

Tradename: AC ExoVitalize

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Lot #: N230612B

Sponsor: *Active Concepts, LLC; 107 Technology Drive Lincolnton, NC 28092*

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Test Performed:

In-vivo VISIA Analysis

Pigmentation Study

Introduction

Skin pigmentation is determined by the amount of melanin present, which is produced by melanocytes in the bottom layer of the epidermis. Skin pigmentation can lighten, darken, or change color as a result of sun exposure, skin damage, genetics, and hormones. Dark circles and discoloration, which can be caused by factors such as stress, lack of sleep, or dehydration, can influence the appearance of aging and fatigue under the eye. Undereye discoloration is a result of deoxygenated blood pooling in the vessels that lie close to the skin, which is what gives dark circles the appearance of blue and purple hues. Lightening skin pigmentation, improving dark circles, and reducing discoloration under the eye leads to a healthier and more youthful undereye appearance.

Accordingly, an *in-vivo* study was conducted over a period of six weeks to evaluate the effect of **AC ExoVitalize** on skin pigmentation under the eye. To determine if **AC ExoVitalize** is capable of decreasing the appearance of dark circles and undereye discoloration, a VISIA image analysis and pigmentation study were conducted on the undereye area.

Study Principle

Participants applied specific products to particular undereye areas twice a day for four weeks. Measurements were collected once a week during the four-week use period and for two weeks after application ceased for a total of six weeks. Photographs of participant faces were obtained using the VISIA Complexion Analysis System (Canfield Scientific., Fairfield, NJ, USA) and analyzed using ImageJ software (NIH) to determine color intensity of the undereye region. Pigmentation measurements were obtained via the DermaLab Combo handheld probe to assess undereye melanin levels.

Materials

- A. Equipment:** DermaLab Skin Combo (Pigmentation Probe); VISIA Complexion Analysis System (Canfield Scientific., Fairfield, NJ, USA); Simple® Cleansing Facial Wipes
- B. Base Lotion:** Simple® Hydrating Light Moisturizer
- C. Software:** Excel Analysis ToolPak (Microsoft)

Methods

This study was conducted using 8 M/F participants between the ages of 23-54 with Fitzpatrick skin types I to IV (Table 1). Each participant was provided two products and were instructed to apply 0.2 g of product to the specified undereye area twice daily for a four-week period. Participants were instructed to continue their usual skin care routine and to apply the lotion once their everyday skin care routine is finished. One product was the control base lotion (Simple® Hydrating Light Moisturizer) and the other consisted of 5.0% **AC ExoVitalize** in the base lotion. This was a blind study and eye specification was randomly chosen for each participant. Baseline measurements were taken prior to starting the lotion regimen. Measurements were collected once a week during the four-week use period and for two weeks after application ceased for a total of six weeks. Participants were instructed not to wear makeup or SPF products for the measurement sessions.

Photographic assessments were performed using the VISIA Complexion Analysis System (Canfield Scientific., Fairfield, NJ, USA). The VISIA System ensured consistent positioning of each participant's head and each participant cleaned their face with a gentle facial wipe (Simple® Cleansing Facial Wipes) before the image was obtained. The photographic images were captured with standard, cross-polarized, parallel polarized, and ultraviolet light. Images taken by the VISIA System were exported and analyzed using ImageJ software (NIH) to assess color intensity of the undereye region. Specifically, histogram analysis was performed on the acquired images in specific regions of interest to evaluate the black and white color distribution. The color spectrum ranges from 0 (left) to 255 (right), where the left side of each histogram reflects exclusively black pixels, and the right side of each histogram reflects exclusively white pixels. A shift towards the left side of the histogram indicates a darker color.

