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LETTER TO THE EDITOR

Improving patient communication on sunscreen choice: Updating mechanistic misconceptions

Dear Editor,

Patients commonly turn to dermatologists for counsel on optimal sunscreen selection, including adequate SPF, broad-spectrum coverage, and reapplication frequency. However, despite the deep interest in patient education on sun protection, there is a knowledge gap in understanding the mechanism of action (MOA) of physical (mineral-based or inorganic) sunscreens. This gap may inappropriately predispose clinicians and patients to choose sunscreens with which they are less comfortable and compliant.

Many assume that chemical sunscreens absorb UV light and convert the energy to heat, while physical sunscreens, such as zinc oxide and titanium dioxide, reflect and scatter UV light. This has been the historic MOA invoked to explain the protective effects of physical sunscreens across decades of patient education.

However, this mechanism is, at best, a historic artifact from when physical sunscreen particle sizes were quite large. Though such non-micronized and non-nanoparticulate physical sunscreens may have had a greater proportion of its protective mechanism from reflection and scatter in the past, these formulations have largely been abandoned for more commercially viable options with the advent of micronization technologies. Furthermore, even microsized physical sunscreen formulations have been increasingly replaced by nanoparticle formulations.[1] The modern available physical sunscreens are more cosmetically tolerable with increased transparency and ease of application,[1] but their protective MOA deviates significantly from ultraviolet photon scatter and reflection.

It is important for dermatologists to recognize that the primary MOA of modern physical sunscreen agents is the very same protective mechanism of chemical sunscreens: absorption of UV light.[2–5] In fact, it was recently found that modern particulate-sized physical zinc oxide and titanium oxide reflected <5% of incoming UV light on average.[6] Rather than relying on reflection and scatter, the overwhelming majority of the attributable protective effect of zinc oxide and titanium dioxide is by UV light absorption, which excites electrons from the valence band to the higher energy conductance band. This energy is later primarily dissipated as heat in a manner analogous to chemical sunscreen UV light absorption.[1,7]

This information is important, as many dermatologists weigh the different properties of sunscreen agents when making recommendations that are tailored for their specific patients. For example, some dermatologists may favor physical sunscreen agents due to the perceived safety and simplicity of their MOA. However, given that both physical and chemical sunscreen agents work via similar mechanisms, other factors such as cosmetic elegance and ease of use may become more important considerations. Even modern physical sunscreens are sometimes known to leave patients with a cosmetically unacceptable 'white cast', as both zinc oxide and titanium dioxide reflect visible light. It is important to note that some patients' attempts to avoid a 'white cast' may result in less sunscreen use than recommended, leaving them vulnerable to ongoing sun damage, increased skin cancer risk, and worsening of pigmentary disorders. This is especially true in patients with darker skin tones, where the 'white cast' can be more prominent and bothersome.

As experts in the science of the skin and as frequent recommenders of sun-protective measures, it is important for dermatologists to be well-versed on sunscreen agents and dispel the common misconception that modern physical agents scatter and reflect UV light. The convergence of available evidence convincingly shows that both physical and chemical sunscreen agents protect against the vast majority of UV light via absorption. Dermatologists should be aware of sunscreen characteristics such as MOA, ease of use, cosmetic elegance and likelihood of compliance when recommending specific products for patients.

AUTHOR CONTRIBUTIONS

Michelle Wong, Courtney Rubin, Ahuva Cices and Avi Bitterman have made substantial contributions to the

conception of the ideas presented. Melissa Peri Zundell and Avi Bitterman have been actively involved in drafting the manuscript and revising it critically. All authors have contributed significantly to reviewing and editing the manuscript and have given final approval for the version to be published. They take public responsibility for the appropriate portions of the content and have agreed to be accountable for all aspects of the work in ensuring the accuracy and integrity of the research.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analysed in this study.

ETHICS STATEMENT

This paper does not require IRB/animal approval. This report was reviewed internally and approved by all authors for integrity, accuracy, and consistency with scientific and ethical standards. There are no specific patients referenced or included. All patients in this manuscript have given written informed consent for participation in the study and the use of their deidentified, anonymized, aggregated data and their case details (including photographs) for publication.

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