

Tradename: AC ExoEternal

Code: 60200

CAS #: 7732-18-5 & 68333-16-4 (or) 92128-79-5 & 90082-61-4 (or) 68132-21-8 & 123465-35-0

Test Request Form #: 14437

Lot #: 9420611

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

Study Director: Daniel Shill

Principal Investigator: Kayla Goodson

Test Performed:

High Resolution Ultrasound Skin-Imaging Study

Introduction

Collagen is the most abundant protein found in the skin and other areas of the body. Collagen connects other tissues to bone, muscles, tendons, cartilage, and skin. Within the skin, collagen aids in the youthful appearance by providing an anchor point. With age, collagen naturally decreases and results in sagging, wrinkles, and fine lines, which can be accelerated by excessive sun exposure. Collagen encourages the top layer of skin to regenerate which in return keeps skin looking healthy and youthful.

Accordingly, a High-Resolution Ultrasound Skin Imaging Study was conducted to assess the ability of **AC ExoEternal** + 0.1% Retinol to improve the Dermal Age-Band, Dermal Collagen Thickness, and Collagen Fiber Density. Additionally, Retinol and a blend of 2.0% **AC ExoEternal** + 0.1% Retinol were tested to elucidate any synergistic effects and to demonstrate the superior nature of bioauthentic exosomes as a delivery system.

Study Principle

Participants applied specific products to designated areas on their forearms twice a day for four weeks. Ultrasound measurements were collected once a week during the four-week study period. Ultrasound skin imaging is based on measuring reflections of an emitted acoustic pulse that are transmitted into the skin. After processing the reflected signals, a cross-sectional image is generated based on the intensity of the reflected signals (Figure 1).

The signal intensity is converted to a color scale with dark colors representing areas of low reflection. This means that there are no changes or very small changes in density between the structures in the skin. Bright colors represent areas with strong reflections, indicating substantial changes in density between structures. The epidermis is characterized by a high intensity white/yellow color while the dermis is a mixture of colors at varying intensities.

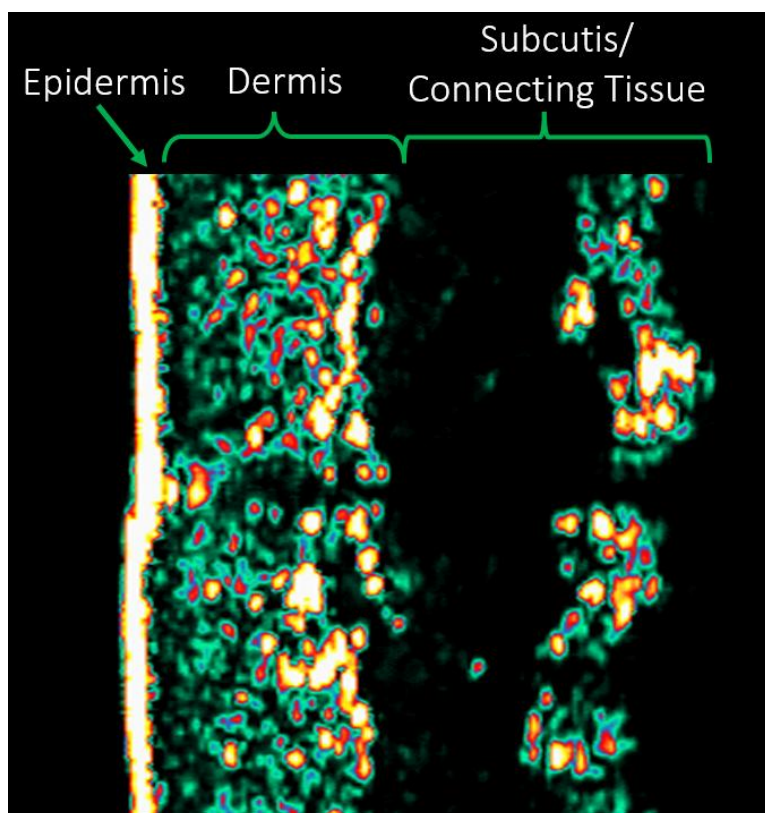


Figure 1. Representative Ultrasound Image with Measurement Areas

Materials

- A. **Equipment:** Dermalab Skin Combo (Ultrasound Probe)
- B. **Products:** Base Lotion (Cetaphil® Moisturizing Cream for All Skin Types); Retinol (Lot #: 25372061)
- C. **Software:** Excel Analysis ToolPak (Microsoft)

Methods

20 volunteers between the ages of 25 and 46, who were known to be free of any skin pathologies with Fitzpatrick skin types I to IV, participated in this study (Table 1).

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	

Five randomly assigned test sites were identified on the volar forearm of participants and baseline measurements were recorded. Following baseline measurements, participants applied 0.2 g of each test material on their volar forearms twice a day for four weeks. Measurements were recorded once a week for four weeks. The skin test site conditions and treatments are described below (Table 2). 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	Untreated Control	None
2	Base Lotion	Base Lotion
3	0.3% Retinol	0.3% Retinol in Base Lotion
4	2.0% AC ExoEternal	2.0% AC ExoEternal in Base Lotion
5	2.0% AC ExoEternal + 0.1% Retinol	2.0% AC ExoEternal + 0.1% Retinol in Base Lotion

The DermaLab Skin Combo Ultrasound Probe analyzes three distinct parameters: Low Echogenic Band (LEB), Skin Thickness, and Intensity. LEB, also known as the Dermal Age-Band, represents the area just behind the epidermis, with higher values indicative of aging and photo damage. Skin Thickness (Dermal Collagen Thickness) measures the area behind the epidermis to the back of the dermis, with lower values correlating with age and less collagen. Intensity (Collagen Fiber Density) is an indicator of the amount of collagen within the dermis, with greater intensities correlating with higher levels of collagen.

