



## Determination of Solar Ultraviolet Dose in the Dead Sea Treatment of Psoriasis

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### Abstract

**Background:** An increased risk of developing cancer of the skin is the only potentially serious (albeit unproven) long-term side effect of heliotherapy and it is therefore prudent to avoid unnecessary exposure to solar ultraviolet radiation. Traditional heliotherapy for psoriasis at the Dead Sea calls for a sun exposure of 5–6 hours daily for 28 days. Studies have determined that mid-summer exposure for 3 hours is equally effective.

**Objectives:** To determine the effect of 3 hours sun exposure daily in the heliotherapy of psoriasis at the Dead Sea during the months March to December; and to monitor the associated ambient doses of solar UVB radiation.

**Methods:** A total of 194 patients with moderate to severe psoriasis was treated in the months of March to December by 3 hours of sun exposure each day. The dose of ambient solar UVB was monitored by a Solar Model 501A UVB-Biometer.

**Results:** Three hours of sun exposure daily was therapeutically efficacious in all months from March to November, but not in December. The lowest effective cumulative UVB dose was 170 SED (standard erythema dose), recorded in March and November.

**Conclusions:** Daily sun exposure for the heliotherapy of psoriasis at the Dead Sea can be reduced to at least 3 hours daily, about half the time originally recommended.

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### Methods

#### Subjects and treatment regimen

During 1995–1997 we studied 194 adults, most with moderate to severe plaque-type psoriasis, with males and females being approximately equally represented. Groups of 9–17 subjects each were exposed to the sun for 3 hours daily for 28 days each month. The initial mean Psoriasis Area and Severity Index scores of the groups ranged from 9.7 to 18.9. There were usually two exposure sessions of 1½ hours each day. From April to August these began at 08.00 and 14.00 hours Israel Standard Time, and in March, September and October at 09.00 and 13.00 hours. In November and December there was a single 3 hour session, starting at 09.00. During the first few days the exposure time was shortened depending on the individual skin type and degree of acquired pigment protection, and was gradually increased to 3 hours daily by the end of the first week.

The patients sat or reclined, alternately exposing different aspects of the body surface to the sun's rays. Occasionally they stood, walked, or briefly showered in fresh water in the open air. Bathing in Dead Sea water was in shaded indoor pools for 20–30 minutes either before or after each sun exposure. Use of skin emollients and sunscreens was permitted after the heliotherapy session but no other antipsoriatic treatment was given. UV-opaque sunglasses were generally worn except when exposing lesions around the eyes.

#### Psoriasis severity

The PASI [4] was assessed weekly by the same dermatologist.

#### Ambient solar UV radiation

The erythemally effective ambient solar UV radiation was monitored by a Solar Light Co. Inc. Model 501A UVB-Biometer [5] and the dose expressed in terms of the standard erythema dose [6]. One SED is equivalent to an erythemally effective UV radiation exposure of 100 J/m<sup>2</sup>. A just perceptible erythema is produced in unacclimatized skin by exposures of about 1.5 SED in Type I subjects, 2 SED in Type II subjects, and 3 SED in Type III subjects [7].

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The original schedules for the 28 day Dead Sea heliotherapy of psoriasis called for a sun exposure of 6–7 hours daily, following shorter acclimatization sessions during the first week [1,2]. Short-term side effects are usually absent or banal and the only potential long-term deleterious effect of consequence is an increased risk of developing actinically induced skin cancer. A study in 1993 demonstrated that in July and August, sun exposure for 3 hours daily was as efficacious as exposure for the traditional 6 hours or more [3]. The present study employed a daily sun exposure of 3 hours from March to December and monitored the ambient dose of solar UV radiation received.

UVB = ultraviolet B

PASI = Psoriasis Area and Severity Index

SED = standard erythema dose

**Table 1.** Ambient solar UV dose and therapeutic efficacy of 3 hours sun exposure daily

1995–97	No. of patients	UV dose SED	Group PASI score		Student <i>t</i> -test ( <i>P</i> )
			Initial (av.)	% Improv (SD)	
March	9	170	12.2	81.3 (14.3)	0.931
April	12	310	18.9	86.0 (12.7)	0.256
May	18	340	12.7	80.0 (12.6)	1.000
June	22	390	14.8	84.2 (13.1)	0.503
July	40	360	13.6	80.0 (20.0)	0.253
August	30	340	15.0	84.6 (17.4)	0.923
September	16	250	13.4	69.7 (17.6)	0.019
October	19	200	13.3	75.4 (15.6)	0.151
November	19	170	11.6	72.3 (19.1)	0.187
December	9	120	9.7	33.0 (25.5)	0.002

### Statistical analyses

Comparison of PASI improvement between the groups was by Kruskal-Wallis one-way non-parametric ANOVA and/or by Student *t*-tests.

### Results

A summary of the monthly results, collated over the 3 year period, is presented in Table I. The results were therapeutically satisfactory between March and November, with a monthly median PASI score improvement ranging from 69.7% to 86%. The lowest cumulative ambient solar UV dose found to be effective was 170 SED, recorded in March and November, and the highest 390 SED, recorded in June. Median monthly efficacies did not differ significantly from each other with the exception of an unexplained lower value for September (*P* = 0.019). The median seasonal efficacy was slightly but significantly less in autumn (September–November) than those in spring (March–May, *P* = 0.0004) or summer (June–August, *P* = 0.0046). In a single winter study, in December 1995, the cumulative UV dose was 120 SED and the therapeutic result was unsatisfactory (*P* = 0.002).

### Discussion

Because of the potential, additive, carcinogenic effect of UVB radiation, the lowest effective dose should be chosen for heliotherapy. This is particularly important in managing a recurring, lifelong disease such as psoriasis in which treatment is frequently repeated. The use of a daily sun exposure time of about 6 hours or more in the original Dead Sea heliotherapy schedules was not evidence-based. The choice was made partly on an erroneous assumption that little or no solar UVB radiation penetrated to the area and was also influenced by the desire of many patients to sunbathe for as long as possible. The present study demonstrates that, at stipulated times of day, an exposure of 3 hours daily is sufficient for treatment between early spring to late autumn. Unpublished studies performed during the same period and employing exposure times of 4.5 and 5 hours daily did not give better results than those obtained after exposure for 3 hours. In

some months an even shorter period may prove adequate. During heliotherapy different aspects of the skin surface are alternately partly or completely concealed from the sun's rays and many regions of the body are therefore exposed to only half of the ambient dose of UV radiation.

The lowest effective, cumulative ambient solar UV dose recorded was 170 SED, measured in March and November. A dose of 120 SED in December did not give satisfactory results. Thus, a cumulative ambient solar UV dose lying somewhere between 120 and 170 SED should prove adequate for the Dead Sea treatment of psoriasis under the conditions mentioned. Whether such a dose would be equally effective when achieved by shorter or longer exposure times at other hours of the day remains to be determined. Kushelevsky et al. [8] calculated that their 80 psoriasis patients treated at the Dead Sea in 1993 received a mean dose equivalent to 311 SED, appreciably higher than the dose reported in the present study.

The results of heliotherapy may be influenced by changes in the solar UV spectrum. The marked attenuation of UV wavelengths below 310 nm at the Dead Sea has been investigated [5] but other climatic and meteorologic factors also need to be studied. Seasonal variations in such factors as tropospheric ozone and aerosol levels might possibly account for the slight decrease of therapeutic efficacy found in the autumn.

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