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 ORIGINAL ARTICLE

Evaluation of an SPF50 Sunscreen Containing Photolyase and Antioxidants for its Anti-Photoaging Properties and Photoprotection

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ABSTRACT

Background: Skin exposure to ultraviolet radiation (UVR) causes DNA damage, which can lead to mutagenesis, carcinogenesis, cellular death, and photoaging. Signs of photoaging include wrinkling, erythema, skin laxity, uneven skin texture, and hyperpigmentation. Photolyase is an exogenous DNA repair enzyme that can restore DNA integrity when applied topically to human skin. Antioxidants also play a key role in reducing UVR-associated molecular damage.

Objective: To assess the efficacy and safety of a tinted mineral-based sunscreen containing 10.7% zinc oxide (SPF50) with the active ingredients photolyase, antioxidants (Peptide Q10), and peptides in both protecting and repairing signs of photoaging. Methods: In an open-label, single-center, 12-week study, patients aged 35–55 years and Fitzpatrick skin phototypes II–IV applied the sunscreen daily for 84 days. VISIA photography was performed at baseline as well as 6- and 12-week follow-ups. At each visit, the investigator and subject evaluated clinical photoaging parameters including overall photodamage, fine lines/wrinkles, coarse lines/wrinkles, skin tone evenness, tactile roughness, and radiance.

Results: The Investigator Global Aesthetic Improvement Scale (IGAIS) found that 63% of patients showed improvement at week 6 and 81% at week 12. The Subject Global Aesthetic Improvement Scale (SGAIS) showed 58% and 62.5% of patients reported the appearance of their skin was improved at week 6 and 12, respectively. Overall, there was a statistically significant improvement in skin radiance as well as improvement in overall facial aesthetics reported by both investigators and subjects.

Conclusion: This tinted mineral based SPF50 sunscreen containing photolyase, antioxidants, and peptides is effective at repairing some clinical signs of photoaging and is well-tolerated for daily use.

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INTRODUCTION

Skin exposure to ultraviolet radiation (UVR) causes DNA damage, which can lead to mutagenesis, carcinogenesis, cellular death, and photoaging.The term photoaging refers to the premature aging of skin that results from chronic exposure to UVR. Histopathologically, photoaged skin shows a decreased collagen content, decreased elastin and disintegration of elastin fibers, and a reduced density of cutaneous microvasculature, among other microscopic changes.[1] Clinical signs of photoaging include wrinkling, erythema, skin laxity, uneven skin texture, and hyperpigmentation. Although endogenous DNA repair mechanisms exist, some damage persists and can accumulate with continued UV exposure leading to permanent damage to the skin structure.

Photolyase is a naturally occurring DNA repair enzyme that uses a light-dependent process to restore DNA integrity but is absent in humans and other placental mammals. Numerous in vitro and clinical studies over the past several decades have supported the addition of exogenous photolyase to topical preparations to augment human DNA repair mechanisms, allowing for more efficient prevention and repair of UVR damage.[2] This function has been demonstrated through the reversal of cyclobutane pyrimidine dimers (CPDs),[3-6] prevention of apoptotic cell death,[5] as well as the treatment of mild to moderate actinic keratoses.[7] Photolyase has also been shown to defend against photoaging through multiple mechanisms including the reduction of pro-inflammatory cytokine IL-6[4] and

the enzyme matrix metalloproteinase (MMP) 1,[8] both of which are implicated in the degradation of dermal collagen and elastic fibers.[1,7]

Antioxidants also play a key role in reducing UVR-associated molecular damage by combating reactive oxygen species produced when UV-A, and lesser degree UV-B, penetrates the living layers of the epidermis and the dermis. Unopposed, these free radicals cause DNA oxidation, protein carbonylation, and upregulation of MMPs, leading to inflammation, cell mutation, and structural damage.[1] A recent study examined the efficacy of an SPF50 sunscreen with or without antioxidants and/or DNA repair enzymes in reducing free radical-induced protein damage, oxidative damage to DNA, and the formation of CPDs.[6] The preparation containing both antioxidants and photolyases resulted in the greatest reduction in all three molecular markers of UVR damage, suggesting that antioxidants and photolyases may have synergistic effects.[6]

In this study, we examined the use of a tinted mineral-based sunscreen containing 10.7% zinc oxide (SPF50) with the active ingredients photolyase, antioxidants (Peptide Q10, which boosts coenzyme Q10 synthesis and Vitamin E), and peptides in protecting against and repairing visible signs of photoaging after 84 days of daily usage. The clinical photoaging parameters examined included overall photodamage, fine lines/wrinkles, coarse lines/wrinkles, skin tone evenness, tactile roughness, and radiance, and were assessed by both the investigator and subject at baseline and 6- and 12-week follow-ups. Subjects also reported their satisfaction with the product's texture and application as these features impact the likelihood of daily use.

