in the past 3 wk or if subjects used any oral antibiotics in the past 2 wk. No change in other therapies was allowed.

Subject Demographics and Previous Exposure Attributes There were 16 men and four women who participated with a mean ($\pm$ SD) age of 43.0 $\pm$ 14.8 y and range of 26–74 y. Self-reported skin types were as follows: type I, six participants; type II, six participants; type III, eight participants. Our subjects had a history of psoriasis for an average of 14.3 y. Seven subjects had previously used tanning beds in the treatment of their psoriasis an average of 3 mo each, and six of these reported that it had previously helped their condition. Seven of nine subjects who had previously been treated with UVB or psoralen photochemotherapy reported that these treatments had helped. Seventeen of 20 subjects reported that solar irradiation helps their disease.

Quality of Life Assessments Initial and final health-related quality of life information collected included the following instruments:

(i) The 53-item Brief Symptom Inventory (BSI): a measure of psychiatric symptom severity (Derogatis and Spencer, 1982).

(ii) The 20-item Psoriasis-Related Stressor Scale (PRSS): a measure of stressful aspects of psoriasis developed at the Bowman Gray School of Medicine (SR Rapp, ML Exum, SR Feldman, AB Fleischer, DM Reboussin, AR Clark, unpublished data).

(iii) The 14-item Perceived Stress Scale: a measure of psychologic stress (Cohen *et al*, 1983).

(iv) The 36-item Psoriasis Disability Scale: a measure of psoriasis-related functional and social disability.[1]

Side Effect Profiles To determine the acute side effects of tanning therapy, we assessed phototoxic reactions (burns) and rashes objectively by physical examination and subjectively assessed itching at each visit. We subjectively graded all phototoxic reactions as mild, moderate, or severe.

Subjective Satisfaction To obtain an estimate of subject satisfaction with this protocol, a series of questions presented as VAS was administered at the study completion. Questions assessed satisfaction, whether the subject would recommend this treatment modality to a friend with psoriasis, and a global side effect profile.

RESULTS

Three-Fourths of the Participants Completed the Study Fifteen subjects completed the study to the full 6 wk of therapy. The other five subjects had exit severity and health-related quality of life data collected at their last visit. Two subjects discontinued participation after six treatments or less despite no recorded untoward side effects. Another discontinued in the fourth week due to becoming pregnant. Another subject obtained tanning bed exposure supplemental to the study, and all data were dropped after initiation of this secondary treatment. The last subject discontinued treatment after 13 treatments for unknown reasons.

UV Tanning Treatments To quantify the phototherapy exposure, we calculated the number of tanning sessions and cumulative exposure time in minutes. The mean number of tanning sessions was 19 $\pm$ 7.6 with a median of 19 and range of 3–29 sessions. Participants completed between 9 and 442 min of phototherapy with a mean ($\pm$ SD) of 261 $\pm$ 142 min.

Psoriasis Severity Improved With Treatment To determine the effect on psoriasis of phototherapy with a commercial tanning unit, we assessed psoriasis severity before therapy and after the final treatment. Initial and final psoriasis severity measures on all 20 subjects are presented in **Tables II** and **III**. No psoriasis subject completely cleared in the 6-wk study period, but most showed improvement from baseline. To prevent potential bias from failing to include subjects who left the study, exit data from all subjects were analyzed. Analysis of all 20 enrolled subjects found that 16 (80%) showed clinical response as measured by PASI, whereas 17 (85%) showed SAPASI response. One subject decreased to a minimal SAPASI score of 0.12, a score clinically difficult to distinguish from clearing.

