Enhanced Skin Delivery via UV Dye

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Tradename: AC ExoRoot

Code: 60202

CAS #: 7732-18-5 & 91079-57-1 (or) 223749-83-5 & 123465-35-0 (or) 8002-43-5 & 68333-16-4 (or) 1686112-36-6 (or) 9015-54-7

Test Request Form #: 14386

Lot #: N250520B

Sponsor: *Active Concepts, LLC; 107 Technology Drive Lincolnton, NC 28092*
Study Director: *Daniel Shill*
Principal Investigator: *Kayla Goodson*

Test Performed:
Enhanced Skin Delivery via UV Dye

Introduction

The skin's ability to regenerate, repair, and maintain homeostasis is influenced by intercellular communication and the delivery of bioactive molecules to deeper layers. Exosomes—nanosized extracellular vesicles secreted by cells—play a critical role in mediating this communication by transporting proteins, lipids, and nucleic acids that regulate cellular activity. When effectively delivered into the skin, exosomes can contribute to improved elasticity, barrier function, and overall skin vitality. In contrast, limited Delivery reduces their biological efficacy, diminishing potential benefits for skin rejuvenation and repair. Therefore, enhancing exosome Delivery in cosmetic formulations offers a promising strategy to promote healthier, more youthful-looking skin through targeted cellular communication and regeneration.

Accordingly, a UV Dye Skin Delivery Study was conducted to evaluate the skin delivery of **AC ExoRoot** over time on the skin.

Study Principle

Test materials were applied to a defined area on each participant's cheek using a makeup sponge and standardized template (Image 1). Measurements were recorded at baseline, as well as one, four, and eight hours after application. Facial photographs were captured with the VISIA® Complexion Analysis System under UV light and subsequently analyzed using ImageJ software. The fluorescence intensity observed under UV light corresponds to the concentration of exosomes remaining on the skin surface. Over time, a decrease in surface fluorescence indicates that the fluorescent signal is no longer confined to the stratum corneum, suggesting increased absorption into the skin. Thus, lower fluorescence intensity values reflect greater exosome delivery, while sustained surface fluorescence suggests limited absorption and primarily superficial localization. This analytical approach allows for quantitative comparison of Skin Delivery properties between the test material and Base Lotion as pilot studies demonstrated the UV dye does not fade over time with exposure to ambient light when not incorporated into a lotion.

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Materials

A. **Equipment:** VISIA Complexion Analysis System (Canfield Scientific., Fairfield, NJ, USA)
B. **Products**: Base Lotion (Cetaphil® Moisturizing Cream for All Skin Types)
C. **Software:** ImageJ (National Institutes of Health (NIH)); Excel Analysis ToolPak (Microsoft)

Methods

5 volunteers between the ages of 24 and 35, who were known to be free of any skin pathologies with Fitzpatrick skin types I to III, participated in this study (Table 1).

Table 1. The Fitzpatrick Classification of Skin Types Chart[1]

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	

A predetermined test site was identified on the cheek of participants and initial photographs (no product) were taken. Following initial photographs, the principal investigator applied 0.2 g of each treatment to the test site using a makeup sponge and standardized template. VISIA images were obtained immediately after application (Baseline) and one, four, and eight hours after test material application. Participants limited their exposure to UV light throughout the duration of the study. The skin test site conditions and treatments are described below (Table 2). A special lot of **AC ExoRoot** was prepared with a fluorescent probe integrated into the lipid bilayer of the exosomes to visualize their skin Delivery behavior. This labeled version was incorporated into the Base Lotion at an equivalent concentration of 2.0% **AC ExoRoot**, enabling qualitative tracking of exosome-associated fluorescence over time. The Base Lotion utilized in this study was Cetaphil® Moisturizing Cream for All Skin Types.

Table 2. Descriptions of the Conditions and Treatments for each Skin Test Site

Skin Test Site	Condition	Treatment / Test Article Application Description
1	Base Lotion	Base Lotion
2	2.0% **AC ExoRoot**	2.0% **AC ExoRoot** in Base Lotion

Photographs were obtained using the VISIA Complexion Analysis System (Canfield Scientific., Fairfield, NJ, USA). The VISIA System ensured consistent positioning of each participant's head while images were obtained. The photographic images were captured with ultraviolet light. Images taken by the VISIA System were exported and analyzed using ImageJ software (NIH) to assess color intensity of the UV Dye present on the skin. 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.

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All data are displayed as averages and t-test analyses were performed with statistical significance accepted at $p \leq 0.05$. Percent change is expressed relative to Baseline values and calculated by the following equation:

$$Percent\ Change\ (\%) = \frac{Intensity_{Measurement\ Time} - Intensity_{Baseline}}{Intensity_{Baseline}}\ x\ 100$$

Results

The data obtained met criteria for a valid study. As expected, Base Lotion slightly decreased UV dye intensity. However, application of 2.0% **AC ExoRoot** once in an eight-hour period demonstrated effective skin delivery by reducing UV dye intensity to a greater extent than Base Lotion at all time points.