An average of three consecutive measurements for LEB (µm), Skin Thickness (µm), and Intensity (average) were recorded per condition at each time point. Data are displayed as averages from all volunteers and analyzed using t-tests with statistical significance accepted at $p \leq 0.05$. The percent change for Dermal Age-Band (LEB), Dermal Collagen Thickness (Skin Thickness), and Collagen Fiber Density (Intensity) measurements were calculated for each test site at every timepoint relative to baseline values, using the following equation:

$$\text{Percent Change (\%)} = \frac{\text{Measurement}_{\text{Week}} - \text{Measurement}_{\text{Baseline}}}{\text{Measurement}_{\text{Baseline}}} \times 100$$

Results

The data obtained met criteria for a valid study as the Untreated Control, Base Lotion, Retinol, and AC ExoEternal performed as anticipated. Application of 2.0% AC ExoEternal + 0.1% Retinol twice a day for four weeks demonstrated effective improvements in LEB, Skin Thickness, and Intensity throughout the study duration.

Dermal Age-Band AC ExoEternal

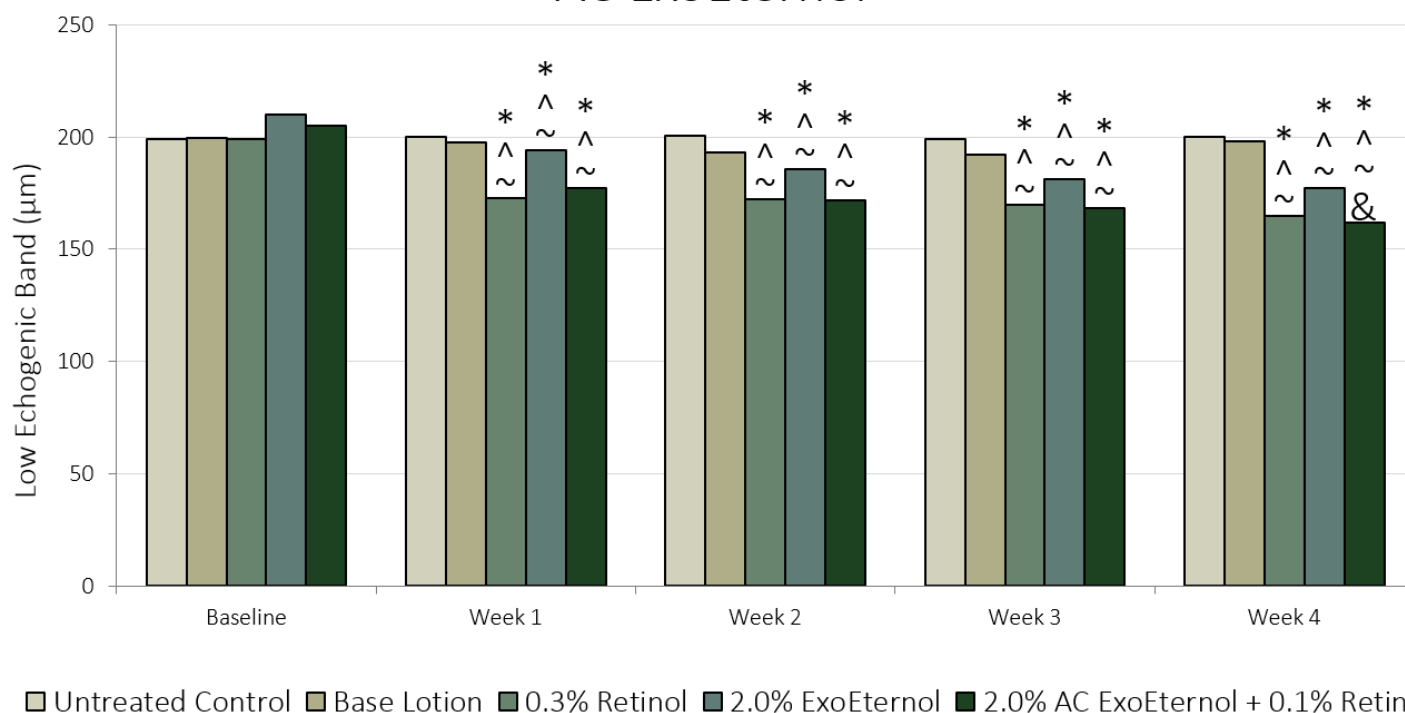


Figure 2. Dermal Age-Band Overtime. * indicates significance ($p \leq 0.05$) compared to Baseline values within the same condition. ^ indicates significance ($p \leq 0.05$) compared to Untreated Control within the same timepoint. ~ indicates significance ($p \leq 0.05$) compared to Base Lotion within the same timepoint. & indicate significance ($p \leq 0.05$) compared to 0.3% Retinol.

Table 3. T-test Analysis of Age-Band from Baseline to After Four Weeks of Application. * indicates significance ($p \leq 0.05$) compared to Baseline values within the same condition.

	Untreated Control	Base Lotion	0.3% Retinol	2.0% AC ExoEternal	2.0% AC ExoEternal + 0.1% Retinol
P-value	0.980	0.958	0.021*	0.002*	0.004*

Table 4. T-test Analysis of Age-Band After Four Weeks of Application. ^ indicates significance ($p \leq 0.05$) compared to Untreated Control within the same timepoint. ~ indicates significance ($p \leq 0.05$) compared to Base Lotion within the same timepoint. & indicate significance ($p \leq 0.05$) compared to 0.3% Retinol.

