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Phototesting for a variety of skin conditions before narrowband (TL-01) Ultraviolet-B

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Abstract: **Background:** For the majority of photo responsive skin disorders, narrowband ultraviolet-B (NBUV-B) phototherapy is currently regarded as the preferred option. The initial dosage of NBUV-B phototherapy is determined as a percentage of the minimal erythema dose (MED) at the majority of dermatology centers that offer phototherapy. This will shorten the time of therapy and lower the chance of burning while optimizing the therapeutic effect. Three times a week is the usual dosage for NBUV-B phototherapy treatment, which takes 18 to 30 sessions on average to clear the condition. For these types of treatment plans, a precise evaluation of the MED is necessary before starting treatment in order to prevent NBUV-B overdoses or underdoses. **Aim:** The objective of this study is to investigate the MED of 311nm NBUV-B phototherapy in a group of Libyan patients. **Methods:** For this prospective study, 150 patients with a range of skin conditions who saw the phototherapy unit at Bir Usta Melad Hospital of Dermatology and Venereology in Tripoli, Libya over an 8-month period were enrolled. Skin conditions include vitiligo, atopic dermatitis, and psoriasis are among those being researched. Using Fitzpatrick's questionnaire, skin types were assigned to each patient. Using a MED tester instrument (Dermalight® 80), 311 nm NBUV-B was applied to the right forearm. The test findings were recorded 24 hours later. **Results:** Of the patients studied, 82 (54.7%) were female and 68 (45.3%) were male. Their ages ranged from 10 to 60 years, with 30% of the sample falling between the ages of 31 and 40. The patients were clinically diagnosed with the following conditions: vitiligo 65(43.3%), psoriasis 61(40.7%), eczema 8(5.3%), pruritus 6(4%), and alopecia areata and lichen planus 5(3.3%) each. According to Fitzpatrick's categorization, the skin prototypes in the included series were 15(10%) patients of skin type III, 118(78.7%) patients of skin type IV, and 17(11.3%) patients of skin type V. Among the enrolled participants, the minimum necessary dose to elicit an erythema for NBUV-B ranged between 300 mJ/cm2 and 750 mJ/cm2, with the mean dosage was 484.7 ± 82.2 mJ/cm2. **Conclusions:** The average MED to 311nm NBUV-B in Libyan patients was around 500 mJ/cm2, which can be utilized to determine the initial dose and treatment regimen of phototherapy for various skin conditions**.**

Keywords: Phototherapy, Narrowband, Erythema, Minimal, Dose.

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INTRODUCTION

When narrow band Ultraviolet-B (NBUV-B) phototherapy was first developed, it was primarily used to treat psoriasis, but there are now more and more conditions for which it can be used [1]. Determining the initial optimum irradiation dose of NB-UVB phototherapy, known as the minimal erythema dose (MED), is a critical step in phototherapy treatment. By determining the MED, it is possible to prevent the risk of starting the phototherapy course with an inadequate or excessive dosage by providing the initial correct dose [2]. This will increase the effectiveness of the treatment and decrease the number of exposures needed to remove the skin lesions [3]. Furthermore to prevent a greater overall UVB dosage. Typically, the MED is ascertained using the skin phototype. Since skin phototype is a poor predictor of MED, this is not satisfactory. Additionally, there are numerous variations in MED even within the same skin phototype [4]. The MED can be found using a variety of techniques, such as the Diffey template, Waldman skin testing unit, filtered xenon arc lamp with liquid light guide, ultraviolet-opaque template with TL-01 panel, Dermalight® 80 MED-Tester, and many more. The purpose of this study is to use the Dermalight® 80 MED tester to ascertain the MED in a group of patients from Libya.

PATIENTS AND METHOD

Patients

This study involved 150 Libyan patients, both male and female, with a variety of skin conditions who were receiving phototherapy at the Bir Usta Melad Hospital of Dermatology in Tripoli, Libya.

The requirements for inclusion are as follows

1. One of the inclusion criteria is for patients who are between the ages of 10 and 60.
2. Individuals with skin conditions that respond well to phototherapy

The following are the exclusion criteria:

1. A woman who is nursing and pregnant.
2. Photosensitivity's past.
3. Skin alterations that point to a malignant change.
4. Diseases of the collagen arteries.
5. Individuals who had phototherapy in any form within the three months prior.
6. Age extremes (younger than 10 or older than 60).

