Efficacy of Sunscreen Filters and Visible-Light Blockers on Photoprotection of Melanated Skin

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BACKGROUND AND AIMS

Photoprotection in individuals with skin of color requires consideration beyond traditional UVB-focused sunscreen strategies. While darker Fitzpatrick skin types (IV–VI) have lower rates of skin cancer, they are disproportionately affected by pigmentary disorders such as melasma and post-inflammatory hyperpigmentation, which are exacerbated by long-wave UVA and visible light exposure.[1,2] Despite this, current sunscreen guidance remains largely UVB-centric and lacks ingredient-specific recommendations tailored to melanated skin.

This systematic review evaluates clinical evidence on sunscreen filters and formulations relevant to skin of color, with a focus on iron oxides, extended UVA1/visible light organic filters, and antioxidant-enriched products. Following Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA)-guided methodology, studies involving Fitzpatrick III–VI participants were analyzed for outcomes, including pigmentation, melasma severity, erythema, and tolerability.[3]

RESULTS AND DISCUSSION

Iron oxide-containing formulations consistently demonstrated superior protection against visible light-induced pigmentation compared to non-tinted mineral sunscreens.[4] In randomized studies, sunscreens with iron oxide achieved earlier and greater improvement in melasma, with significant changes observed as early as 8 weeks and sustained through 12 weeks.[5] However, variability in optimal concentration and limited long-term data highlight the need for further investigation.[6]

Organic filters extending into the UVA1 and visible light spectrum provided additional protection beyond standard SPF formulations. Filters targeting wavelengths around 350–400 nm were associated with measurable reductions in melanin index within 4 weeks, independent of UVB strength.[7] Broad-spectrum filters such as phenylene bis-diphenyltriazine (PBDT) also demonstrated short-term efficacy against blue light-induced pigmentation in Fitzpatrick III–V individuals.[8] Notably, many of these studies were industry-sponsored, underscoring the importance of independent validation.

Adjunctive formulations incorporating antioxidants and anti-inflammatory agents showed promising additive benefits. Combination therapies, including glycolic acid, hydroquinone, and vitamins C and E, improved melasma outcomes in up to 75% of participants compared to sunscreen alone.[9] In post-procedural settings, antioxidant-enriched sunscreens achieved complete prevention of post-inflammatory

hyperpigmentation in select cohorts, suggesting a role in mitigating inflammation-driven pigmentation pathways.[10]

Despite these advances, significant barriers remain. Current literature is limited by small sample sizes, short follow-up durations, and underrepresentation of diverse skin tones.[1,2] Additionally, clinical translation is hindered by the limited availability of iron oxide-containing products, inadequate shade inclusivity, cosmetic acceptability concerns such as white cast, and cost-related adherence barriers.[10]

Opportunities for advancement include the development of cosmetically elegant, shade-inclusive formulations, expansion of antioxidant-based photoprotective strategies, and incorporation of visible light and UVA1 coverage into clinical guidelines. Improved patient education and targeted counseling are also essential to address misconceptions and enhance sunscreen adherence in skin of color populations.[1]

CONCLUSION

Overall, iron oxides, extended-spectrum organic filters, and antioxidant-enriched formulations demonstrate measurable benefits in reducing photodamage and pigmentary disorders in melanated skin. Larger, independent clinical trials and broader access to tailored formulations are necessary to establish evidence-based recommendations and optimize photoprotection in this population.[3]

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