4 Weeks After Application	Untreated Control vs Base Lotion	Untreated Control vs 0.3% Retinol	Untreated Control vs 2.0% AC ExoEternal	Untreated Control vs 2.0% AC ExoEternal + 0.1% Retinol	Base Lotion vs 0.3% Retinol
	0.952	0.038^	0.045^	0.035^	0.048~
	Base Lotion vs 2.0% AC ExoEternal	Base Lotion vs 2.0% AC ExoEternal + 0.1% Retinol	0.3% Retinol vs 2.0% AC ExoEternal	0.3% Retinol vs 2.0% AC ExoEternal + 0.1% Retinol	2.0% AC ExoEternal vs 2.0% AC ExoEternal + 0.1% Retinol
	0.042~	0.017~	0.058	0.042&	0.049

Change in Dermal Age-Band AC ExoEternal

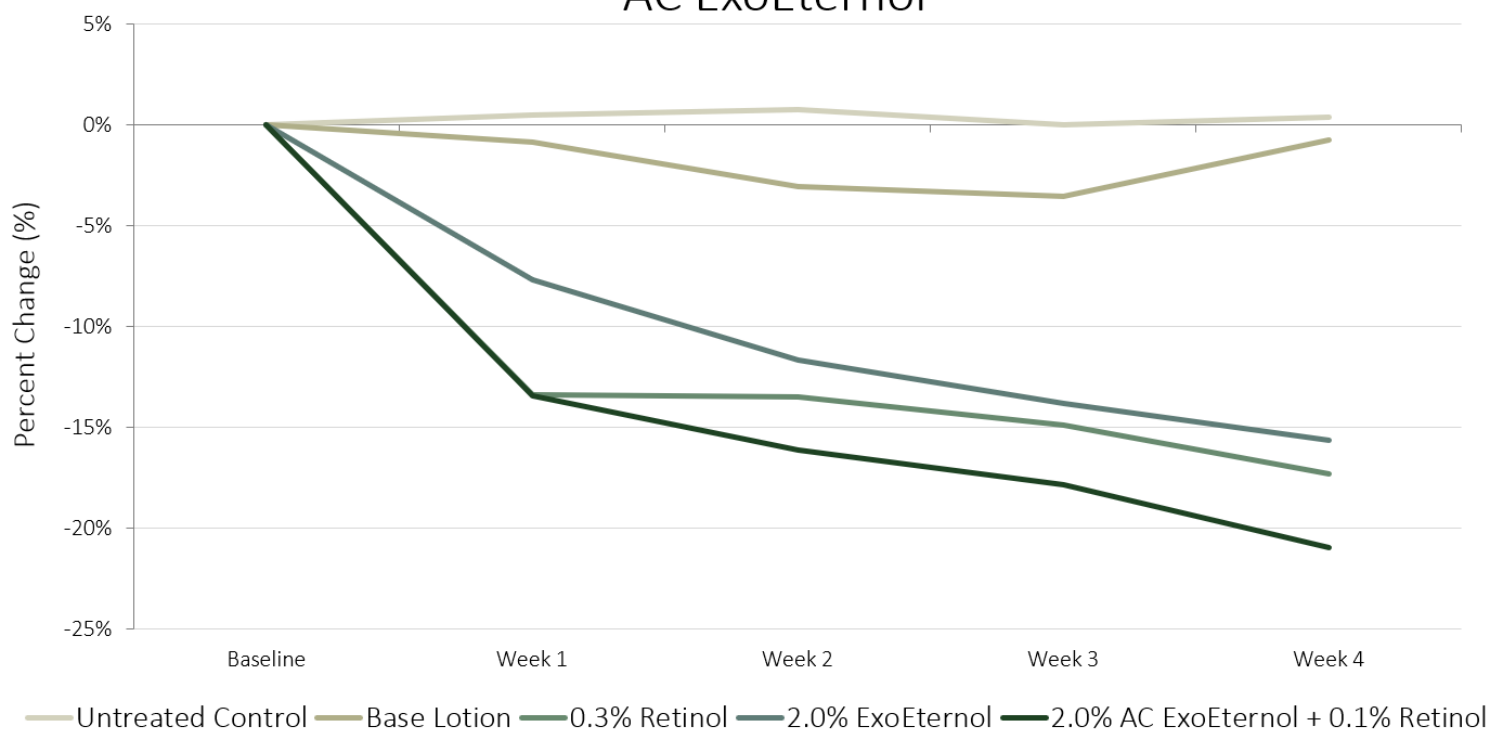


Figure 3. Percent Change in Dermal Age-Band Relative to Baseline Values

Dermal Collagen Thickness AC ExoEternal

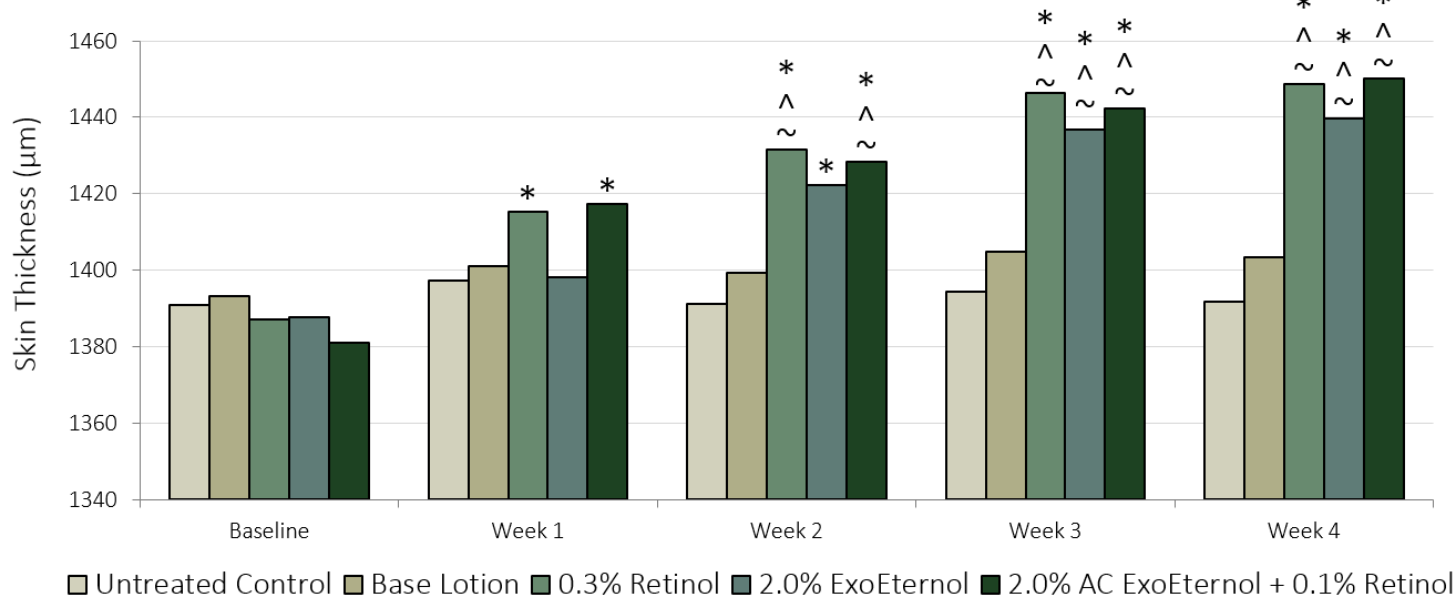


Figure 4. Dermal Collagen Thickness Overtime. * indicates significance ($p \leq 0.05$) compared to Baseline values within the same condition. ^ indicates significance ($p \leq 0.05$) compared to Untreated Control within the same timepoint. ~ indicates significance ($p \leq 0.05$) compared to Base Lotion within the same timepoint.

