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Original Article

Dermatology Section

Clinical Characteristics of Photodermatoses in Indian Patients and their Phototesting Findings: A Cross-sectional Study

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ABSTRACT

Introduction: Phototesting helps to confirm photosensitivity, identify the action spectra, reproduce lesions by photo provocation for biopsy, calculate starting dose of desensitisation therapy, assess the severity of the photodermatoses, and monitor response to treatment. The effect of sunlight on darker skin has only been sparingly studied and hence, this study was undertaken in our population.

Aim: To identify the spectrum of photodermatoses, with their clinical characteristics and phototesting findings.

Materials and Methods: A cross-sectional study was conducted in Outpatient Department (OPD) of the Department of Dermatology, Pushpagiri Medical College, Tiruvalla, Kerala, India from January to December 2015. A total of 30 patients clinically diagnosed as photodermatoses were subjected to phototesting using the whole body phototherapy unit with Ultraviolet A (UVA) and UVB exposure. After 24 hours the UV-exposed areas were examined for the Minimal Erythema Dose (MED), and for the reoccurrence of skin lesions to determine the action spectra for the disorder, and the values were expressed in mean, frequency, and percentage.

Results: Polymorphic Light Eruption (PLE) remains the most common photodermatosis (n=25) with a definite female preponderance (n=19). The mean MED-UVB for type IV skin with photodermatoses was found to be 766 mj/cm^2 and for type V skin was found to be 900 mj/cm^2. MED-UVA was not observed in the majority of patients (n=24). Among the 25 patients with PLE, 16 patients had normal MED values to both UVA and UVB, four had reduced MED-UVB alone, one patient to UVA alone, and three patients had reduced MED to both. MED-UVB was not observed in one patient. MED-UVA was not observed in 21 patients (normal). Of the three patients with photoallergic dermatitis, one patient had reduced MED-UVB and MED-UVA. The other two patients had normal MEDs. The chronic actinic dermatitis patient had reduced MED to UVB and UVA and the actinic lichen planus patient had normal MEDs.

Conclusion: Phototesting remains a very useful tool in the evaluation and management of photodermatoses and PLE was the most common photodermatoses in studied population.

Keywords: Polymorphic light eruption, Photosensitivity, Phototherapy

INTRODUCTION

Photodermatoses are disorders of the skin characterised by an abnormal cutaneous response to ordinary light exposure [1]. Erythema is the most visually apparent indicator of UV-induced skin inflammation. Erythema has been used as the endpoint for measuring the relative effects of UVB and sometimes of UVA, usually expressed as the action spectrum [2]. The effect of sunlight on darker skin has only been sparingly studied [3,4]. The effect of sunlight does depend on the skin colour, skin type, and type of melanin in the skin [4]. Photodermatoses are common in the Indian population despite the better natural photoprotection offered by melanin [4]. Phototesting helps to confirm photosensitivity [5], identify the action spectra, reproduce lesions by photoprovocation for biopsy [3], calculate starting dose of desensitisation therapy, assess the severity of the photodermatoses and monitor response to treatment [5].

In India, the incidence of photodermatoses is high in view of the tropical weather, lack of knowledge regarding sun protection, and inadvertent consumption of phototoxic drugs [6]. Identification of the cause and avoidance of triggering factors will help in reducing the incidence of photodermatoses [6]. This study intends to identify the spectrum of photodermatoses with their clinical characteristics and phototesting findings and to find out the minimal erythema dose in these patients by UVA and UVB irradiation.

MATERIALS AND METHODS

A cross-sectional study was conducted in the Department of Dermatology, Pushpagiri Medical College, Kerala, India from January to December 2015. A total of 30 patients attending OPD with photodermatoses during the stipulated period of study duration were included in the study, after obtaining ethical committee clearance (PIMSRC/E1/388A/12/2015) and patient consent.

Inclusion criteria: Patients clinically diagnosed to have photodermatoses based on distribution of skin lesions on or predominantly on sun exposed areas, and patients willing to undergo the phototesting procedure, which takes about an hour in the phototherapy unit were included in the study.

Exclusion criteria: Patients with severe photosensitivity with dissemination of lesions to large areas and pregnant women were excluded from the study.