METHOD

Verbal agreement was gained from each patient after they were fully informed about the nature of the testing method. Every patient had a thorough medical history taken, which included information about their personal and family histories, photosensitivity, and previous phototherapy experiences. A thorough dermatological examination was conducted, including the location, form, quantity, and arrangement of skin lesions. Every patient included in the current study had their skin phototype determined using the "Fitzpatrick self-reported questionnaire" [5].

Fitzpatrick's scale is a commonly used tool to evaluate a patient's skin phototype. It is based on three primary factors: genetic predisposition, skin reactivity to sun exposure, and tanning practices. Every question has a response scale that ranges from zero to four. The total score that corresponds to the Fitzpatrick skin type is obtained by adding the answers to all the questions.

The Dermalight®80 MED tester was used to determine the MED. The Dermalight® 80 MED tester was placed on the inside of the right forearm, halfway between the wrist and the antecubital fossa, with the emission field pointing downward (Figure 1).

Once the tester is turned on, it must be maintained steadily at the designated location until the end of the radiation, at which point the LEDs will automatically turn off. Following that, the patient was told to avoid exposing the examined area to any light, artificial or natural. The patient returned to the hospital a day later to have the test site read (Figure 2). A positive result is defined as erythema that can be identified by the Phototesting portion's margins. In the end, the Dermalight®80 MED tester and the corresponding MED value were taken from (Table 1).

Statistical Analysis

Version 16 of the Statistical Package for Social Science (SPSS) program was used to analyze the current study's findings.

The one-way ANOVA post-hoc test (F) and Spearman's rank correlation coefficient (r) were used to examine correlations between the variables. A p-value less than 0.05 were deemed statistically significant.

RESULTS

Out of the 150 patients who were enrolled, 68 patients were males and 82 females, with a male to female ratio of 1:1.2. The patients' ages varied from 10 to 60 years old, with a mean age of 33.5±13.1 years. Thirty percent of the series featured were between the ages of thirty, forty and twelve percent were between the ages of fifty and sixty. Thirty-one patients (20.7%) had received phototherapy in the past, and the remaining 119 patients (79.3%) will receive phototherapy soon. The Fitzpatrick self-reported questionnaire results for skin prototypes are shown in (Figure 3). (Table 2) lists the various clinical skin conditions that participants in this study were enrolled for.

The relationship between MED and patient characteristics

For the patients included in this investigation, the lowest dose needed to cause an erythema for NB UV-B ranged from 300 to 750 mJ/cm², with a mean dose of 484.7±82.2 mJ/cm². 99 patients (66%), 43 patients (28.7%), four patients (2.7%), and four patients (2.7%) had estimated mean electrode potential (MED) values of 440 mJ/cm², 580 mJ/cm², and 300 mJ/cm², respectively.

Using a Spearman correlation coefficient test, we examined the relationship between age and MED and discovered that it is weakly positive (r = + 0.241, 0.003 P value (Table 3). The relationship between gender and MED in male and female patients was shown to be statistically significant (P value 0.001) when we examined the relationship using a Student's t test (Table 4). The relationship between newly admitted patients who are scheduled for phototherapy treatment and MED and patients who have previously had phototherapy treatment was statistically not significant (P value 0.138). (Table 5).

Using an ANOVA test, we were able to find a statistically significant link between MED and various skin prototypes; the P value was (0.001) (Table 6).

For the patients with psoriasis, the lowest mean estimated dose (MED) was 300 mJ/cm², and the highest dose (750 mJ/cm²) with a mean dose of 492 mJ/cm² (Figure 4); for the patients with eczema, the lowest mean estimated MED was 440 mJ/cm², and the highest dose was 580 mJ/cm² with a mean dose of 475 mJ/cm² (Figure 5).