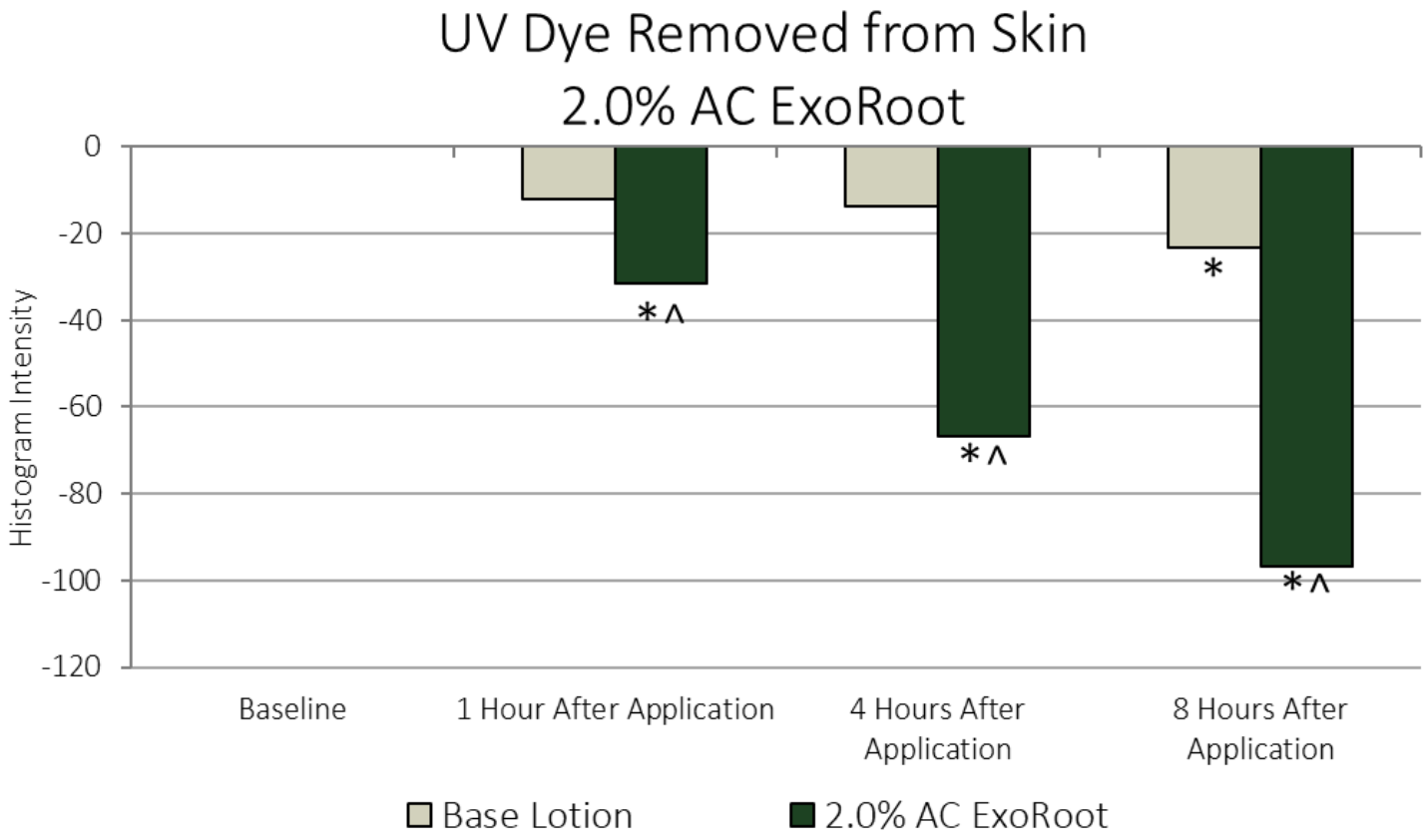

Figure 1. UV Dye Removed from Skin Overtime. * indicates significance ($p \leq 0.05$) compared to Baseline (Immediately After Application). ^ indicates significance ($p \leq 0.05$) compared to Base Lotion within the same timepoint.

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Table 3. P-values from t-test analyses of Intensity across time and between conditions. * indicates significance ($p \leq 0.05$) compared to Baseline (Immediately After Application). ^ indicates significance ($p \leq 0.05$) compared to Base Lotion within the same timepoint.