Pigmentation levels, measured as melanin, were obtained via the DermaLab Combo handheld probe. Three consecutive measurements were recorded and averaged for each test site. A control area, located on the outer region of the eye (cheek bone), was measured in addition to the undereye region. Percent change is calculated by the following formula:

$$\text{Percent Change (\%)} = \frac{\text{Pigmentation Value}_{\text{Weeks of Application}} - \text{Pigmentation Value}_{\text{Baseline}}}{\text{Pigmentation Value}_{\text{Baseline}}} \times 100$$

Table 1. The Fitzpatrick Classification of Skin Types Chart¹

Fitzpatrick Skin Type Descriptions*	
Skin Type	Description
I	Always burns, never tans
II	Burns easily, tans minimally
III	Burns moderately, tans to light brown
IV	Burns minimally, tans to moderate brown
V	Rarely burns, tans to dark
VI	Never burns, least sensitive to changes

*Adapted from The Surgeon General's Call to Action to Prevent Skin Cancer

Results

The data obtained from this study met criteria for a valid assay as the color intensity of the control area, located on the outer region of the eye (cheek bone), did not change throughout the study duration. Applying 5.0% **AC ExoVitalize** to the undereye area reduced melanin values and the undereye dark circle intensity during the four-week application period and continued to exhibit positive results during the two-week regression period.

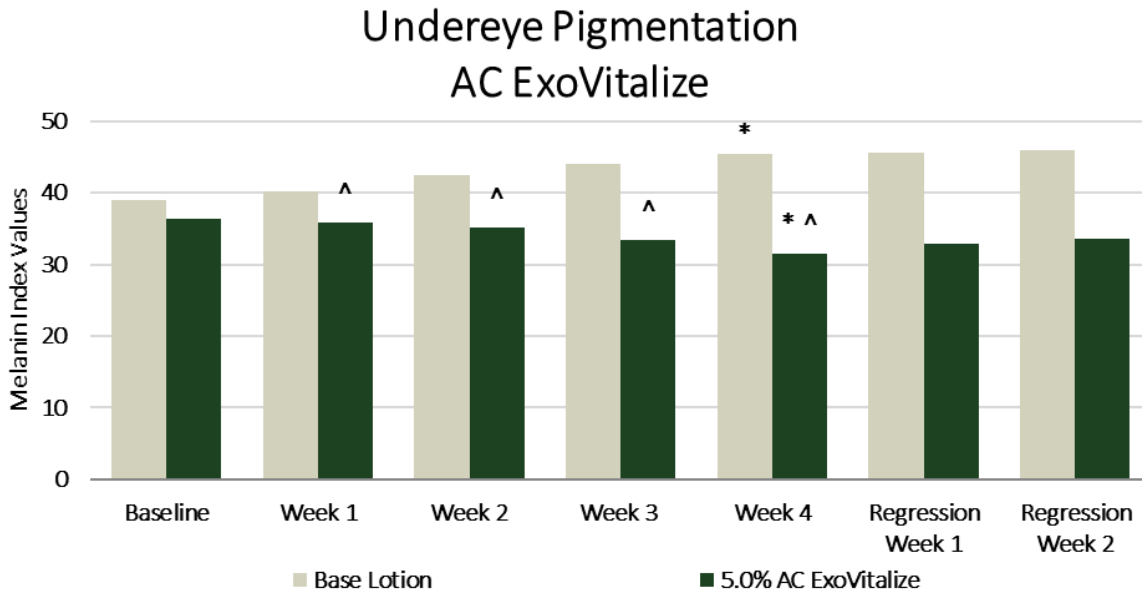


Figure 1. Average Melanin Levels throughout the Six-Week Study Protocol. * indicates significance ($p \leq 0.05$) compared to Baseline. ^ indicates significance ($p \leq 0.05$) between conditions within each timepoint.

