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ORIGINAL ARTICLE

Determination of Minimal Erythema Dose and Anomalous Reactions to UVA Radiation by Skin Phototype☆

A. Pérez Ferriols,[a,*] J. Aguilera,[b] P. Aguilera,[c] D. de Argila,[d] M.A. Barnadas,[e] X. de Cabo,[f] J.M. Carrrascosa,[g] M.V. de Gálvez Aranda,[b] J. Gardeazábal,[h] A. Giménez-Arnau,[i] M. Lecha,[c] J. Lorente,[f] J.A. Martínez-Lozano,[j] M.T. Rodríguez Granados,[k] Y. Sola,[f] M.P. Utrillas[j], of the Spanish Photobiology Group (GEF)

[a] *Servicio de Dermatología, Hospital General Universitario de Valencia, Valencia, Spain*
[b] *Unidad de Fotobiología Dermatológica y Oncología Cutánea, Departamento de Dermatología y Medicina, Universidad de Málaga, Málaga, Spain*
[c] *Servicio de Dermatología, Hospital Clínic de Barcelona, Barcelona, Spain*
[d] *Servicio de Dermatología, Hospital Universitario de La Princesa, Madrid, Spain*
[e] *Servicio de Dermatología, Hospital Sta. Creu i St. Pau, Barcelona, Spain*
[f] *Departamento de Astronomía y Meteorología, Universidad de Barcelona, Barcelona, Spain*
[g] *Servicio de Dermatología, Hospital Germans Trías i Pujol de Badalona, Barcelona, Spain*
[h] *Servicio de Dermatología, Hospital Universitario Cruces, Baracaldo, Spain*
[i] *Servicio de Dermatología, Hospital del Mar, Barcelona, Spain*
[j] *Grupo de Radiación Solar, Universidad de Valencia, Valencia, Spain*
[k] *Facultad de Medicina, Complejo Hospital Universitario, Santiago de Compostela, Spain*

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KEYWORDS
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Photodermatosis

Abstract
Background: Phototesting is a technique that assesses the skin's sensitivity to UV radiation by determining the smallest dose of radiation capable of inducing erythema (minimal erythema dose [MED]) and anomalous responses to UV-A radiation. No phototesting protocol guidelines have been published to date.
Methodology: This was a multicenter prospective cohort study in which 232 healthy volunteers were recruited at 9 hospitals. Phototests were carried out with solar simulators or fluorescent broadband UV-B lamps. Each individual received a total of 5 or 6 incremental doses of erythemal radiation and 4 doses of UV-A radiation. The results were read at 24 hours.
Results: At hospitals where solar simulators were used, the mean (SD) MED values were 23 (8), 28 (4), 35 (4), and 51 (6) mJ/cm^2 for skin phototypes I to IV, respectively. At hospitals where

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* Corresponding author.
E-mail address: perez_ampferr@gva.es (A. Pérez Ferriols).

broadband UV-B lamps were used, these values were 28 (5), 32 (3), and 34 (5) mJ/cm^2 for phototypes II to IV, respectively. MED values lower than 7, 19, 27, and 38 mJ/cm^2 obtained with solar simulators were considered to indicate a pathologic response for phototypes I to IV, respectively. MED values lower than 18, 24, and 24 mJ/cm^2 obtained with broadband UV-B lamps were considered to indicate a pathologic response for phototypes II to IV, respectively. No anomalous responses were observed at UV-A radiation doses of up to 20 J/cm^2.
Conclusions: Results were homogeneous across centers, making it possible to standardize diagnostic phototesting for the various skin phototypes and establish threshold doses that define anomalous responses to UV radiation.

PALABRAS CLAVE
Fototest;
Dosis eritemática mínima;
Simulador solar;
Lámparas de luz ultravioleta B de banda ancha;
Fotodermatosis

Determinación de la dosis eritemática mínima y reacciones anómalas a radiación ultravioleta A según fototipo

Resumen
Antecedentes: La técnica del fototest evalúa la sensibilidad de la piel a la radiación ultravioleta (RUV) mediante la determinación de la mínima dosis de radiación capaz de producir eritema (dosis mínima eritemática [DEM]) y la respuesta anómala a UVA. No existen guías protocolizadas para la técnica del fototest.
Metodología: Estudio multicéntrico de cohortes prospectivo. Un total de 232 voluntarios sanos fueron reclutados en 9 centros hospitalarios. El fototest se realizó con simuladores solares (SS) o lámparas fluorescentes de UVB de banda ancha (UVBBA). Cada sujeto recibió un total de 5 o 6 dosis progresivas de radiación eritemática y 4 dosis de UVA. La lectura se realizó a las 24 h.
Resultados: La DEM media por fototipo fue de 23 ± 8, 28 ± 4, 35 ± 4 y 51 ± 6 mJ/cm^2 (fototipos I a IV respectivamente) para los centros que utilizaron SS y de 28 ± 5, 32 ± 3 y 34 ± 5 mJ/cm^2 cuando se utilizaron lámparas de UVBBA para fototipos del II al IV. Se consideraron valores de DEM patológica 7, 19, 27 y 38 mJ/cm^2, para los fototipos I al IV respectivamente cuando se emplearon SS y de 18, 24 y 24 mJ/cm^2 para los fototipos II-IV expuestos a lámparas de UVBBA. A dosis de hasta 20 J/cm^2 de UVA no se observaron respuestas anómalas.
Conclusiones: Existe homogeneidad de resultados en los diferentes centros participantes, lo que permite estandarizar el método del fotodiagnóstico para los diferentes fototipos cutáneos, así como establecer las dosis umbral que definen una respuesta anómala a la radiación ultravioleta.

Introduction

Phototesting is used to evaluate the skin's response to light and attempt to establish the spectrum of radiation that will cause adverse reactions or inhibit them.[1]

A phototesting session can determine a) the minimal erythema dose (MED), which is to say the lowest dose of UV radiation able to cause visible erythema; b) abnormal responses to UV-A light; and c) abnormal responses to visible light. Although phototesting guidelines have recently become available,[2] the UV irradiation doses able to induce erythema in healthy individuals and standardized MED doses for testing have not been well established in the literature.[3–6] Physicians who undertake phototesting, therefore, may disagree about how to read and interpret the results. For practical purposes, the MED thresholds described by Fitzpatrick[7,8] are usually considered reference values for assessing an individual's MED according to phototype.

Lack of homogeneity, both in the use of light sources and dose measurements, between the various members of the Spanish Photobiology Group (GEF) has prevented the development of a common phototesting protocol in the recent past.[9]

This study's aim was to standardize the phototesting protocol, analyze MED values in a healthy Spanish population by phototype, determine MED threshold values below which an individual could be considered photosensitive, and assess the doses that may trigger abnormal responses to UV-A radiation in this population.

Material and Methods

Study Design

This was a multicenter, prospective cohort study.

The study was independently reviewed and approved by the ethics committees of the participating hospitals (Table 1) and followed the principles of the Declaration of Helsinki.

All subjects gave their written informed consent before enrollment.