

Use of a Cosmetic Moisturizer Promotes Corneocyte Maturity

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INTRODUCTION

The skin forms an effective barrier preventing loss of water, invasion of pathogens, and damage from chemical and physical assaults. These barrier functions are localized to the stratum corneum (SC), a two-component system of corneocytes embedded in a lipid matrix. Corneocytes consist of a stabilized array of keratin filaments contained within a covalently cross-linked cornified envelope. Fully mature corneocytes located in the outer SC layers, are characterized by being relatively large, very hydrophobic and highly cross-linked when compared to immature corneocytes of deeper SC layers. Immature corneocytes in the outer SC have been associated with poor barrier function.¹

OBJECTIVE

In the current study we examined how a cosmetic formulation known to improve skin barrier function affects biomarkers of corneocyte maturity such as size, hydrophobicity and degree of cross-linking.

BACKGROUND

As keratinocytes migrate from the epidermal basal layer to the SC, they undergo a differentiation or “maturation” process resulting in the formation of the corneocyte envelope (CE). The CE is made up of several different proteins, one of which is involucrin, that are highly cross-linked to produce the insoluble (hydrophobic) structure of the SC corneocytes.^{2,3} The simultaneous identification of “mature” and “immature” corneocytes has been described previously and is based upon the premise that fully “mature” CE would stain only with Nile red (detects hydrophobicity) but not stain for involucrin because the epitope for the involucrin antibody would not be recognized due to the high degree of cross-linking. In contrast, “immature” CE would stain solely with involucrin because of the lack of cross-linking.⁴

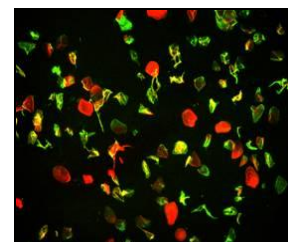


Figure 1. Example of the double staining corneocyte maturity identification method. Fully mature corneocytes stain intensely with Nile red (red), while fully immature corneocytes stain intensely for involucrin (green). Corneocytes in between these two extremes stain for both, giving different levels of yellow.

20 female subjects (40-60yrs old) applied the test cosmetic formulation containing known barrier enhancing cosmetic ingredients, including niacinamide, hexamidine and Pal-KT, to one side of their face twice daily for 4wks, while the other side served as a non-treatment control. D-Squame® tapes were collected at baseline and 4wks from an area just below the outside corner of the eye on both the treated and non-treated sides. Corneocytes were extracted from the 1st tape and double stained with Nile red and an anti-involucrin antibody to evaluate the degree of hydrophobicity and envelope cross-linking. Corneocyte size (µm²) and staining intensity (red:green signal) for each corneocyte were measured microscopically using Image-Pro Plus®. Based upon the red:green signal ratio, the corneocytes were classified as red, mostly red, 50/50, mostly green, or green. **Figure 2** shows the scale used, as well as examples from the image in **Figure 1**.

METHODS

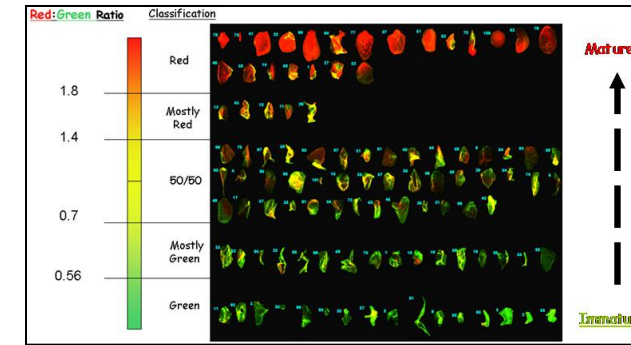


Figure 2. Scale used for corneocyte classification and examples from Figure 1.

SUMMARY

Corneocyte Stain Classification:

Compared to control, there was a significant 18% (p=0.002) increase in the percentage of Nile red staining fully mature corneocytes as a proportion of the total population of corneocytes after treatment with the cosmetic moisturizer. Additionally there was a significant decrease in fully immature corneocytes (p=0.067), as well as “less mature” corneocytes (p=0.038) after treatment with the cosmetic moisturizer.