Mean reduction in PASI severity was 35.4 $\pm$ 24.1%, which was comparable to the mean SAPASI reduction of 36.2 $\pm$ 44.8%. To assess whether dropout subjects were different from subjects com-

[1] Rapp, SR, Exum ML, Feldman SR *et al*: Suicide ideation, distress and disability associated with psoriasis: a profile of high risk patients. *Unpublished manuscript.*

Table II. Tanning Bed Treatment Improves Psoriasis Severity and Health-Related Quality of Life Measures

Severity Measure	Initial Score[a] (n = 20)	Final Score[b] (n = 20)	Significance[c] (p value)
Disease severity			
Psoriasis area Severity index	7.96 ± 1.77	5.04 ± 2.5	0 = .0001
Self-administered Psoriasis area Severity index	11.8 ± 4.4	7.9 ± 7.7	0 = .02
Quality of Life			
Psoriasis-related Stresser scale	41.0 ± 11.0	24.1 ± 11.0	0 = .0001
Brief symptom Inventory	0.25 ± 0.28	0.10 ± 0.13	0 = .02
Perceived stress	29.6 ± 6.3	26.6 ± 8.9	0 = .2
Total disability	39.8 ± 8.3	37.4 ± 4.9	0 = .2

[a] Initial scores represent the mean ± SD of the outcome variable before the first tanning exposure.
[b] Final scores represent the mean ± SD of the outcome variable after the final tanning exposure.
[c] Paired t test.

pleting the trial, the 15 participants that completed the full 6-wk treatment course reduced their PASI by 39.4 ± 25.3% and SAPASI by 52.3 ± 27.6%. By contrast, the 5 participants who did not complete the full treatment course decreased their PASI score by 23.5 ± 16.9% and increased their SAPASI score by 8.74 ± 55.9%. Comparing those who completed and did not complete the study, a t test showed no difference between changes in PASI scores (p = 0.5) but did show a significant difference between changes in SAPASI scores (p = 0.05).

Dose-Response Relationship Demonstrated To confirm that the observed improvement in psoriasis severity was due to the treatment and not to unrelated factors, we analyzed the relationship between the degree of improvement and the cumulative exposure. If the improvement was due to tanning bed treatments, we expect that changes in severity scores would be related to cumulative exposure. The reduction in the PASI and SAPASI scores were highly ($measure_{final} - measure_{initial}$) intercorrelated (Pearson R = 0.75, p = 0.0002). Also, the reduction in the PASI score and SAPASI score adjusted for the baseline score [($measure_{final} - measure_{initial}$)/$measure_{initial}$] were highly intercorrelated (Pearson R = 0.65, p = 0.003). The validity of the SAPASI as a measure of changing psoriasis severity (responsiveness) has not been assessed in a clinical trial.

Control of Other Factors Does Not Influence Improvement of Psoriasis Severity Multiple regression of the change in PASI on cumulative exposure, age, and gender indicated a significant effect of cumulative exposure, with a decrease of 0.90 ± 0.36 (slope ± SEM) PASI units per hundred tanning minutes (p = 0.02). For the PASI, we found no significant effect for age (0.003 ± 0.034, p = 0.9) or female sex (−1.45 ± 1.31, p = 0.3). Analogous multiple regression of the change in SAPASI on cumulative exposure, age, and gender indicated a significant effect with a decrease of 2.90 ± 0.9 SAPASI units per hundred minutes (p = 0.01). For SAPASI, no significant effect was observed for age (0.035 ± 0.087, p = 0.7) or female sex (−2.44 ± 3.36, p = 0.5).

Quality of Life Measures Show That Improvement in Psoriasis Is Clinically Significant To determine the clinical significance of reduction in disease severity observed in this study, we collected health-related quality of life data by using general and psoriasis-specific measures. Significant decreases in the mean BSI and PRSS scales were demonstrated at the completion of the study. The severity of the psychiatric symptoms (BSI) and the stressfulness of psoriasis-related stressors (PRSS) were decreased after tanning. We found no significant effect on disability (Psoriasis Disability Scale) or perceived stress (Perceived Stress Scale).

Side Effects Are Observed But Are Minor Episodes of mild phototoxic reactions occurred in seven of 20 (35%) participants, with five experiencing one reaction, and two participants each experiencing two and three such reactions, respectively. No patients were observed to have a rash, but three reported itching after one tanning session and one additional subject reported itching after two tanning sessions.