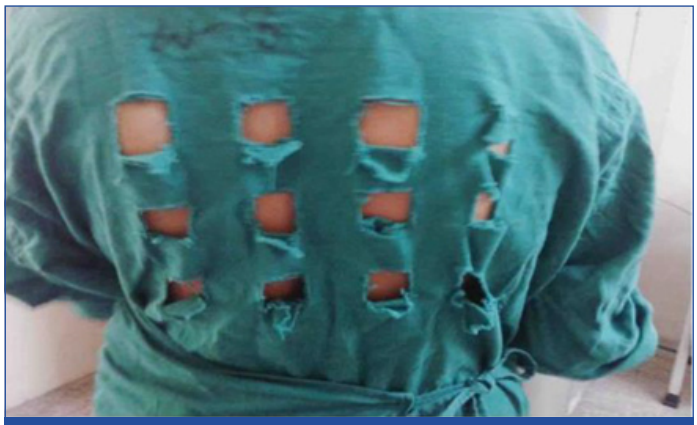
Their clinical characteristics, Fitzpatrick's skin types, [Table/Fig-1] [7] were recorded and they were then subjected to phototesting in the active stage before initiation of the treatment.

'Daavlin 3 series SP™ and 3 series PC™ Full body phototherapy device with smart touch control system, model number 311/350-24/24' was used for the purpose of phototesting. The device is equipped with 24 lamps that emit UVA (peak 350 nm) and 24 Narrow Band UVB/TL-01 lamps (peak 311 nm). A full length

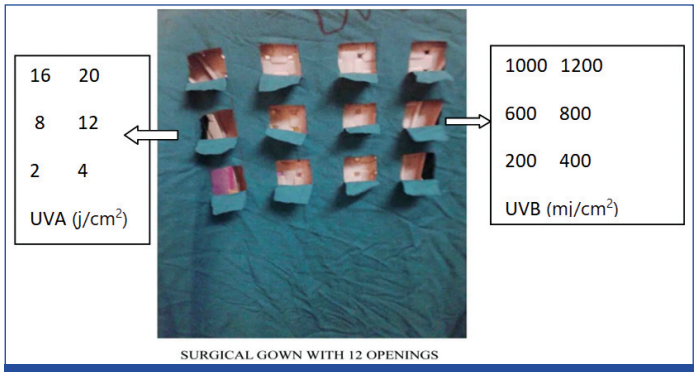
Skin type	Characteristics
I	Always burns, never tans
II	Usually burns, sometimes tans
III	Sometimes burns, usually tans
IV, V	Moderate constitutive pigmentation
VI	Marked constitutive pigmentation

[Table/Fig-1]: Skin phototypes [7].

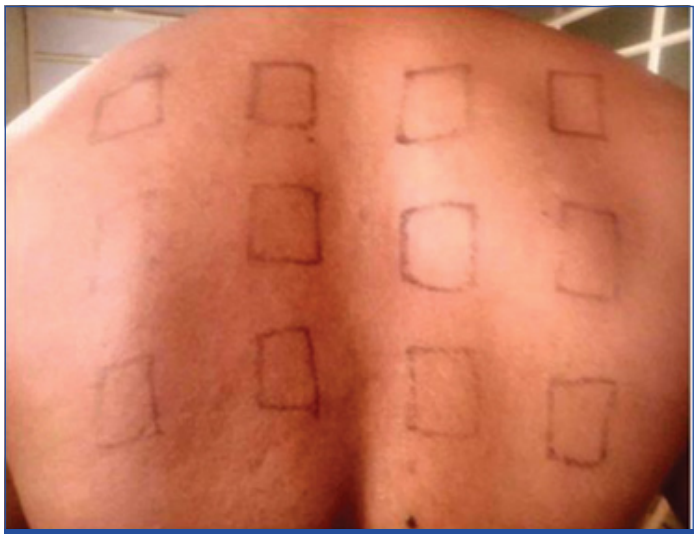
gown with full sleeves was worn by the patient [Table/Fig-2]. 4 cm^2 openings were put on the back of the gown, six on each side, for UVA and UVB exposure [Table/Fig-3]. Eyes were protected with UV blocking goggles and the face was covered with a cloth. Areas to be exposed were marked with a marker pen [Table/Fig-4].