Corneocyte Area:

Concurrent with the higher number of mature corneocytes, there was also a significant 20% (p=0.01) increase in the size of mature corneocytes compared to control samples. A significant increase in size was also observed in “less mature” corneocytes (p=0.035) compared to control samples.

CONCLUSIONS

The observed improvement of corneocyte maturity biomarkers suggests that use of the cosmetic moisturizer containing known barrier enhancing cosmetic ingredients, including niacinamide, hexamidine and Pal-KT, promotes a more mature SC. This SC contains larger, more hydrophobic corneocytes at the surface, providing greater tortuosity and better covalent bonding of SC intercellular lipids to protect the skin and prevent water loss.

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References

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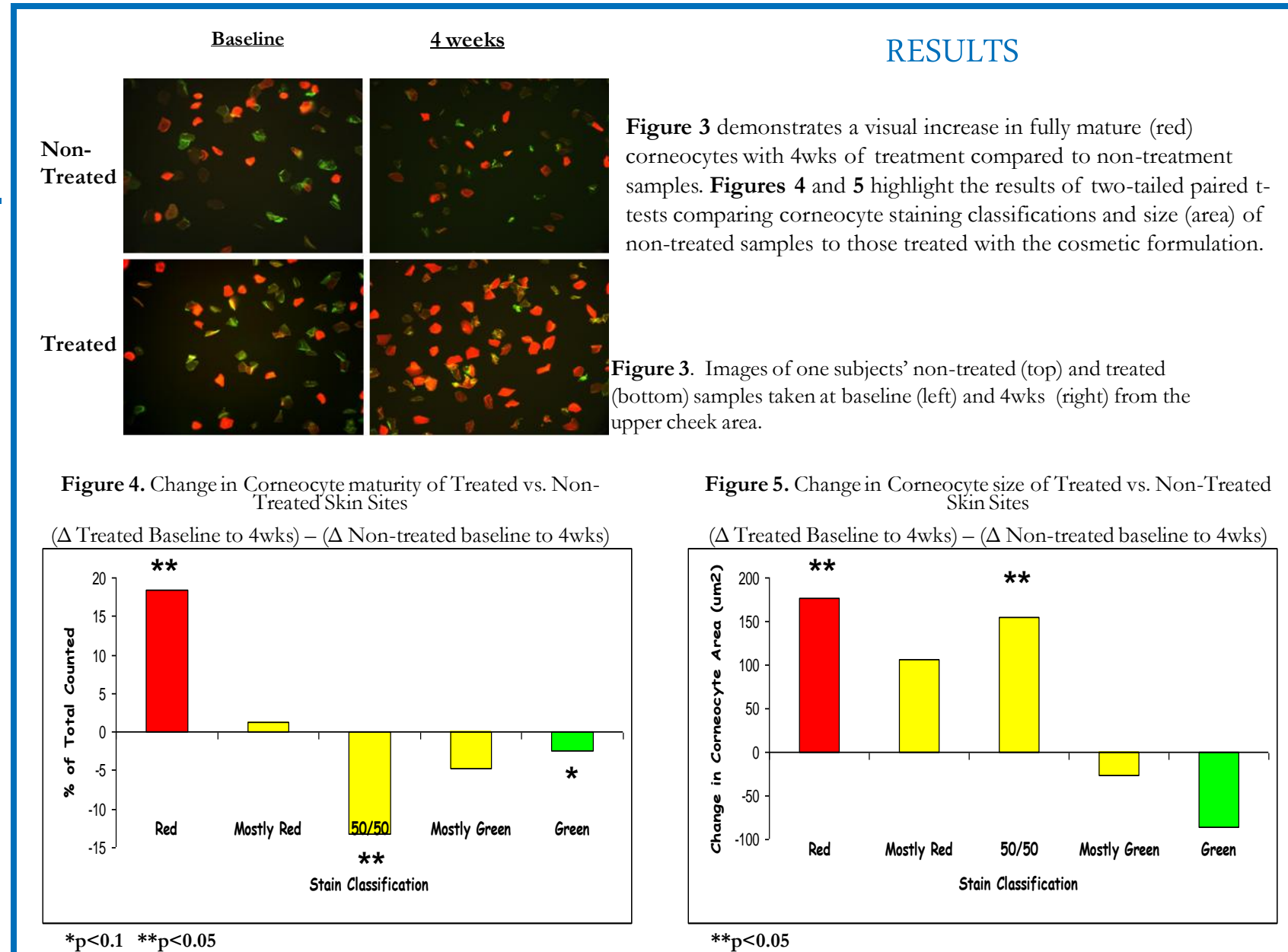
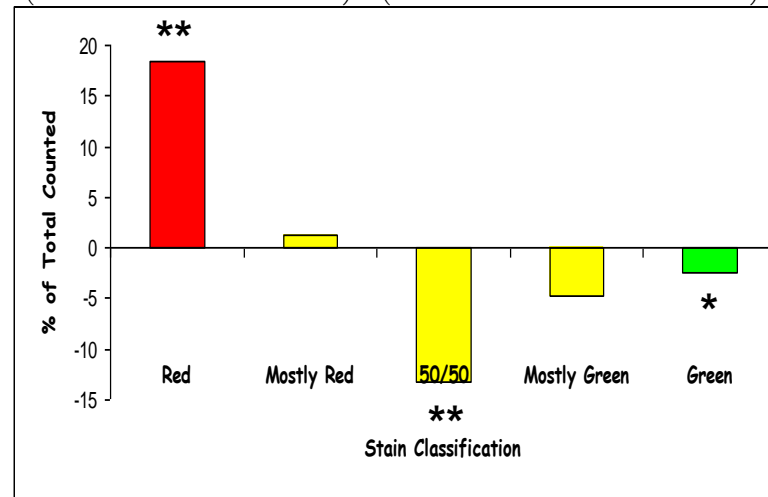