Subjects Were Satisfied with Treatment At the study completion, a side effect VAS (where zero represented no side effects and 100 represented many side effects) had a mean response of 8.9 ± 8.1 with minimum of zero and maximum of 35. For treatment satisfaction (where zero represented not satisfied and 100 represented completely satisfied), we found a mean of 73.0 ± 28.4. Fifteen had satisfaction scores greater than 50. When asked

Table III. Responsiveness of Psoriasis Severity in Individual Subjects to Tanning Bed Treatments

Subject	Number of Doses	Cumulative Exposure (min)	Initial PASI[a]	Final PASI[b]	ΔPASI (%Δ)[c]	Initial SAPASI[a]	Final SAPASI[b]	ΔSAPASI (%Δ)[c]
1	3	9	7.2	5.4	−1.8 (−25)	15.4	13.4	−2.0 (−13)
2	4	12	6.5	5.0	−1.5 (−23)	13.8	18.5	4.7 (+34)
3	19	276	9.0	5.1	−9.9 (−43)	6.6	3.8	−2.8 (−443)
4	6	22	7.0	7.0	0.0 (0)	20.2	32.4	12.2 (+60)
5	16	158	11.1	5.8	−5.3 (−48)	15.7	3.3	−12.4 (−79)
6	24	396	5.8	2.5	−3.3 (−57)	7.4	2.2	−5.2 (−70)
7	25	342	7.8	5.8	−2.0 (−26)	8.1	6.9	−1.3 (−15)
8	24	409	12.0	4.1	−7.9 (−66)	18.1	0.7	−17.4 (−96)
9	27	328	9.4	6.3	−3.1 (−33)	12.2	9.2	−2.9 (−24)
10	23	348	7.7	9.4	1.7 (+22)	14.5	15.8	1.3 (+9.0)
11	26	168	5.9	3.9	−2.0 (−34)	6.8	1.4	−5.4 (−80)
12	25	314	8.4	3.6	−4.8 (−57)	12.6	9.1	3.5 (+28)
13	19	440	8.2	2.8	−5.4 (−66)	10.5	3.7	−6.7 (−64)
14	13	288	8.3	3.9	−4.4 (−53)	8.8	6.7	−2.1 (−24)
15 •	25	95	6.4	5.0	−1.4 (−22)	7.8	11.0	−3.2 (+41)
16	17	442	6.4	2.6	−3.8 (−59)	6.1	0.1	−5.9 (−98)
17	15	360	9.4	5.0	−4.4 (−47)	15.9	8.1	−7.8 (−49)
18	21	173	10.1	9.3	−0.8 (−8)	17.3	12.8	−4.5 (−26)
19	18	358	6.4	2.8	−3.6 (−56)	9.5	5.1	−4.5 (−47)
20	29	283	6.1	5.6	−0.5 (−8)	8	2.6	−5.4 (−68)

[a] Initial scores represent the outcome variable before the first tanning exposure.
[b] Final scores represent the outcome variable at the final assessment available.
[c] Difference in initial and final socres with percent change (%Δ).

"Would you recommend this treatment to a friend with psoriasis," (where zero represented no and 100 represented yes) the mean score was 82.9 ± 21.5. Eighteen had recommend scores greater than 50. On the subjective improvement VAS completed by participants, the mean score was 73.0 ± 25.0. Seventeen had improvement scores greater than 50.

DISCUSSION

Our brief study suggests that a commercial tanning unit outfitted with nonprescription tanning lamps can improve psoriasis severity. The amount of improvement was predicted by the number of tanning treatments that subjects received, and neither age nor sex influenced treatment response. Depending on the measure, for those that completed 6 wk of treatment, the disease severity decreased by 39–52%.

We believe the observed improvement is clinically significant. Recent short-duration psoriasis studies using betamethasone valerate (Cunliffe *et al*, 1992), calcipotriol (Cunliffe *et al*, 1992), dithranol (Berth-Jones *et al*, 1992), and etretinate (Schopf *et al*, 1992) show comparable PASI reduction to this tanning study. These other agents represent typical valuable agents used in our daily clinical practice.