	Baseline	1 Hour After Application	4 Hours After Application	8 Hours After Application
Base Lotion	---	> 0.05	> 0.05	< 0.05*
2.0% **AC ExoRoot**	---	< 0.05*	< 0.05*	< 0.05*
Base Lotion vs 2.0% **AC ExoRoot**	> 0.05	< 0.05^	< 0.05^	< 0.05^

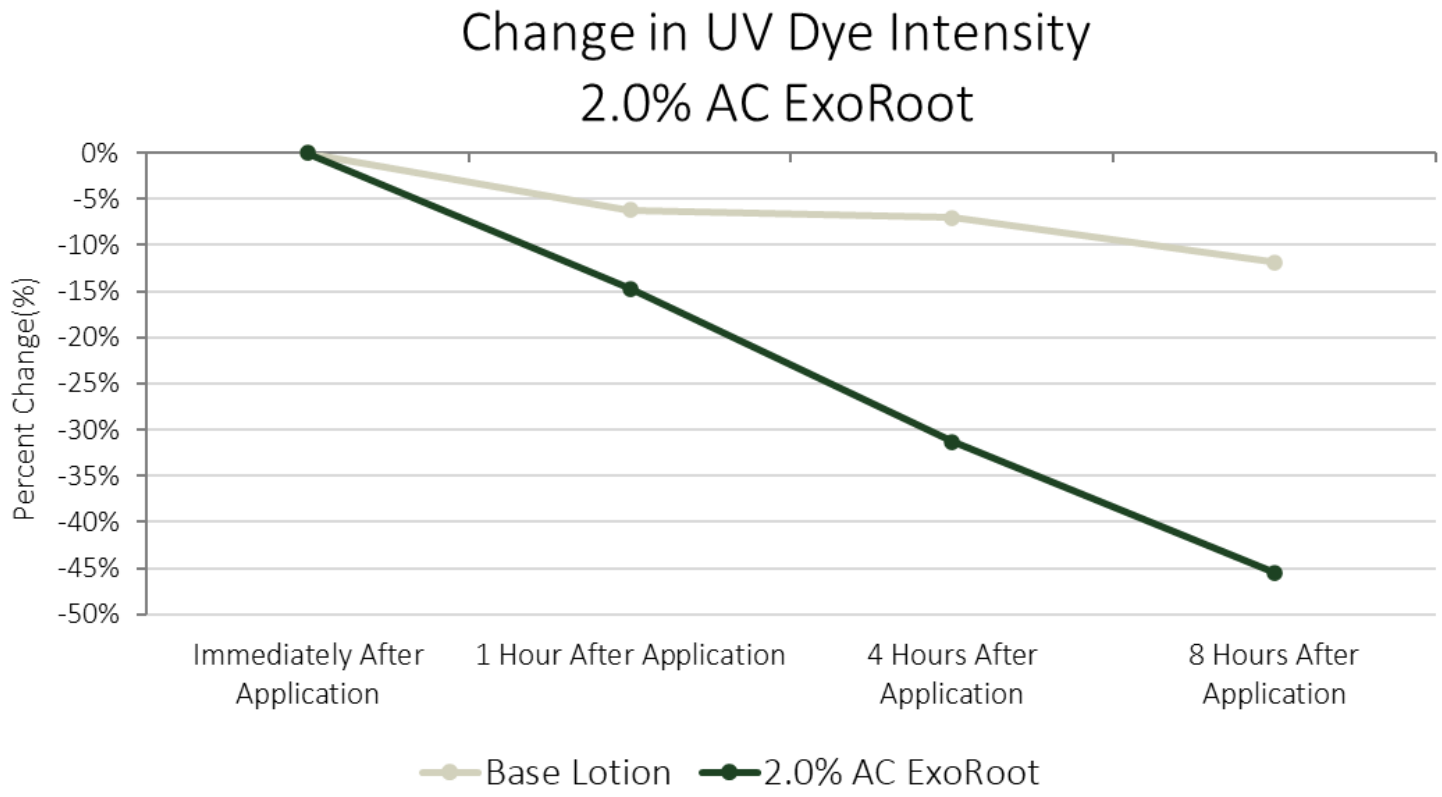

Figure 2. Percent Change in UV Dye Intensity Overtime.