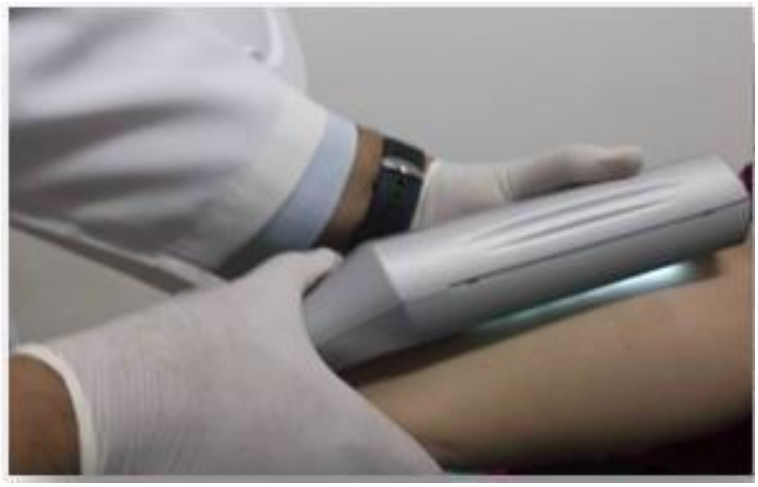

Figure-1: The inner aspect of the forearm was used to hold the Dermalight® 80 MED tester

Figure-2: The examination location According to the accompanying table (Table 1), the patient's minimal erythema dose was determined to be 580mJ/cm² 24 hours later