MATERIALS AND METHODS

A single-center, institutional review board-approved, open-label, prospective, clinical trial was conducted to study the efficacy of a mineral-based sunscreen containing 10.7% zinc oxide (SPF50), photolyase, antioxidants (Peptide Q10), and peptides (Eryfotona Ageless Sunscreen, Isdin, Provençals 33, 08019 Barcelona, Spain) in the prevention and improvement of the clinical signs of facial photoaging in normal conditions of use. Twenty subjects, age 35–65, Fitzpatrick Skin Types II–IV were enrolled in the study, 16 of which completed the study. Subjects applied the SPF50 sunscreen daily for 84 days with the aim to evaluate its anti-photoaging efficacy and safety. VISIA photography was obtained at baseline and at 6- and 12-week follow-up visits. Investigator Global Aesthetic Improvement Scale assessments, Subject Global Aesthetic Improvement Scale assessments, Investigator Skin Quality Assessments with Griffith's Modified 10-Point Scale, Subject Skin Quality Assessments with Griffith's Modified 10-Point Scale, and Subject Satisfaction assessments were performed at all visits to evaluate improvement. The Griffith's Modified 10-point photonumeric scale was used to evaluate overall photodamage, fine lines/wrinkles, coarse lines/wrinkles, skin tone evenness, tactile roughness, and radiance. Changes in scores over time were measured using a Single-Factor Analysis of Variance (ANOVA). Subjects also recorded their weekly sun exposure and evaluated the tolerability and qualities of the sunscreen.

RESULTS

During the trial, the average weekly sun exposure was 7.36 hours with no recorded sunburns with use of the sunscreen. Analysis of Investigator Skin Quality Assessments with Griffith's

FIGURE 1. Analysis of Investigator Skin Quality Assessments with Griffith's Modified 10-Point Scale showed statistically significant improvement in skin tone evenness and radiance at week 12.