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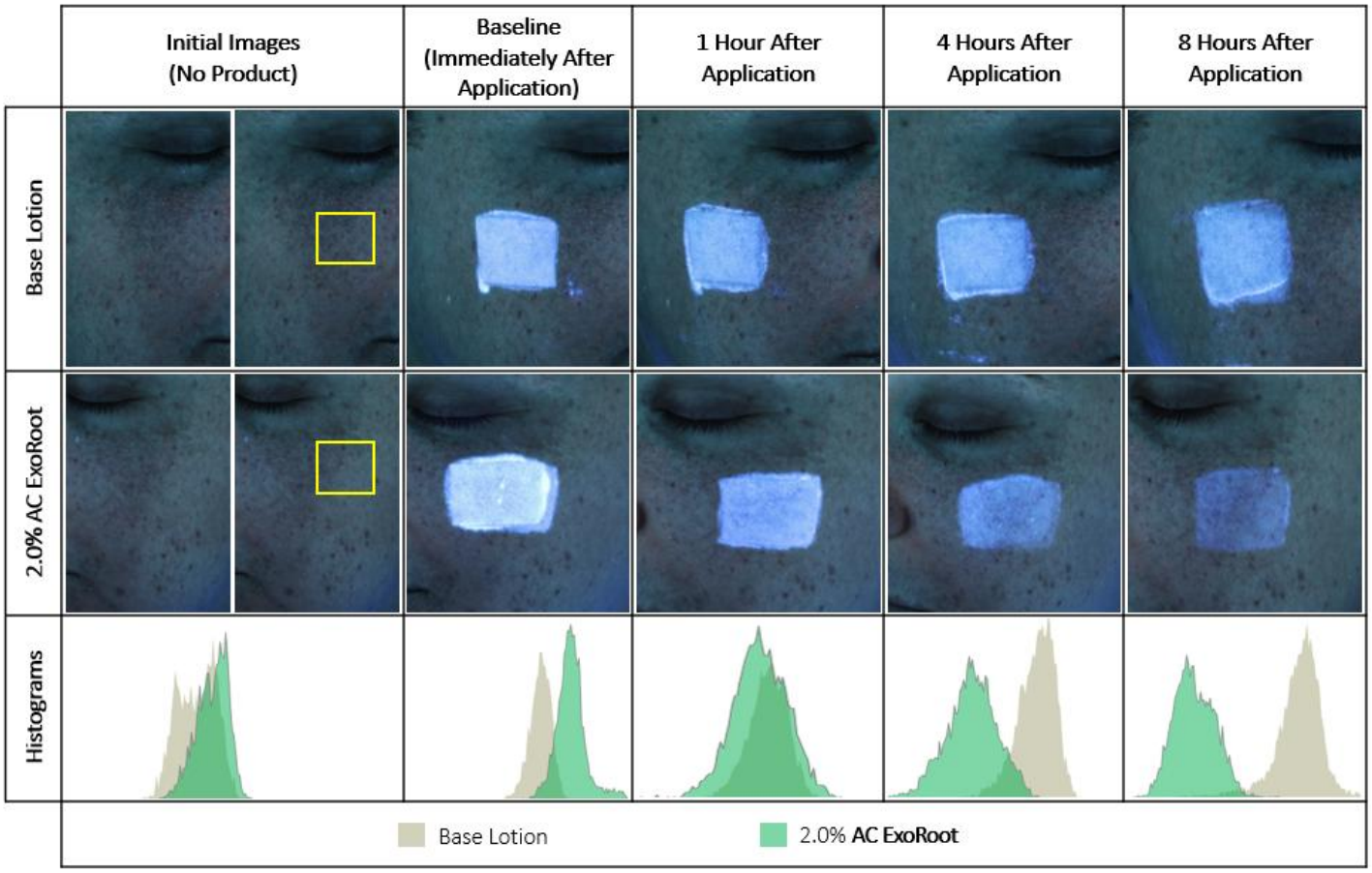

Image 1. VISIA UV Dye Participant Images and Intensity Histograms at All Timepoints.

Discussion

The ability of **AC ExoRoot** to enhance delivery on skin was assessed via VISIA Images captured in UV light after one initial application. As shown in Figure 1, Base Lotion slightly reduced the intensity of UV dye present on the skin eight hours after application, indicating Base Lotion exhibits marginal skin delivery (Figures 1 and 2; Table 3). Conversely, application of 2.0% **AC ExoRoot** resulted in a 67% and 97% reduction in UV dye intensity four hours and eight hours after application, respectively (Figures 1 and 2; Table 3). These results demonstrate **AC ExoRoot** exhibits robust exosome delivery properties on the skin with just one application.

Similar results are shown when comparing the Base Lotion and 2.0% **AC ExoRoot** over time. 2.0% **AC ExoRoot** displayed a greater reduction in UV dye intensity four and eight hours after application compared to the Base Lotion (Figures 1 and 2; Table 3). Visually, UV dye intensity is drastically reduced after application of 2.0% **AC ExoRoot** compared to Base Lotion (Image 1). These results demonstrate **AC ExoRoot** enhances exosome delivery properties on the skin.

Taken together, these results indicate **AC ExoRoot** augments exosome delivery properties when added to personal care applications at recommended use levels. Importantly, participants limited UV light exposure during the study to avoid potential interference with measurements. Collectively, **AC ExoRoot** demonstrates enhanced exosome delivery properties which promotes more youthful-looking skin through the targeted delivery of actives to facilitate cellular communication.

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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/