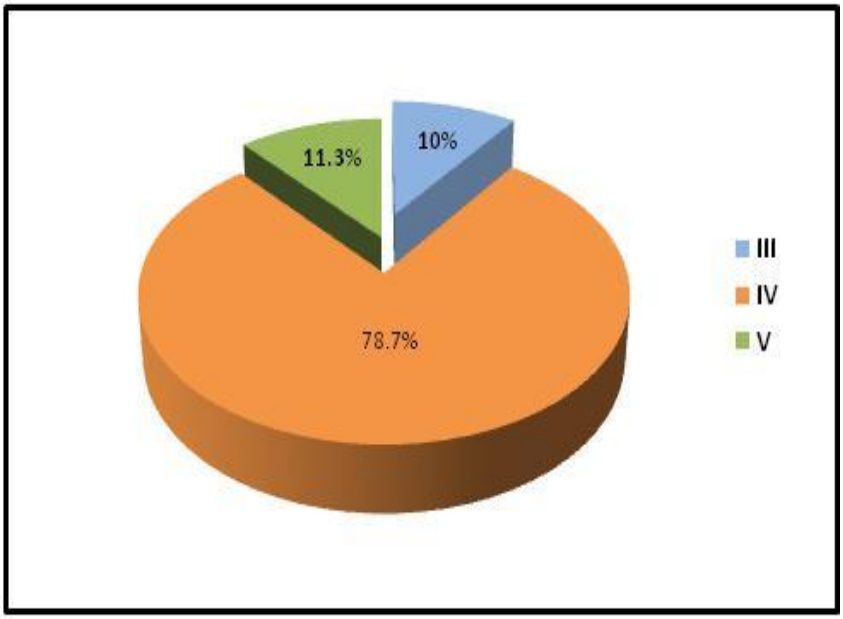

Figure-3: The patients' skin prototypes that were examined

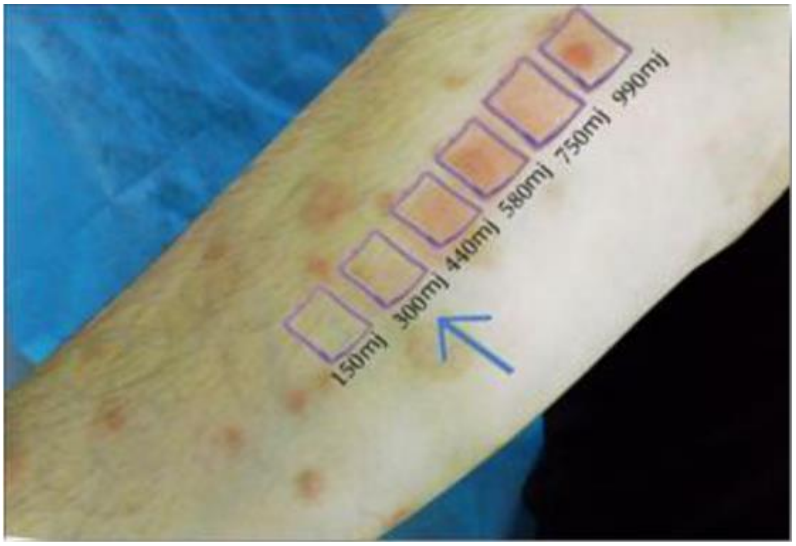

Figure-4: Psoriatic patient with MED to narrow band UVB at 300 mJ/cm²

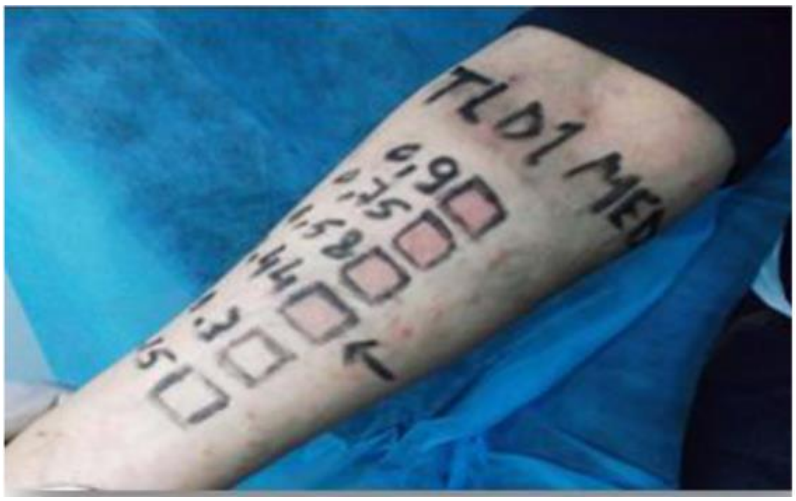

Figure-5: Eczema patient with MED of 440 mJ/cm²

Table-1: The matching Dermalight® MED-Tester dose values

		Test field 1	Test field 2	Test field 3	Test field 4	Test field 5	Test field 6
	Emission rate	100 %	83 %	65 %	49 %	34 %	17 %
Skin type	Time Min : Sec	Dose (J/cm²)	Dose (J/cm²)	Dose (J/cm²)	Dose (J/cm²)	Dose (J/cm²)	Dose (J/cm²)
1	0 : 36	0,400	0,332	0,260	0,196	0,136	0,068
	0 : 41	0,450	0,374	0,293	0,221	0,153	0,077
2	0 : 45	0,500	0,415	0,325	0,245	0,170	0,085
	0 : 55	0,600	0,498	0,390	0,294	0,204	0,102
3	1 : 04	0,700	0,581	0,455	0,343	0,238	0,119
	1 : 13	0,800	0,664	0,520	0,392	0,272	0,136
4	1 : 22	0,900	0,747	0,585	0,441	0,306	0,153

Table-2: The patients under study and their clinical diagnoses

The clinical diagnosis	**Frequency**	**Percentage**
Vitiligo	65	43.3
Psoriasis	61	40.7
Eczema	8	5.3
Pruritus	6	4
Lichen planus	5	3.3
Alopecia areata	5	3.3
Total	150	100

Table-3: The Spearman rank correlation between age and MED:

			AGE	MED
Spearman's rho	**AGE**	Correlation Coefficient	1.000	.241**
		Sig. (2-tailed)	.	.003
		N	150	150
	MED	Correlation Coefficient	.241**	1.000
		Sig. (2-tailed)	.003	.
		N	150	150

Correlation is significant at the 0.01 level (2-tailed).

Table-4: Gender and MED in the investigated patients, both male and female (Student's T test; independent samples):

Gender	**Frequency**	**Mean±SD**	***P* value**
Male	68	513.8±93.2	**0.001**
Female	82	460.5±62.7	

Table-5: The relationship between MED and patients who had previously had phototherapy treatments was positive (Student's T test; independent samples).

H/O Previous phototherapy	**Frequency**	**Mean±SD**	***P* value**
Yes	31	504.2±82.3	
No	119	479.6±81.7	**0.138**

Table-6: The proportion of MED in various skin types:

			Skin Phototype			
			III	**IV**	**V**	**Total**
MED	300	Count	4	0	0	4
		% within Skin Phototype	26.7%	0.0%	0.0%	2.7%

	440	Count	10		86		3	99
		% within Skin Phototype	66.7%		72.9%		17.6%	66.0%
	580	Count	1		30		12	43
		% within Skin Phototype	6.7%		25.4%		70.6%	28.7%
	750	Count	0		2		2	4
		% within Skin Phototype	.0%		1.7%		11.8%	2.7%
Total		Count	15		118		17	150
		% within Skin Phototype	100.0%		100.0%		100.0%	100.0 %

DISCUSSION

MED determination is crucial for rational phototherapy treatment. MED readings are essential for the stating dose and subsequent increments of UV irradiation. Although this procedure may at first looks simple but it is complicated by a number of factors and the observer's subjective assessment, the skin spot examined, the patient's age, the surrounding temperature, the patient's skin's level of pigmentation, and, of course, their skin phototype will all influence the final MED number. Furthermore, different MEDs can be used by people with the same skin phototype [4].