[Table/Fig-2]: Template with openings on the back of a patient.



[Table/Fig-3]: Surgical gown with 12 openings.



[Table/Fig-4]: Areas for exposure marked.

Patients were then subjected to sequentially higher doses of UV light exposure on 4 cm^2 area of the upper back. UVA was exposed at doses of 2,4,8,12,16 and 20 j/cm^2 [Table/Fig-5]. UVA dose of 2 j/cm^2 was initially applied on the back. The first opening on the back of the gown was then closed. 2 j/cm^2 was applied again, so that, a total of 4 j/cm^2 is received at the second opening, which was then closed, and the process was repeated till all the openings received the required doses. UVB was also similarly exposed at doses of 200, 400, 600, 800, 1000 and 1200 mj/cm^2.

After 24 hours the UV exposed areas were examined for the minimal erythema dose, and for reoccurrence of skin lesions to determine the action spectra for the disorder.

[Table/Fig-5]: 6 Holes for UVA open, 6 Holes for UVB closed.

STATISTICAL ANALYSIS

Statistical analysis was done using epi info 7 software. The continuous variables like age, duration of disease, time from sun exposure to development of lesions etc were summarised as mean and standard deviation. The type of photodermatoses and sensitivity to UVA or UVB was expressed in frequency and percentage.

RESULTS

A total of 23 females and 7 males were included in the study. Majority of the participants were in 41-50 years of age [Table/Fig-6]. The mean age was 43 years.

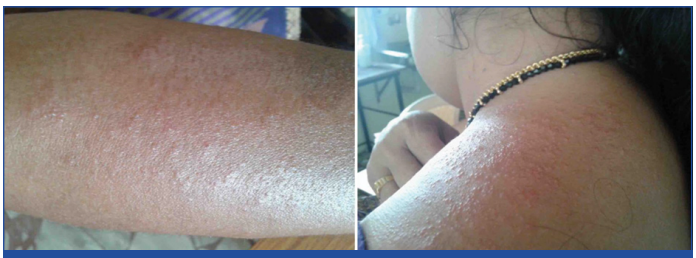
Age group (years)	Number of patients (%)
20-30	4 (13.3)
31-40	7 (23.3)
41-50	10 (33.3)
51-60	9 (30)

[Table/Fig-6]: Agewise distribution of subjects.

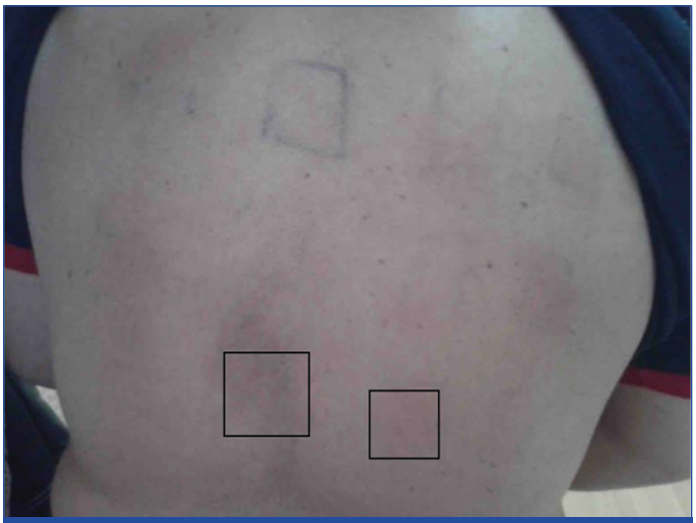
PLE remains the most common photodermatoses (n=25), with a definite female preponderance [Table/Fig-7,8]. None of the patients had a family history of PLE. About 14 patients with PLE had recurrent episodes of the disease. Most of the patients (n=26,86.6%) diagnosed to have photodermatoses were involved in indoor works. They were incidentally exposed to sunlight for different purposes like hanging clothes, travel to work place etc. Only four patients were involved in regular outdoor works. Sixteen patients developed lesions after exposure to afternoon sun, nine after exposure in the morning, four in the evening and one patient after exposure to a newly installed CFL in the office [Table/Fig-9]. Most patients (n=18) developed the disease within 7-24 hours of exposure to light, six patients within six hours, five patients after 24 hours and time of onset was unnoticed by one patient. The patient with chronic actinic dermatitis had a history of parthenium dermatitis earlier while residing in North India. There was a definite seasonal exacerbation in summer for 66.7% patients [Table/Fig-10].