Figure 3. Images of one subject's non-treated (top) and treated (bottom) samples taken at baseline (left) and 4wks (right) from the upper cheek area.

RESULTS

Figure 4. Change in Corneocyte maturity of Treated vs. Non-Treated Skin Sites

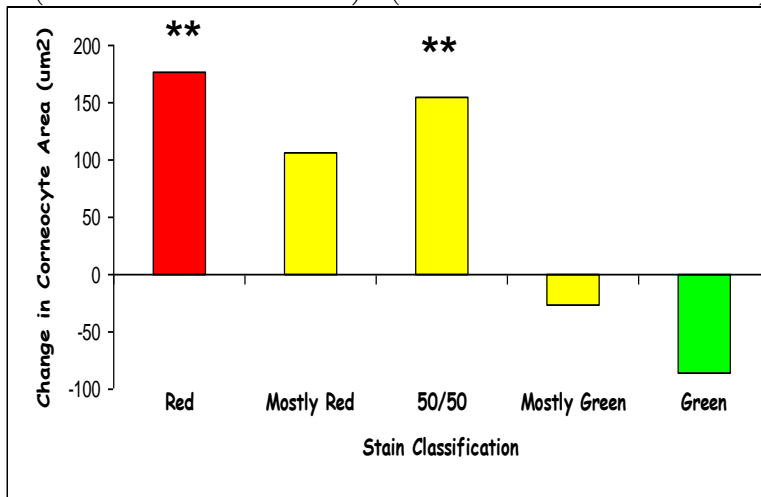
(Δ Treated Baseline to 4wks) – (Δ Non-treated baseline to 4wks)



*p<0.1 **p<0.05

Figure 5. Change in Corneocyte size of Treated vs. Non-Treated Skin Sites

(Δ Treated Baseline to 4wks) – (Δ Non-treated baseline to 4wks)



**p<0.05