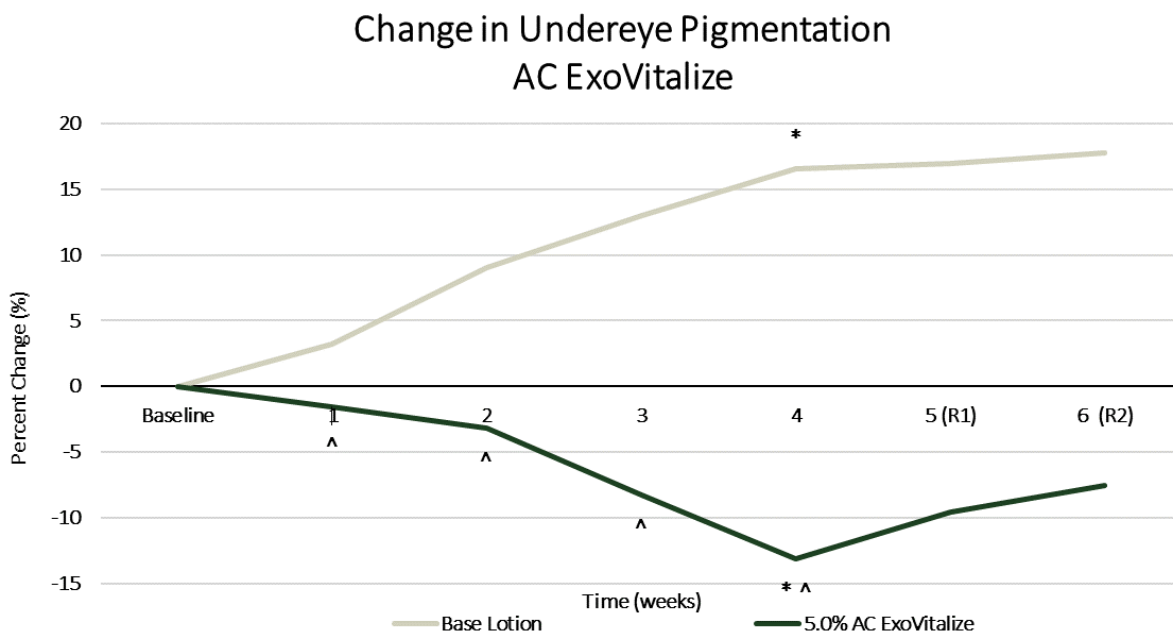


Figure 2. Average Percent Change in Undereye Melanin Levels from Baseline. R1 and R2 indicate regression weeks with no application. * indicates significance ($p \leq 0.05$) compared to Baseline. ^ indicates significance ($p \leq 0.05$) between conditions within each timepoint.