Type of photodermatosis	Male (%)	Female (%)	No. of patients (%)
Polymorphic light eruption	6 (24)	19 (76)	25 (83.3)
Photoallergic dermatitis	1 (33.3)	2 (66.6)	3 (10)
Chronic actinic dermatitis	0	1 (100)	1 (3.3)
Actinic lichen planus	0	1 (100)	1 (3.3)

[Table/Fig-7]: Type of photodermatoses.



[Table/Fig-8]: Polymorphic light eruption with multiple erythematous papules.



[Table/Fig-9]: PLE induced by CFL with MED UVB at 200 mj/cm^2 and MED-UVA at 4 j/cm^2.

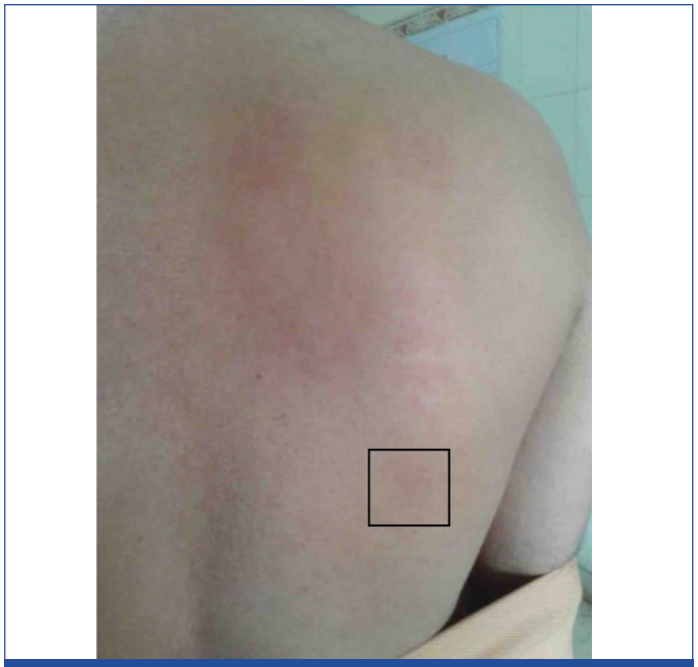
Season	No. of patients and type of photodermatosis
Onset in summer	20 (66.7%) [16 PLE, 3 PAD,1 ALP]
Winter	1 PLE (3.3%)
Summer and spring	8 (26.7%) [1 CAD, 7 PLE]
Nil	1 PLE (3.3%)

[Table/Fig-10]: Distribution of subjects on the basis of seasonal variation.
PLE: Polymorphic light eruption; PAD: Photoallergic dermatitis; ALP: Actinic lichen planus; CAD: Chronic actinic dermatitis