Table 5. T-test Analysis of Dermal Collagen Thickness from Baseline to After Four Weeks of Application. * indicates significance ($p \leq 0.05$) compared to Baseline values within the same condition.

	Untreated Control	Base Lotion	0.3% Retinol	2.0% AC ExoEternal	2.0% AC ExoEternal + 0.1% Retinol
P-value	0.974	0.728	0.005*	0.001*	0.001*

Table 6. T-test Analysis of Dermal Collagen Thickness After Four Weeks of Application. ^ indicates significance ($p \leq 0.05$) compared to Untreated Control within the same timepoint. ~ indicates significance ($p \leq 0.05$) compared to Base Lotion within the same timepoint.

4 Weeks After Application	Untreated Control vs Base Lotion	Untreated Control vs 0.3% Retinol	Untreated Control vs 2.0% AC ExoEternal	Untreated Control vs 2.0% AC ExoEternal + 0.1% Retinol	Base Lotion vs 0.3% Retinol
	0.665	0.044^	0.003^	0.002^	0.042~
	Base Lotion vs 2.0% AC ExoEternal	Base Lotion vs 2.0% AC ExoEternal + 0.1% Retinol	0.3% Retinol vs 2.0% AC ExoEternal	0.3% Retinol vs 2.0% AC ExoEternal + 0.1% Retinol	2.0% AC ExoEternal vs 2.0% AC ExoEternal + 0.1% Retinol
	0.003~	0.003~	0.355	0.466	0.308