Age may be important. Gilchrest *et al.* noted that extremely young children and the elderly typically have lower MEDs, suggesting that MED may be impacted by extremes in age [6]. On the other hand, Cox *et al.* discovered that there are no variations in visually judged MEDs between patients under 25 and subjects over 60 [7].

The age range of our patients in this study was 10 to 60 years old; the extremes of the age range were not included. Our study's findings indicate that there was a weakly positive association between age and MED within this range.

Men are somewhat more likely than women to get sunburned, according to a 2006 study by Brown *et al*[8]. However, our research indicates a statistically significant difference in MED between the sexes, suggesting a gender variation in the function of the skin with regard to photo protection, with males having a higher MED than females. Numerous characteristics, including skin type, color, and eye and hair color, have been identified as significant predictors of skin sensitivity [9].

To determine the initial dosage of NB-UVB, clinicians utilize Phototesting to acquire the MED or depend on skin type as a predictor of erythema response.

A straightforward screening technique called skin photo typing is used to forecast how the skin will respond to UV light. Fitzpatrick first introduced the idea of skin type in 1975 based on people's documented vulnerabilities to UVR-induced tanning and burning. But the idea behind this was based on accounts about white skin. Reports about brown skin are scarce. Brown skin was first classified by Pathak and Fitzpatrick as skin type V, in addition to the skin types I through IV of white skin. Afterwards, three categories were created for brown skin: type VI was designated for black skin, type V for dark brown skin, and type IV for light brown skin.

According to Cox *et al*. [10], there is strong evidence that erythema response in White patients is not well predicted by skin type.

Gorden *et al*. have provided support for this observation [11]. Additionally, a research by Leslie *et al*. failed to find a relationship between MED and skin types [12]. On the other hand, a Korean study did discover a connection between MED and skin type in psoriatic patients [13]. Asian and Chinese skin types showed a reasonable correlation between their skin types and the MED to UVA and UVB [14].

Pai *et al.* observed that fair-skinned Indian subjects had erythema considerably earlier and at a lower dosage than those with type V skin [3]. Alora and Tylor [15] have shown a noteworthy rise in MED values between skin types I-III in contrast to skin types IV-VI. Skin types and MED were found to significantly correlate in another Bahraini study [16]. Despite the limitations of our data, we were able to identify a statistically significant association between skin types and MED, but not between the clinical diagnosis and MED.

In this investigation, the established mean electro dermal potentials (MEDs) for the skin of Libyan patients were 300–580 mJ/cm² for type III, 440–750 mJ/cm² for type IV, and 440–750 mJ/cm² for type V, with a mean of 575.3 mJ/cm². According to our findings, the average MED increases gradually for skin types III through V. There is a large variety of MEDs within each skin type and a significant amount of

overlap in the MED range among various skin types, despite the fact that the skin types and MED were associated. Our MED values differ from those found in other research, which may be caused by changes in measuring techniques, instrumentation, or genetic variability among groups. Tejasvi *et al*. found that the range of the average mean dose (MED) for narrowband UVB exposure for type IV and type V skin was 500–1100 mJ/cm² and 750–1100 mJ/cm², respectively, in an Indian study. [(4)] According to a Taiwanese study, MEDs with a mean average dose of 300 mJ/cm² were determined to be 275 mJ/cm² for skin type III and 312 mJ/cm² for skin type IV [17].

Therefore, rather than applying general standards, these study variances emphasize the necessity for more precise MED estimation and individual patient testing.

CONCLUSION

The beginning dosage and course of treatment for various skin conditions can be determined using the mean MED to 311nm NBUV-B in Libyan patients, which was approximately 500 mJ/cm2.

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