Undereye Dark Circle Intensity AC ExoVitalize

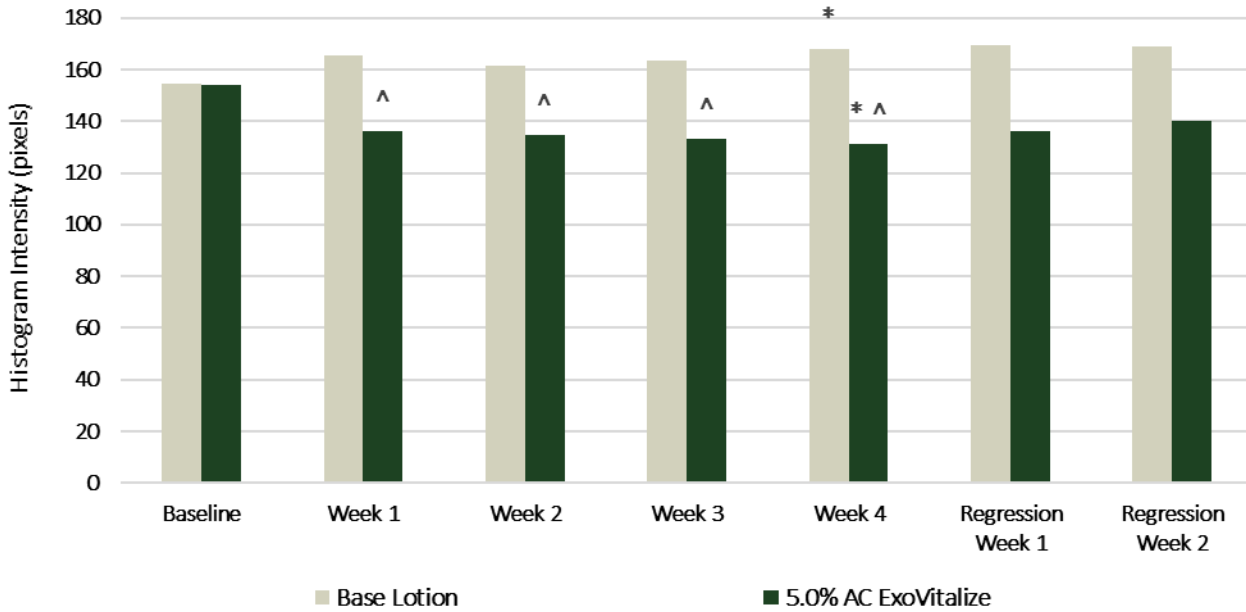


Figure 3. Average Undereye Dark Circle Intensity throughout the Six-Week Study Protocol. * indicates significance ($p \leq 0.05$) compared to Baseline. ^ indicates significance ($p \leq 0.05$) between conditions within each timepoint.

Change in Undereye Dark Circle Intensity AC ExoVitalize

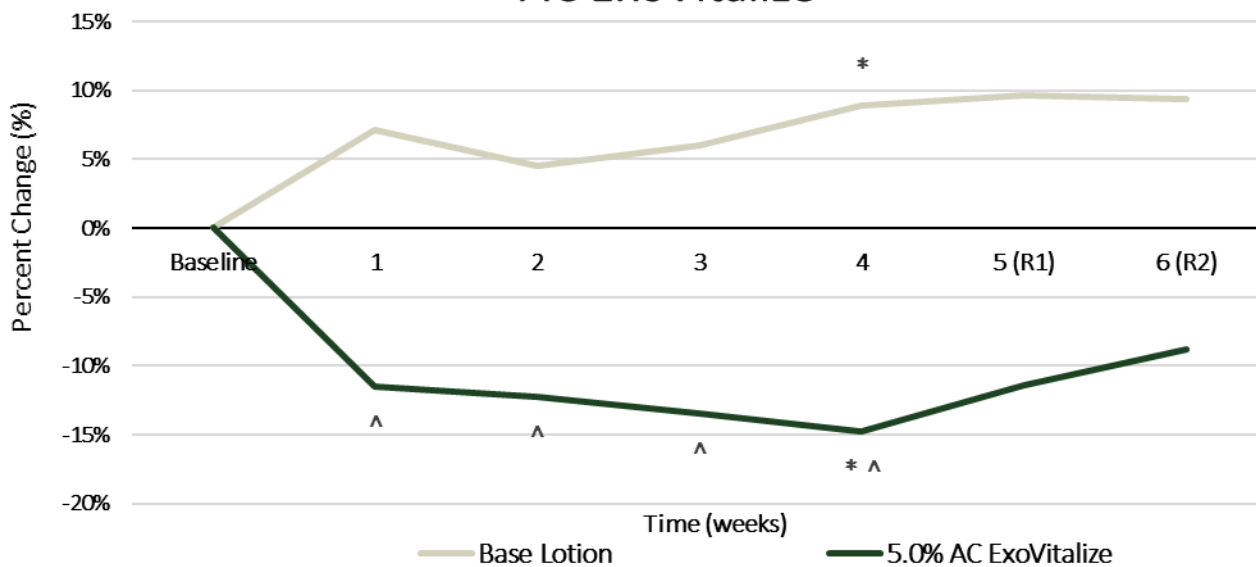


Figure 4. Average Percent Change in Undereye Histogram Intensity from Baseline. R1 and R2 indicate regression weeks with no application. * indicates significance ($p \leq 0.05$) compared to Baseline. ^ indicates significance ($p \leq 0.05$) between conditions within each timepoint.