Change in Dermal Collagen Thickness AC ExoEternal

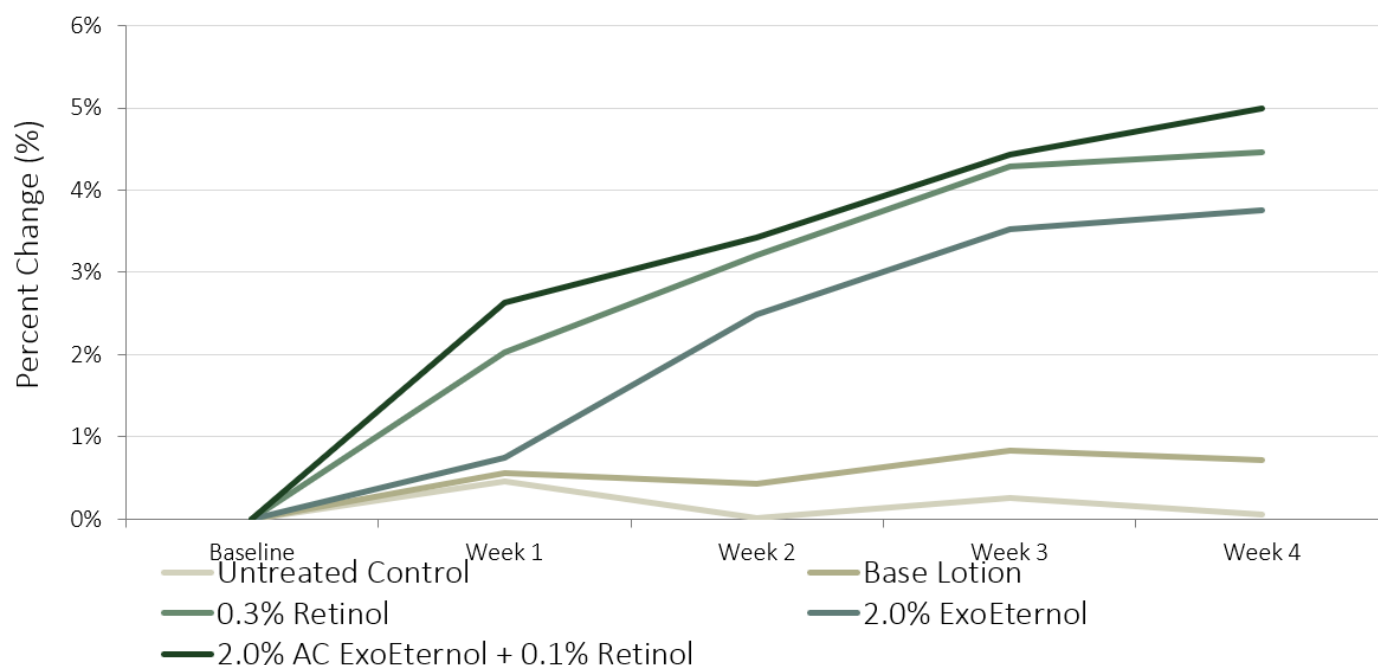


Figure 5. Percent Change in Dermal Collagen Thickness Relative to Baseline Values

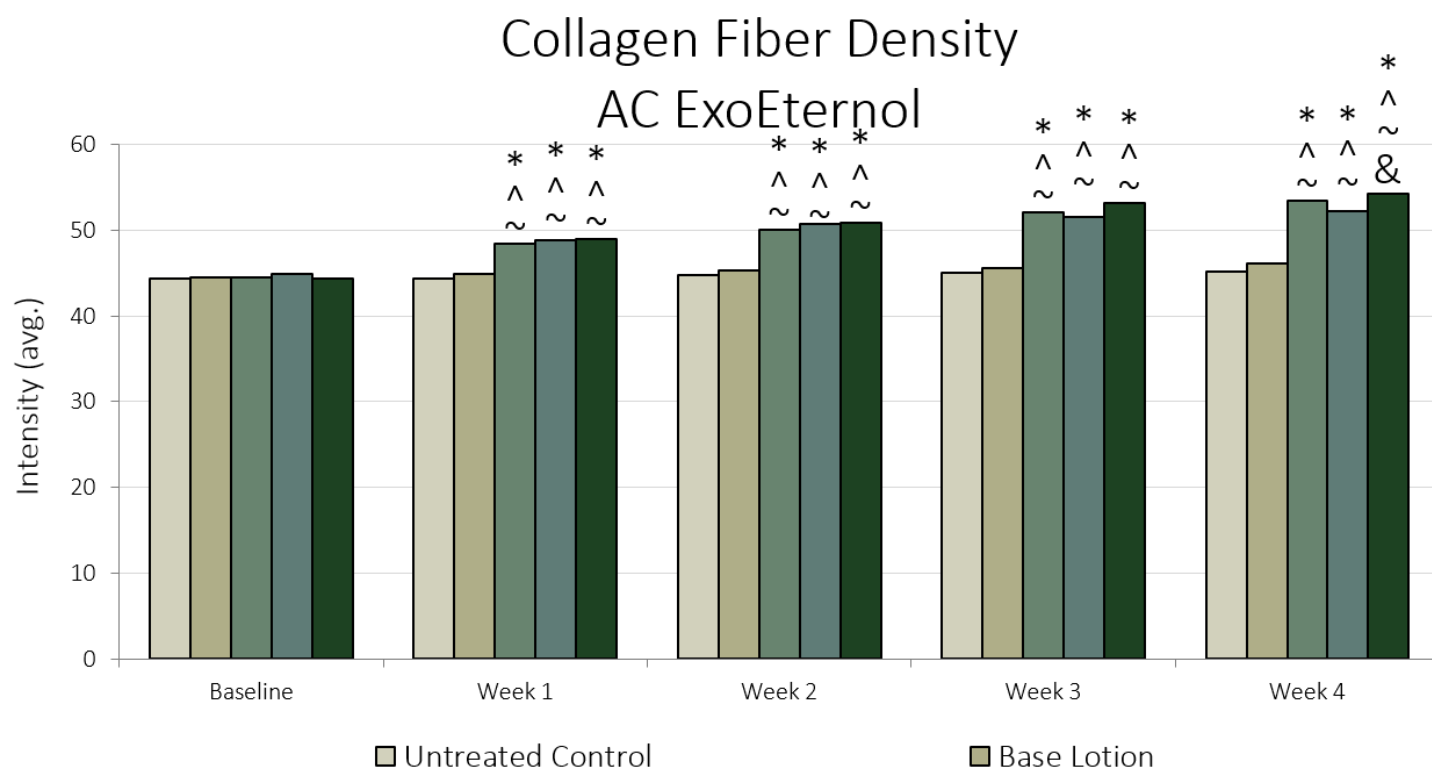


Figure 6. Collagen Fiber Density Overtime. * indicates significance ($p \leq 0.05$) compared to Baseline values within the same condition. ^ indicates significance ($p \leq 0.05$) compared to Untreated Control within the same timepoint. ~ indicates significance ($p \leq 0.05$) compared to Base Lotion within the same timepoint. & indicates significance ($p \leq 0.05$) compared to 0.3% Retinol within the same timepoint.

Table 7. T-test Analysis of Collagen Fiber Density from Baseline to After Four Weeks of Application. * indicates significance ($p \leq 0.05$) compared to Baseline values within the same condition.

	Untreated Control	Base Lotion	0.3% Retinol	2.0% AC ExoEternal	2.0% AC ExoEternal + 0.1% Retinol
P-value	0.637	0.510	0.003*	0.015*	0.002*

Table 8. T-test Analysis of Collagen Fiber Density After Four Weeks of Application. ^ indicates significance ($p \leq 0.05$) compared to Untreated Control within the same timepoint. ~ indicates significance ($p \leq 0.05$) compared to Base Lotion within the same timepoint. & indicates significance ($p \leq 0.05$) compared to 0.3% Retinol within the same timepoint.