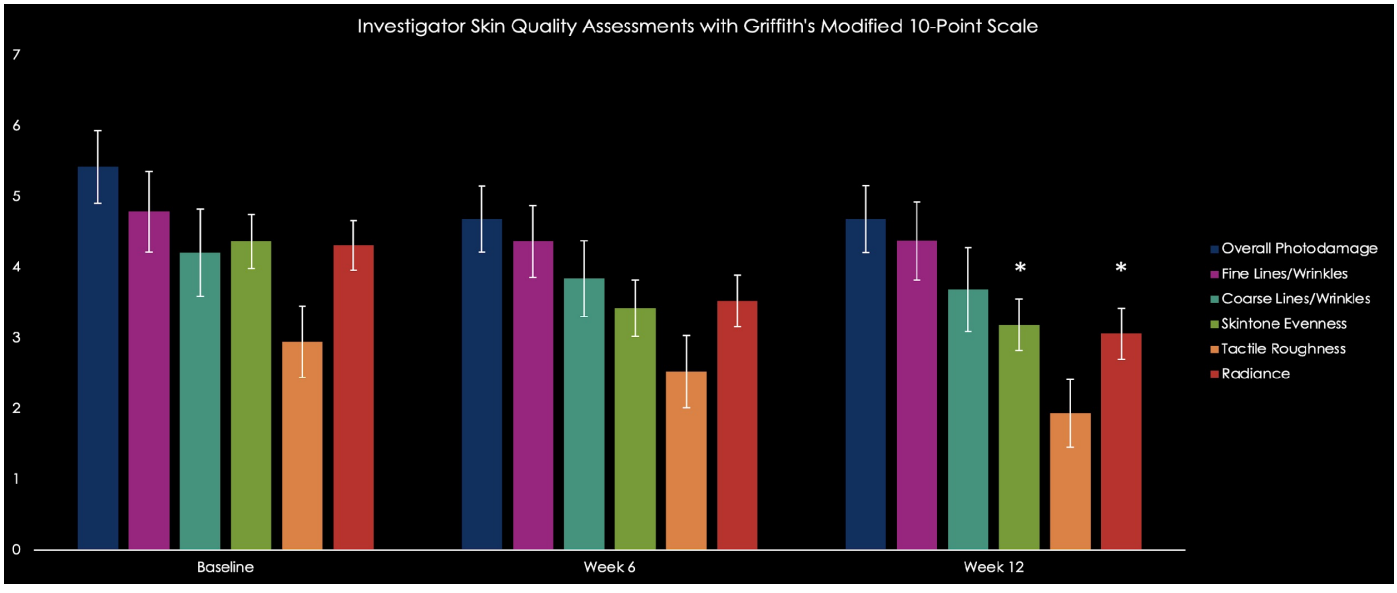


FIGURE 2. Before (left), 6 weeks after use (middle), and 12 weeks after use (right) of sunscreen.

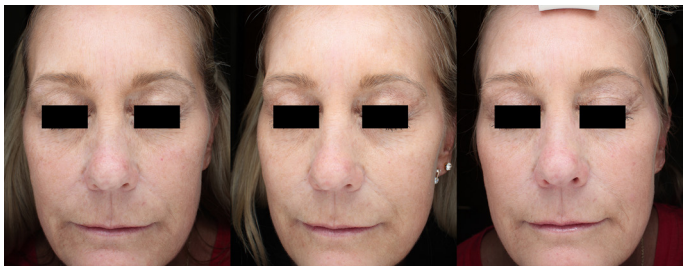


FIGURE 3. Before (left), 6 weeks after use (middle), and 12 weeks after use (right) of sunscreen.

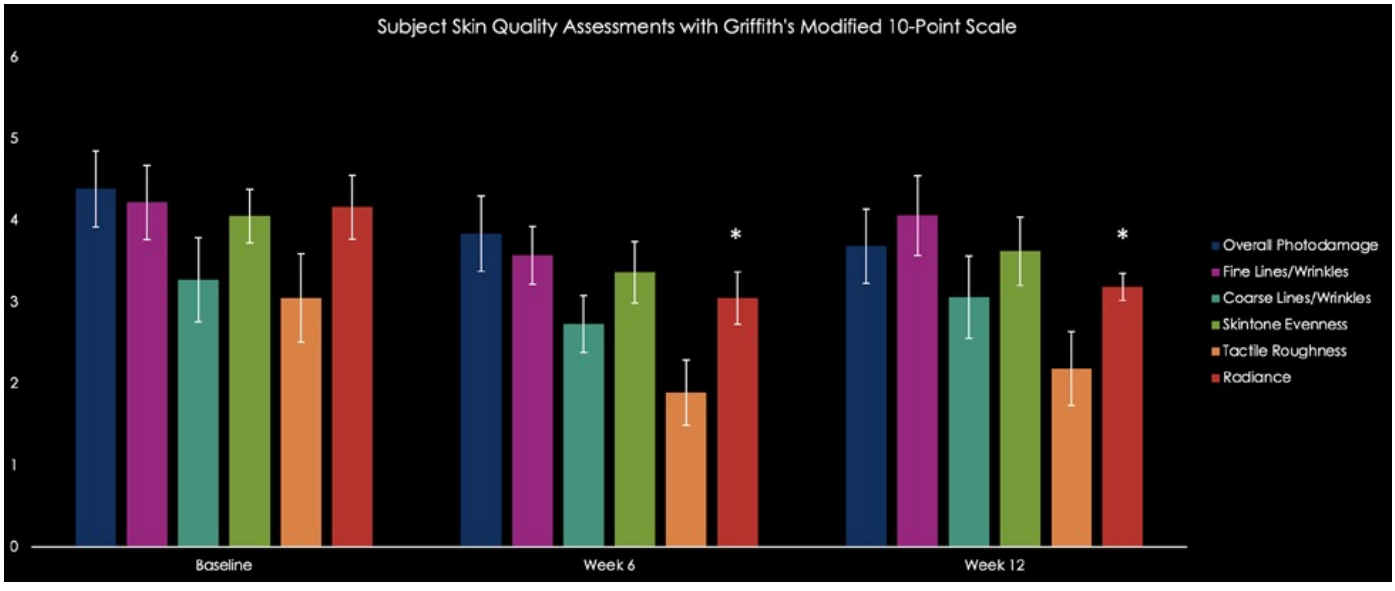
Modified 10-Point Scale showed a significant change in skin tone evenness at week 12 (baseline 4.37 vs week 12, 3.19; *P*=0.035; Two-Sample t-Test Assuming Equal Variance) and a significant change in radiance at week 12 (baseline 4.32 vs week 12, 3.06; *P*=0.018; Two-Sample t-Test Assuming Equal Variance; Figure 1). Investigator Global Aesthetic Improvement Scale showed that 63% of patients were improved at week 6, and 81% of patients were improved at week 12 (Figures 2 and 3). At week 6, 58% of patients reported the appearance of their skin was improved or better according to the Subject Global Aesthetic Improvement Scale, and 62.5% of patients at week 12 (Figures 2 and 3). There was a statistically significant improvement in radiance according to the Subject Skin Quality Assessment using Griffith's Modified 10 Point Scale (baseline 4.17 vs week 12, 3.19) (Figure 4). Overall photodamage, fine lines/wrinkles, coarse lines/wrinkles, and tactile roughness all trended towards improvement, although not statistically significant (Figures 1 and 4).

