Actas Dermosifiliogr. 2013;104(7):541–542

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Dermo-Sifiliográficas

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OPINION ARTICLE

The Minimal Erythema Dose (MED) Project: In Search of Consensus on Phototesting☆

Proyecto dosis eritematosa mínima (DEM): en busca del consenso en la técnica del fototest

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The examination of a patient who presents with photosensitivity requires us to obtain a targeted medical history by asking the right questions and to perform an appropriate physical examination complemented by tests, such as skin biopsy, laboratory workup, and direct immunofluorescence, as required, all of which are available in most general dermatology departments. These elements provide the necessary basis for reaching a diagnosis in a high percentage of cases. However, a complete photobiological study requires more specific tests that are available only in specialized photobiology departments that have the necessary equipment and medical personnel trained to perform, read, and interpret the tests. One of the basic techniques used in such departments is phototesting.

Phototesting can be used to determine the patient's minimal erythema dose (MED), which is defined as the dose of UV-B radiation that produces perceptible erythema 24 hours after administration. It can also be used to determine abnormal reactions to UV-A radiation and visible light.

Though this procedure may at first seem simple, it is complicated by a number of factors and the resulting MED value will depend on the subjective interpretation of the observer, the skin site tested, the patient's age, the ambient temperature, the degree of pigmentation of the patient's skin, and of course their phototype. Furthermore, individuals with the same phototype can have different MEDs, possibly because of the factors mentioned above.[1]

All these factors make it difficult to determine whether a patient presenting with photosensitivity has a reduced MED if we have no baseline data. Moreover, it has been observed that in up to 68% of patients with photosensitivity the MED value is normal, a finding indicating that this figure is of only relative value[2] in prevalent dermatoses such as polymorphic light eruption and the less frequent photodermatitis and actinic prurigo. In other photodermatoses, such as solar urticaria, the phototest usually becomes a veritable challenge test and we take an immediate reading to determine the minimal urticarial dose at each wavelength tested. In chronic actinic dermatitis, a decrease in the MED is a diagnostic criterion and its detection is therefore a great aid to diagnosis.

As if the interpretation of these results was not already sufficiently problematic, those of us who attend meetings of the Spanish Photobiology Group have been puzzled and concerned by apparently glaring inconsistencies in the MED values obtained using phototesting reported in some presentations; in some cases, MED values have even been stated in terms of time (seconds) rather than doses. Furthermore, even when MED values have been given in units of energy per unit area (mJ/cm^2), the results reported by different working groups for individuals who theoretically have the same phototype have varied by as much as 50 to 70 mJ/cm^2. These findings were incomprehensible because

☆ Please cite this article as: Pérez-Ferriols A. Proyecto dosis eritematosa mínima (DEM): en busca del consenso en la técnica del fototest. Actas Dermosifiliogr. 2013;104:541–2.

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the light sources used in the majority of departments are similar.

In view of this situation and the lack of any consensus on standards in either the Spanish or English literature, in 2010 the Spanish Photobiology Group recognized the need to undertake a joint project to unify standards. The Spanish Photobiology Group is a multidisciplinary working group within the Spanish Academy of Dermatology and Venereology. In this group dermatologists have worked side by side with biologists, physicists, chemists, pharmacists, meteorologists, and astronomers for almost 25 years. This collaboration allows the same problem to be approached from different standpoints by experts in each field.

The first step in our project was to collect information on the methods used to perform phototesting in each photobiology department. A total of 9 Spanish hospitals participated in the project and physicists, meteorologists, and biologists also provided their expertise, time, and equipment. Together we achieved an enhanced understanding of our light sources, which are mainly xenon arc solar simulators and broadband UV-B fluorescent lamps.

We calibrated all the equipment at practically the same time in all the participating institutions, a measure that some members of the group had been requesting for years.[3] Solar simulators in particular are simple but highly sensitive devices, and even the handling required to perform the test can alter the arrangement of the mirror systems that direct the light beam. Each light source was characterized spectrally using a spectroradiometer to determine the erythemal irradiance (ability to produce erythema) of each wavelength.

This procedure revealed the cause of the discrepancies in the radiation doses used by the groups, making everyone aware of the erythemal weighting function, a function used by physicists and biologists but little known to dermatologists which takes into account the ability to produce erythema of each wavelength of the light source.

The group defined a methodology for phototesting, which specified the need to identify the ideal anatomical region, the diameter of each irradiated area, the distance between the irradiated areas, and the reading times. On the basis of previous experience, different series of exploratory doses were specified for departments using solar simulators and for departments using broadband UVB lamps.

The participants in the project performed phototesting on a healthy Spanish population. The primary aim was to identify the MED thresholds for the main skin phototypes and to standardize the doses and units of measurement used by all centers performing phototesting. In addition, we tried to establish the cutoff points for each group below which a MED value would indicate photosensitivity, especially for skin phototypes II and III, the largest groups in the study population and probably those most representative of the Spanish population as a whole.

This project also opened discussion on the usefulness of this procedure in dermatoses such as polymorphic light eruption and actinic prurigo, in view of the high percentage of normal results reported in the literature and by those who perform the test regularly. In these settings, it may be recommendable to perform challenge tests (repeated application of various MEDs at the same location over several days) although these tests are not always relevant and are time-consuming for patients and medical personnel. Furthermore, their usefulness in this setting has been seriously questioned by Spanish photobiologists. In my opinion, for the diagnosis of these diseases it would be more appropriate to obtain a biopsy of the skin lesions and, in the case of polymorphic light eruption, to perform direct immunofluorescence and determine circulating autoantibody titers to rule out lupus erythematosus. However, these diagnostic procedures would not be appropriate in solar urticaria and chronic actinic dermatitis, or in certain cases of systemic drug-induced photosensitivity. In the cases of drug-induced photosensitivity, measurement of the decrease in MED values following administration of the suspected drug would also be very helpful in diagnosis.

The results of the project, soon to be published in this journal, will provide a working methodology for all those who perform phototests and of particular value to novices in the technique. The present project, together with the publication of a study that will lay the foundations for the new European photoallergen battery,[4] to which Spain has made a large contribution, provides clear evidence of the steady progress toward standardization being made by clinical photobiology.

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