4 Weeks After Application	Untreated Control vs Base Lotion	Untreated Control vs 0.3% Retinol	Untreated Control vs 2.0% AC ExoEternal	Untreated Control vs 2.0% AC ExoEternal + 0.1% Retinol	Base Lotion vs 0.3% Retinol
	0.723	0.012^	0.017^	0.005^	0.036~
	Base Lotion vs 2.0% AC ExoEternal	Base Lotion vs 2.0% AC ExoEternal + 0.1% Retinol	0.3% Retinol vs 2.0% AC ExoEternal	0.3% Retinol vs 2.0% AC ExoEternal + 0.1% Retinol	2.0% AC ExoEternal vs 2.0% AC ExoEternal + 0.1% Retinol
	0.017~	0.010~	0.085	0.048&	0.048

Change in Collagen Fiber Density AC ExoEternal

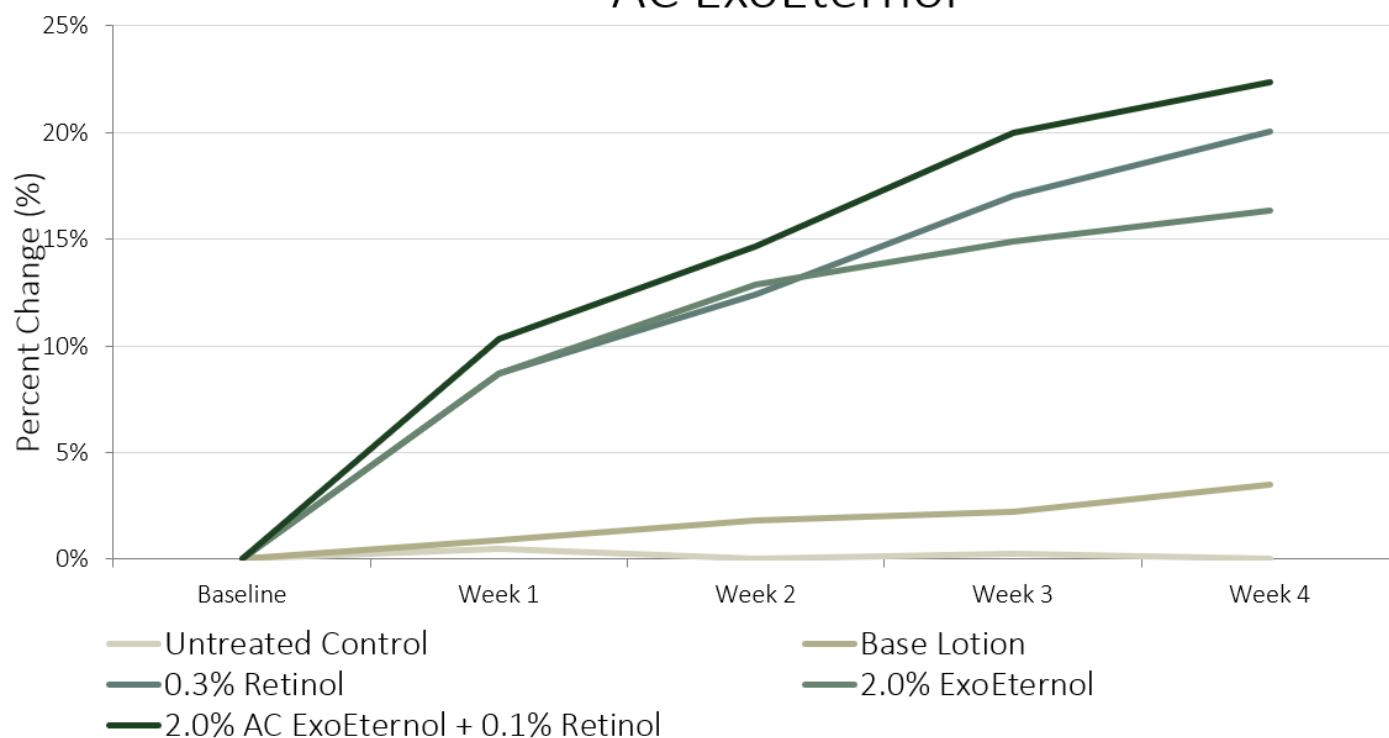


Figure 7. Percent Change in Collagen Fiber Density Relative to Baseline Values

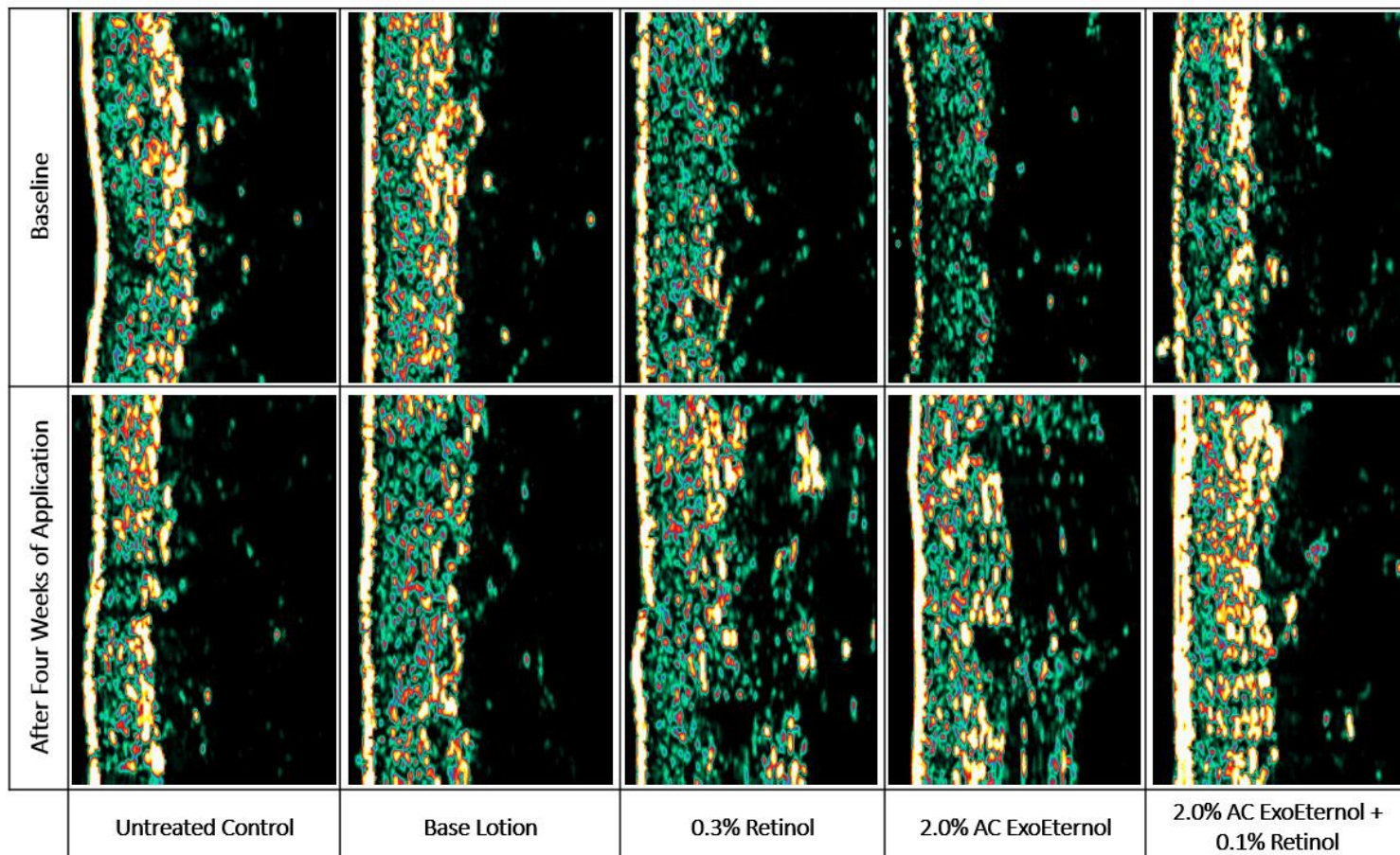


Image 1. Participant Ultrasound Images of Each Test Site at Baseline (Top) and After Four Weeks (Bottom).