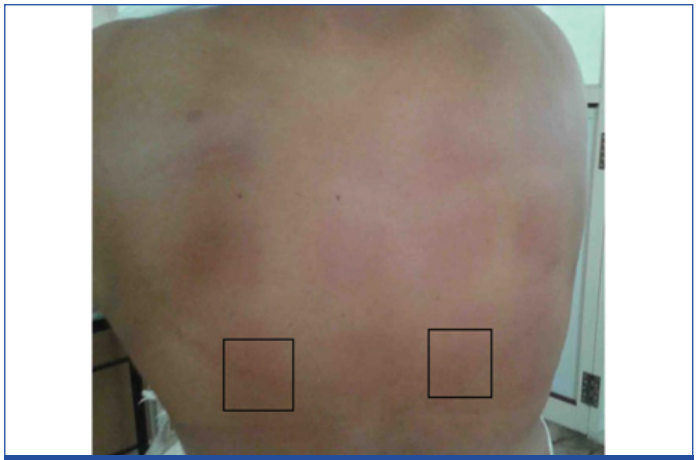
Majority of patients were of Fitzpatrick's skin type IV (n=23), six patients were of skin type V and remaining one patient was of skin type III. The mean MED-UVB (minimal erythema dose to ultraviolet B) for type IV skin with photodermatoses was found to be 766 mj/cm^2 and for type V skin was found to be 900 mj/cm^2. MED-UVA was not observed in the majority of patients (n=24). Among the 25 patients with PLE, 16 patients had normal MED values to both UVA and UVB, four had reduced MED-UVB alone [Table/Fig-11], one patient to UVA alone, three patients had reduced MED to both. MED-UVB was not observed in one patient and MED-UVA was not observed in 21 patients (normal). In the three patients with photoallergic dermatitis, one patient had reduced MED-UVB and MED-UVA. Other two patients had normal MEDs.The chronic actinic dermatitis patient had reduced MED to UVB and UVA [Table/Fig-12] and the actinic lichen planus patient had normal MEDs.

DISCUSSION

PLE was the most common photodermatosis observed in present study population (83.3%), followed by photoallergic



[Table/Fig-11]: PLE patient with MED-UVB at 400mj/cm2.



[Table/Fig-12]: CAD patient with UVA at 2 j/cm^2 and MED-UVB at 200 mj/cm^2.

dermatitis. In a study from India it has been found to be 0.56% in the plains and as high as 3.81% in hilly areas [8]. PLE was the most common photodermatoses reported in previous studies also [1,9-11]. The mean age of PLE patients was 43 years in present study which was higher than a previous study from India (32.7years) [1]. The female predominance in PLE is well documented [12-14] as in present study (n=19,76%). About 14 (56%) of the patients with PLE had recurrent episodes of the disease in present study. None of the patients had a family history of PLE even though it is reported in upto one sixth of patients in literature [15]. Most patients with PLE developed the disease after 6-24 hours of exposure to light, five patients within six hours, four patients after 24 hours and time of onset was unnoticed by one patient. One patient who developed the lesions after 6-24 hours had no history of sun exposure but developed after installation of a new CFL in office. PLE is a delayed type of hypersensitivty response and is reported to occur between 30 minutes to three days after exposure to sunlight [15]. Flourescent lighting has been shown to induce lupus erythematosus lesions and chronic actinic dermatitis and has the potential to induce other idiopathic photodermatoses like PLE but to what extent is not yet clear [16]. Two-third of patients (n=16) had disease onset in summer, followed by disease occurrence in summer and spring. Onset or worsening of PLE in summer and spring is reported. Among the patients with PLE 32% had low MED responses. Four had reduced MED-

UVB alone, one patient had reduced MED-UVA alone and three patients had reduced MED to both. Around 15-30% abnormal MED responses have been documented in literature [17,18] and the incidence was slightly higher in this study. MED-UVB was not observed in one patient. This could probably be due to a MED above the test ladder that was employed, that is, above 1200 mj/cm^2. Higher than normal MED values have also been reported for PLE patients [19]. Rest of the 16 patients (64% of patients) had normal minimal erythemal responses, the incidence was slightly lower than that in previous studies. Que SKT et al., reported 68% (n=216) of their PLE patients to have normal MED responses to UVB, UVA and visible light [10]. Magnus IA [20] in 1964 and Frain-Bell W et al., [21] also had reported normal MED in PLE patients earlier.

Of the three PAD patients, one patient had reduced MED-UVA and UVB, other two patients had normal MEDs. The patient with systemic PAD due to Non Steroidal Anti-Inflammatory Drugs (NSAIDs) intake had the reduced MED. In the CAD patient MED to UVB and UVA was reduced as in previous studies [1,17]. In the absence of abnormal phototests a diagnosis of CAD cannot be made [18]. Actinic lichen planus patient had normal MEDs as in a previous case [22]. All the patients with PAD, and six patients with PLE were using different topical applications on the involved sites. Of these, four patients with PLE were using sandalwood soaps which is a known photosensitiser that might have predisposed them to development of disease [23]. One patient with PAD probably had systemic photoallergic dermatitis due to NSAID use (the patient was also using medicated oils) and the other two had photocontact allergic dermatitis from face pack and fairness creams. The sunscreen incorporated in the fairness cream or fragrance in face pack might have induced photosensitivity in the patients here, but the exact composition could not be assessed. The most common lesions in this study were irregular papules and plaques with scaling and erythema.