It is difficult to assess the significance of the clinical impact of a therapeutic measure by looking at the change in the disease severity alone. The severity of the skin involvement in psoriasis is, however, only one way to measure the impact of the condition. Recent work has focused on other dimensions of psoriasis including psychiatric symptoms, perceived stress, functional disability, and satisfaction with care. We found that subjects experienced significant improvement in their psychiatric distress symptoms (BSI), significant decreases in the stressfulness of psoriasis (PRSS), and general satisfaction with treatment. Thus, this treatment modality appears to have a positive impact upon several important aspects of the health-related quality of life of psoriasis patients and confirms the PASI data that a clinically significant improvement was achieved. We were unable to demonstrate a difference in disability or perceived stress, however. Disability and perceived stress may be harder to reduce with acute changes in disease severity and may be affected by chronic severity. We would expect lower disability and perceived stress as chronic morbidity decreases.

We carefully monitored subjects and observed side effects were minimal. Thirty-five percent of this group experienced one to three phototoxic reactions during the course of therapy. In our recent published retrospective review of psoriasis patients treated in our conventional phototherapy facilities, we found that 78 of 134 (59%) experienced one or more phototoxic reactions during the mean of 36.2 ± 28.1 sessions (Clark *et al*, 1996). In the present study, substantially fewer treatments were performed (mean 19 ± 7.6), and psoralen photochemotherapy and concomitant tar or anthralin treatments were not employed. Accordingly, the risk of phototoxic reaction appears roughly comparable to conventional phototherapy in our hands. This finding of side effect comparability raises the question of whether the improvement observed relates more to UVB dosing than UVA dosing. This question is not answerable in this trial, nor is relevant to the finding of improvement.

None of our subjects developed polymorphic light eruption and three (15%) reported having itching after one to three visits. By contrast, a previous tanning bed study of 31 English subjects found that pruritus occurred in 27 (87%) and polymorphic light eruption occurred in 13 (41%) (Rivers *et al*, 1989). Possible explanations for these observed differences might include a difference in the UV lamp type used, population differences in susceptibility to polymorphic light eruption (Fusaro and Johnson, 1996), and differential dosimetry.

This study has a number of strengths. First, each subject had separate severity assessments, the PASI and SAPASI. In effect, patients had independent observations of their psoriasis severity using the two most validated psoriasis instruments (Feldman *et al*, 1996; Fleischer and Exum, 1995). We have previously demonstrated the stability and responsiveness of the SAPASI over time (Feldman *et al*, 1996), suggesting that our observed significant changes represent real changes. We found that both instruments and an independent health-related quality of life instrument showed statistically significant improvement. The influence of recreational and therapeutic solar exposure was minimized by conducting this trial in the winter and early spring.

There are a number of limitations to this study. We administered our phototherapy treatments not based upon irradiance measurements but instead based upon the timer in the tanning unit to simulate community-based tanning experiences. Despite this inexact dosimetry, acute side effects such as burning were observed no more often than is observed in our conventional phototherapy facilities. We cannot comment on the actual quantity of UVA and UVB light emitted from the unit we tested, as our standard phototherapeutic instruments failed to render accurate readings.

The greatest limitation of this study is the lack of a control group. Identifying appropriate controls are problematic in studies of the efficacy of UV treatment. Our study was designed to minimize the problems inherent in studies lacking controls. Careful attention was paid to eliminating the effects due to changes in therapies and changes in season. Despite the careful study design, the lack of a control group is a serious concern.

The data showing a dose-response relationship between the cumulative tanning bed exposure and reduction in severity scores strongly supports the contention that the observed effects are due to tanning bed treatments. Nevertheless, a randomized blinded placebo-controlled trial would provide better proof of efficacy. The data presented provide a basis for designing such a study with sufficient power to show a treatment effect.

If tanning bed treatments are to be used clinically, it would be valuable to assess the effectiveness of these units in community facilities themselves. For this study, treatments were administered under strict medical supervision in a university setting. All phototherapy sessions were administered by a phototherapy technician or experienced physician assistant. Although it is likely that these same results would be obtained in community commercial tanning facilities, we cannot conclude this from our data. Moreover, all nonprescription tanning devices are not identical in spectral output, so we cannot infer conclusions about units other than the one provided by the sponsor, Wolff System Technology.

These data are intriguing and suggests that a nonprescription tanning unit that is readily accessible in the United States may offer beneficial effects for psoriasis patients. The conventional wisdom that these units offer no benefit to psoriasis patients may not be valid.

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