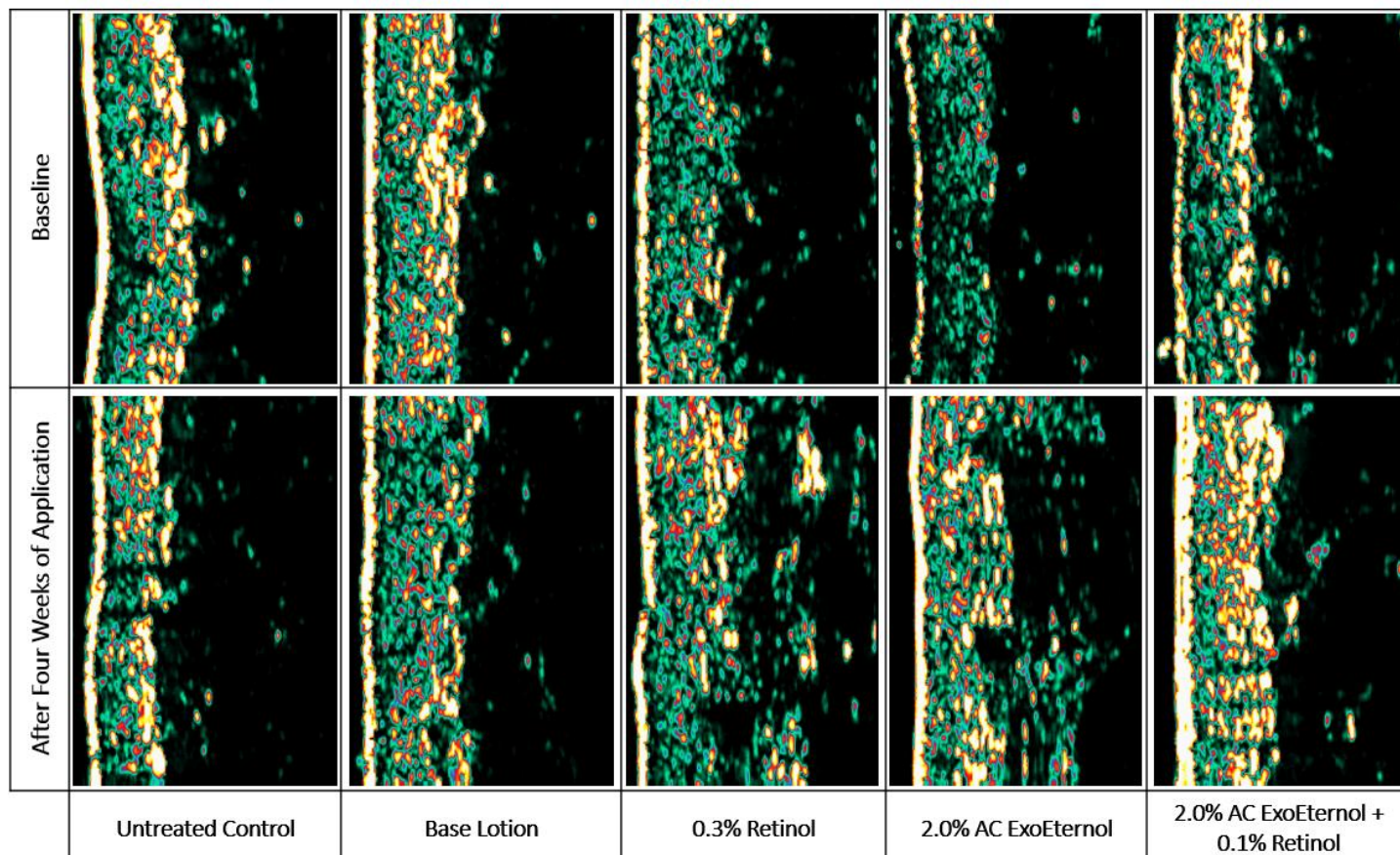


Image 2. Participant Ultrasound Images of Each Test Site at Baseline (Top) and After Four Weeks (Bottom).

Discussion

The ability of **AC ExoEternal** + 0.1% Retinol to improve the Dermal Age-Band, Dermal Collagen Thickness, and Collagen Fiber Density was assessed via ultrasound measurements throughout four weeks of twice daily application.

As shown in Figures 2 and 3, Dermal Age-Band values did not significantly change throughout the study with the Untreated and Base Lotion Test Sites, indicating consistent skin aging throughout the study (Figures 2, 3; Table 3). Conversely, applying 0.3% Retinol and 2.0% **AC ExoEternal** reduced the Dermal Age-Band by 17% and 16% after four weeks of application, respectively (Figures 2, 3; Table 3). Moreover, applying 2.0% **AC ExoEternal** + 0.1% Retinol twice daily significantly reduced Dermal Age-Band values by 21% after four weeks of application (Figures 2, 3; Table 3). There were no differences in Dermal Age-Band values between the Untreated Control and Base Lotion four weeks after application indicating repeated applications of the Base Lotion did not alter the Dermal Age-Band (Figure 2; Table 4). Conversely, applying 2.0% **AC ExoEternal** + 0.1% Retinol twice daily demonstrated a significant reduction in the Dermal Age-Band compared to the Untreated Control, Base Lotion, and 0.3% Retinol after four weeks (Figure 2; Table 4). These results demonstrate the synergistic effect of **AC ExoEternal** + 0.1% Retinol to reduce Dermal Age-Band and improve the visual impacts of photo damage and normal aging.

Similarly, Dermal Collagen Thickness was not significantly changed throughout the study with the Untreated and Base Lotion Test Sites, indicating consistent skin thickness throughout the study (Figures 4, 5; Table 5). However, twice daily application of 0.3% Retinol and 2.0% **AC ExoEternal** significantly augmented Dermal Collagen Thickness by 4.5% and 3.8% after four weeks of application, respectively (Figures 4, 5; Table 5). Moreover, application of 2.0% **AC ExoEternal** + 0.1% Retinol for four weeks significantly improved Dermal Collagen Thickness by 5% (Figures 4, 5; Table 5). Additionally, there was no difference in Dermal Collagen Thickness between the Untreated Control and Base Lotion four weeks after application indicating repeated applications of the Base