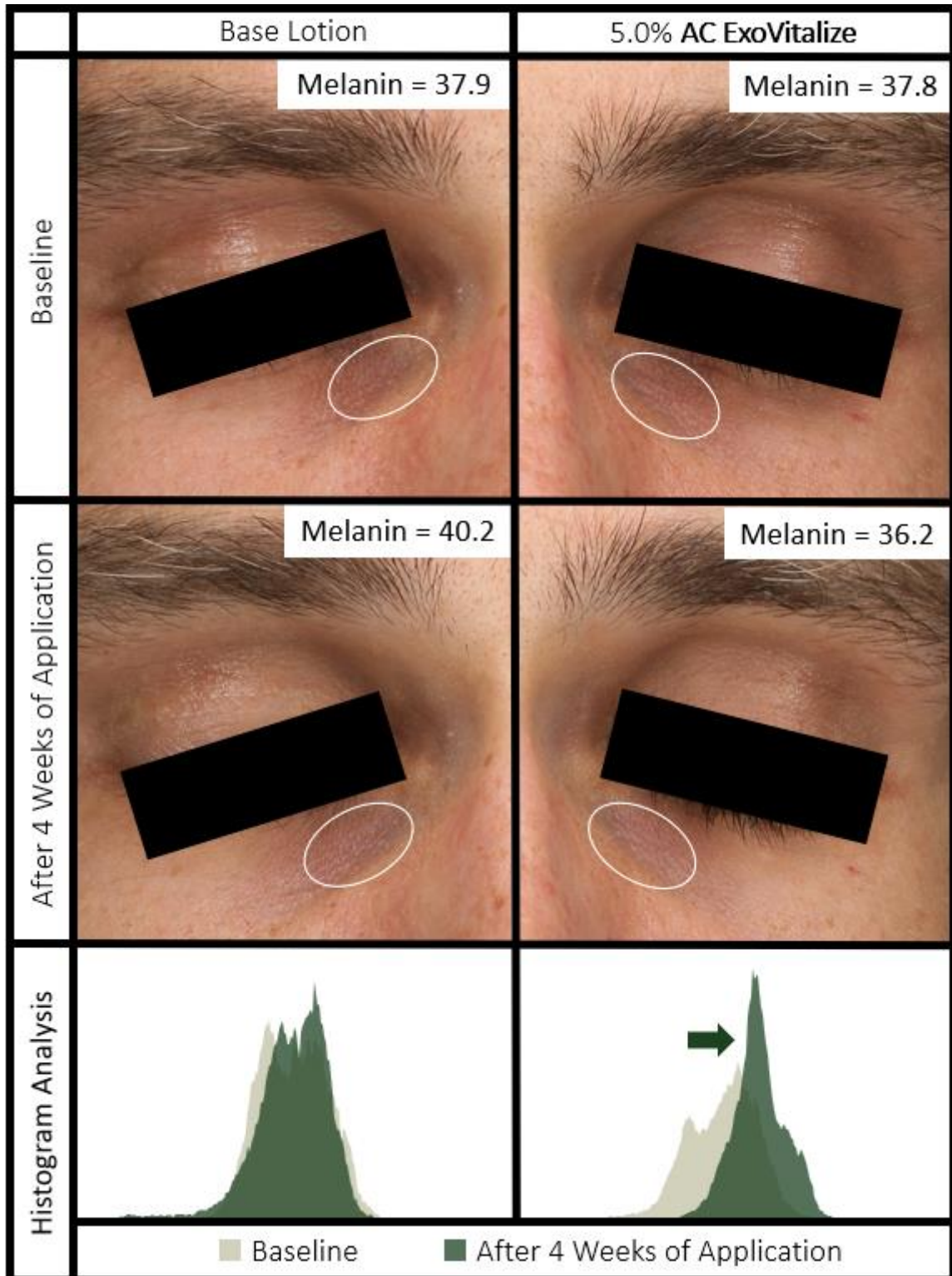


Figure 5. Representative VISIA images and histogram analysis of Participant 1 at baseline and after four weeks of application of the Base Lotion and 5.0% AC ExoVitalize. White circles indicate the area subjected to histogram analysis. The green arrow indicates a shift away from the darker end of the color spectrum.