At week 12, 100% of subjects found the product easy to apply, convenient to use, and protective against sun damage, as well as agreed there was no sticky sensation. At week 12, 88% of subjects found the product provided a natural finish and hydrated their skin. After 12 weeks of use, subjects also found the product quickly absorbed (93%), improved skin tone (68%), increased skin elasticity and flexibility (68%), produced firmer skin (56%), less visible wrinkles (56%), and lightened dark spots (43%).

DISCUSSION

This open-label, single-center, 12-week study demonstrates that a tinted mineral-based SPF50 sunscreen containing photolyase, antioxidants (Peptide Q10, which boosts coenzyme Q10 synthesis and Vitamin E), and peptides results in clinically and statistically significant effects on signs of photoaging. We observed an improvement in skin radiance as well as overall facial aesthetics by both investigators and subjects. The investigator assessments also showed a significant change in skin tone evenness.

FIGURE 4. Analysis of Subject Skin Quality Assessments with Griffith's Modified 10 Point Scale showed statistically significant improvement in radiance at weeks 6 and 12.



These results are congruent with the UVR-associated damage repair and anti-photoaging effects of exogenous photolyase on human skin as reported in previous literature.[2-8] Similarly, the results of this study are consistent with the understanding that antioxidants play an important role in reducing UVR-associated molecular damage. Our findings suggest that synergistic effects of SPF50 sunscreen, antioxidants, and DNA repair enzymes for treating and preventing molecular markers of UVR-induced DNA damage[6] can also be demonstrated clinically when looking at visible characteristics of photoaging.

Patient-reported outcomes are of particular importance when evaluating the efficacy and tolerability of sun-protective products. Importantly, subjects found the sunscreen efficacious at improving their overall facial aesthetics and radiance, easy to apply, and convenient to incorporate into their daily skincare regimen. No participants reported or discontinued the study due to adverse effects, confirming the tolerability of this product. The most effective method of sun protection is the one that is consistently used by the consumer.

The weaknesses of this study include the lack of a control group and the inability to blind subjects to treatment. Subjects were not blinded to treatment which may introduce systematic bias in their final satisfaction evaluations. Longer-term studies may be needed to show further statistically significant changes in many of the endpoints evaluated in this study.

CONCLUSION

This tinted mineral based SPF50 sunscreen containing the active ingredients photolyase, antioxidants (Peptide Q10, which boosts coenzyme Q10 synthesis and Vitamin E), and peptides can both prevent and repair some of the clinical signs of photoaging and is suitable for daily use.

DISCLOSURES

This clinical study was sponsored by Isdin. Isdin paid Dermatology Cosmetic Laser Medical Associates of La Jolla, Inc. to conduct the clinical study but had no involvement in the collection, analysis, or interpretation of the data, nor the writing of this manuscript and decision to publish the results. The authors have no personal conflicts of interest.

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