Only one patient had chronic actinic dermatitis and one had actinic lichen planus both of which are reported to be less common [12]. The patient with chronic actinic dermatitis had a history of parthenium dermatitis earlier while residing in North India. There is a definite trend towards a change from an airborne pattern to a CAD pattern in the natural history of parthenium dermatitis [24]. In actinic lichen planus, skin tests for ultraviolet sensitivity are reported to be negative in most cases. Therefore, the cause of the occurrence of eruptions exclusively on the light-exposed areas remains unclear [25].Verhagen AR and Koten JW hypothesised that light induces the Koebner phenomenon that progresses to actinic lichen planus in a certain population of patients who have a tendency to develop lichenoid eruptions [26].

There were no patients with idiopathic photodermatoses like actinic prurigo, hydroavacciniforme and solar urticaria as in other case series from India [1] as they are very rare in our country. There are no Indian studies on MED in patients with photodermatoses. Considering the two studies from India on normal skin by Pai GS et al., [27] and Tejasvi T et al., [28] an average value of 800 mj/cm^2 for type IV skin and 925 mj/cm^2 for type V skin was considered normal in present study. In present study, seven patients with type IV skin had a MED-UVB less than 800 mj/cm^2 and two patients with type V skin had MED-UVB less than 925 mj/cm^2 (600 mj/cm^2 and 800 mj/cm^2) which was low. Mehtha RV et al., [3] from India could not demonstrate erythema to UVA in type IV and type V skin even after irradiation upto 700 j/cm^2 with a solar simulator. Hence, it is proposed that the MED for UVA on Indian skin is probably greater than 700 j/cm^2. In present study, six patients with photodermatoses had observable erythemal response to UVA at less than 20 j/cm^2 which was abnormal.

Limitation(s)

Small sample size due to the prolonged time required for phototesting in the phototherapy unit.

CONCLUSION(S)

PLE remains the most common photodermatoses and phototesting findings are normal in a majority of patients with PLE. This study emphasises the importance of using phototests in conjunction with a history and physical examination, in conforming the diagnosis, identify those wavelengths of light which are most detrimental to an individual patient, and hence to take adequate measures to prevent exposure to those wavelengths of light.