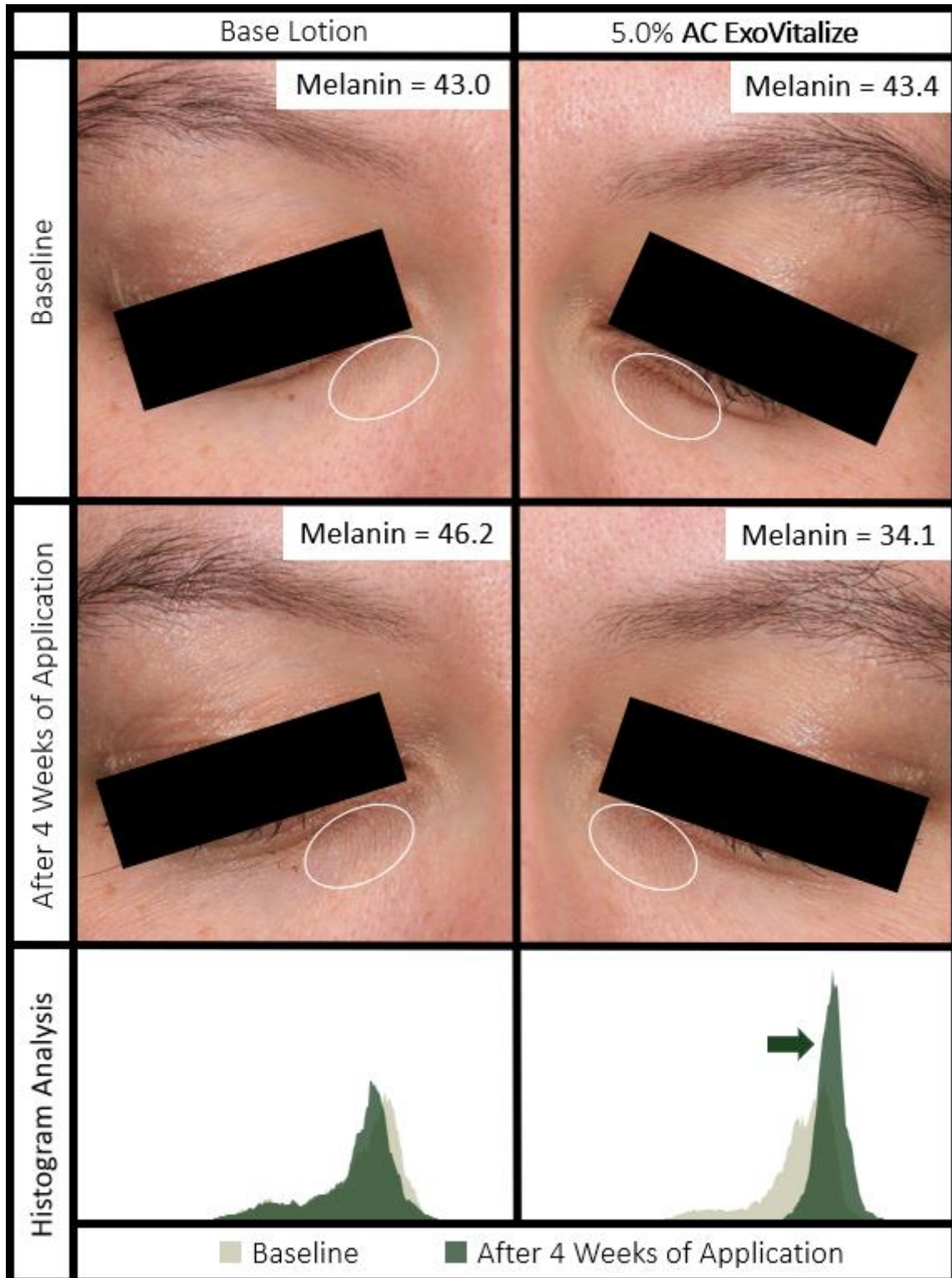


Figure 6. Representative VISIA images and histogram analysis of Participant 3 at baseline and after four weeks of application of the Base Lotion and 5.0% AC ExoVitalize. White circles indicate the area subjected to histogram analysis. The green arrow indicates a shift away from the darker end of the color spectrum.