Lotion did not alter Dermal Collagen Thickness (Figure 4; Table 6). Conversely, applying 2.0% **AC ExoEternal** + 0.1% Retinol twice daily demonstrated a significant increase in Dermal Collagen Thickness compared to the Untreated Control and Base Lotion after four weeks (Figure 4; Table 6). These results indicate **AC ExoEternal** + 0.1% Retinol augments dermal collagen production, to a greater degree than Retinol and **AC ExoEternal** alone, resulting in a more youthful skin appearance.

Additionally, Collagen Fiber Density was not significantly altered throughout the study with the Untreated and Base Lotion Test Sites, indicating consistent collagen density throughout the study (Figures 6, 7; Table 7). However, Collagen Fiber Density significantly increased by 20% and 16% after four weeks of 0.3% Retinol and 2.0% **AC ExoEternal** application, respectively (Figures 6, 7; Table 7). Moreover, Collagen Fiber Density was significantly augmented by 22% after four weeks of 2.0% **AC ExoEternal** + 0.1% Retinol application (Figures 6, 7; Table 7). After four weeks of application, there was no difference in Collagen Fiber Density between the Untreated Control and Base Lotion, indicating repeated applications of the Base Lotion did not alter Collagen Fiber Density (Figure 6; Table 8). Conversely, applying 2.0% **AC ExoEternal** + 0.1% Retinol twice daily demonstrated a significant increase in Collagen Fiber Density compared to the Untreated Control, Base Lotion, and 0.3% Retinol after four weeks (Figure 6; Table 8). Images 1 and 2 visually demonstrate the improvements in Dermal Age-Band, Dermal Collagen Thickness, and Collagen Fiber Density through High Resolution Ultrasound images. These results demonstrate the synergistic effects of 2.0% **AC ExoEternal** + 0.1% Retinol application by improving collagen density and reducing the visual impacts of normal aging.

Taken together, these results indicate **AC ExoEternal** + 0.1% Retinol improves normal skin aging, collagen thickness, and collagen density when added to personal care applications at recommended use levels. Collectively, **AC ExoEternal** + 0.1% Retinol demonstrated significant synergistic effects by improving normal skin aging through augmenting collagen production and density resulting in a healthier and more youthful skin appearance.

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/>