REFERENCES

[1] Wadhwani AR, Sharma VK, Ramam M, Khaitan BK. A clinical study of the spectrum of photodermatoses in dark-skinned populations. Clin Exp Dermatol. 2013;38 (8):823-29.
[2] Kochevar IE, Taylor CR, Krutmann J. Fundamentals of cutaneous photobiology and photoimmunology. In: Goldsmith LA, Katz SI, Gilchrest BA, Paller AS, Leffell DJ, Wolff K, editors. Fitzpatrick's dermatology in general medicine. 8th edition.vol 1.New York: Mc Graw Hill; 2012;1031-65.
[3] Mehta RV, Shenoi SD, Balachandran C, Pai S. Minimal erythema response (MED) to solar simulated irradiation in normal Indian skin. Indian J Dermatol Venereol Leprol. 2004;70(5):277-79.
[4] Sharma VK, Sahni K, Wadhwani AR. Photodermatoses in pigmented skin. Photochem Photobiol Sci. 2013;12(1):65-77.
[5] De Argila D, Aguilera J, Sánchez J, García-Díez A. Study of idiopathic, exogenous photodermatoses, part II: photobiologic testing. Actas Dermosifiliogr. 2014;105 (3):233-42.
[6] Srinivas CR, Sekar CS, Jayashree R. Photodermatoses in India. Indian J Dermatol Venereol Leprol. 2012;78,Suppl S1:1-8.
[7] Fitzpatrick TB. The validity and practicality of sun-reactive skin types I through VI. Arch Dermatol. 1988;124(6):869-71.
[8] Sharma L, Basnet A. A clinicoepidemiological study of polymorphic light eruption. Indian J Dermatol Venereol Leprol. 2008;74(1):15-17.
[9] Morison WL, Stern RS. Polymorphous light eruption: A common reaction uncommonly recognized. Acta Derm Venereol. 1982;62(3):237-40.
[10] Que SKT, Brauer JA, Soter NA, Cohen DE. Normal minimal erythema dose responses in patients with suspected photosensitivity disorders. Photodermatol Photoimmunol Photomed. 2012;28(6):320-21.
[11] Hönigsmann H. Polymorphous light eruption. Photodermatol Photoimmunol Photomed. 2008;24(3):155-61.
[12] Stratigos AJ, Antoniou C, Papathanakou E, Daboudi M, Tranaka K, Tsara K, et al. Spectrum of idiopathic photodermatoses in a Mediterranean country. Int J Dermatol. 2003;42(6):449-54.
[13] Karthikeyan K, Aishwarya M. Polymorphous light eruption- An indian scenario. Indian Dermatol Online J. 2021;12(2):211-19.
[14] Boonstra HE, van Weelden H, Toonstra J, van Vloten WA. Polymorphous light eruption: A clinical, photobiologic, and follow-up study of 110 patients. J Am Acad Dermatol. 2000;42(2 Pt 1):199-07.
[15] Honigsmann H, Hojyo-Tomoka MT. Polymorphous light eruption, hydroavacciniforme and actinic prurigo. In: Lim HW, Honigsmann H, Hawk JLM, editors. Photodermatology. New York: Informa healthcare. 2007;149-67.
[16] Moseley H, Ferguson J. The risk to normal and photosensitive individuals from exposure to light from compact fluorescent lamps.Photodermatol Photoimmunol Photomed. 2011;27(3):131-37.
[17] Farr PM, Dawe RS. Phototesting. In: Lim HW, Honigsmann H, Hawk JLM, editors. Photodermatology. New York: Informa healthcare. 2007;433-40.
[18] Murphy GM. Investigation of photosensitive disorders. Photodermatol Photoimmunol Photomed. 2004;20(6):305-11.
[19] Diffey BL, Farr PM. The erythemal response to ultraviolet radiation in subjects with polymorphic light eruption. Br J Dermatol. 1986;114(1):103-08.
[20] Magnus IA. Studies with a monochromator in the common idiopathic photodermatoses. Br J Dermatol. 1964;76:245-64.
[21] Frain-Bell W, Dickson A, Herd J, Sturrock I. The action spectrum in polymorphic light eruption. Br J Dermatol. 1973;89(3):243-49.
[22] Werth VP, Honigsmann H. Photoaggravated dermatoses. In: Lim HW, Honigsmann H, Hawk JLM, editors. Photodermatology. New York: Informa healthcare. 2007;250-66.
[23] Starke JC. Photoallergy to sandalwood oil. Arch Dermatol. 1967;96(1):62-63.
[24] Sharma VK, Verma P, Maharaja K. Parthenium dermatitis. Photochem Photobiol Sci Off J Eu rPhotochem Assoc Eur Soc Photobiol. 2013;12(1):85-94.
[25] Dekio I, Matsuki S, Furumura M, Morita E, Morita A. Actinic lichen planus in a Japanese man: first case in the East Asian population. Photodermatol Photoimmunol Photomed. 2010;26(6):333-35.

[26] Verhagen AR, Koten JW. Lichenoid melanodermatitis. A clinicopathological study of fifty-one Kenyan patients with so-called tropical lichen planus. Br J Dermatol. 1979;101(6):651-58.
[27] Pai GS, Vinod V, Krishna V. Med estimation for narrow band UV-B on type IV and type V skin in India. Indian J Dermatol Venereol Leprol. 2002;68(3):140-41.
[28] Tejasvi T, Sharma VK, Kaur J. Determination of minimal erythemal dose for narrow band-ultraviolet B radiation in north Indian patients: Comparison of visual and Dermaspectrometer readings. Indian J Dermatol Venereol Leprol. 2007;73(2):97-99.

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