Table 2. P-values from t-test Analyses of Change in Melanin from Baseline to After 4 Weeks of Application. * indicates significance ($p \leq 0.05$) compared to Baseline.

	Baseline vs After 4 Weeks of Application
Base Lotion	0.002*
5.0% AC ExoVitalize	0.003*

Table 3. T-test Analysis of Change in Melanin between Base Lotion and 5.0% AC ExoVitalize After 4 Weeks of Application. ^ indicates significance ($p \leq 0.05$) between conditions within each timepoint.

	After 1 Week	After 2 Weeks	After 3 Weeks	After 4 Weeks
P-value	0.004^	< 0.001^	< 0.001^	< 0.001^

Table 4. P-values from t-test Analyses of Change in Dark Circle Intensity from Baseline to After 4 Weeks of Application. * indicates significance ($p \leq 0.05$) compared to Baseline.

	Baseline vs After 4 Weeks of Application
Base Lotion	0.019*
5.0% AC ExoVitalize	0.036*

Table 5. T-test Analysis of Change in Dark Circle Intensity between Base Lotion and 5.0% AC ExoVitalize After 4 Weeks of Application. ^ indicates significance ($p \leq 0.05$) between conditions within each timepoint.

	After 1 Week	After 2 Weeks	After 3 Weeks	After 4 Weeks
P-value	0.024^	< 0.009^	< 0.020^	< 0.029^

Discussion

As evidenced in this six-week study, **AC ExoVitalize** significantly reduces skin pigmentation and improves the color of dark circles under the eyes. After four weeks, participants applying 5.0% **AC ExoVitalize** demonstrated a decrease of 13% in skin pigmentation and a decrease of 15% in undereye dark circle intensity when compared to the baseline readings (Figures 1, 2, 3, 4; Tables 2 and 4). By comparison, base lotion application elicited an increase of 17% in skin pigmentation and an increase of 9% in undereye dark circle intensity after the four-week period (Figures 1, 2, 3, 4; Tables 3 and 5). Visually, **AC ExoVitalize** effectively reduced undereye skin pigmentation and discoloration than the base lotion after 4 weeks of daily application (Figures 5, 6).

After the four-week application period ended, skin pigmentation and dark circle intensity under the eyes receiving **AC ExoVitalize** continued to outperform the base lotion during the regression period. After two weeks of regression, participants who had applied 5.0% **AC ExoVitalize** still maintained an 8% reduction in skin pigmentation and a 9% reduction in undereye dark circle intensity compared to baseline measurements (Figures 1, 2, 3, 4). Conversely, base lotion treatment sites continued to elicit increased skin pigmentation by 18% and undereye dark circle intensity by 9% compared to baseline measurements (Figures 1, 2, 3, 4). These results indicate that after the four-week treatment period ended, participants who had applied 5.0% **AC ExoVitalize** maintained the benefits of decreased skin pigmentation and undereye discoloration, compared to baseline, suggesting a lasting effect.

Collectively, we demonstrate applying **AC ExoVitalize** for four weeks to the undereye area improves the appearance of dark circles and undereye discoloration through a reduction in skin pigmentation and dark circle intensity. In conclusion, utilizing **AC ExoVitalize** at the recommended use levels provides a more youthful appearance by reducing the visual consequences of undereye dark circles and discoloration.

References

1. Sharma AN, Patel BC. Laser Fitzpatrick Skin Type Recommendations. [Updated 2022 Mar 9]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK557626/>