Journal of Cosmetics, Dermatological Sciences and Applications, 2025, 15(1), 1-23
https://www.scirp.org/journal/jcdsa
ISSN Online: 2161-4512
ISSN Print: 2161-4105

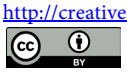
Skin Hydration Augmentation Following Solar Protective and Repair Skincare Regimen

Amaryllis Aganahi[1], Richard Parker[1], Yohei Tanaka[2]

[1]RATIONALE, Kyneton, Australia
[2]Clinica Tanaka Plastic, Reconstructive Surgery and Anti-Aging Center, Matsumoto, Japan
Email: info@clinicatanaka.jp

How to cite this paper: Aganahi, A., Parker, R. and Tanaka, Y. (2025) Skin Hydration Augmentation Following Solar Protective and Repair Skincare Regimen. *Journal of Cosmetics, Dermatological Sciences and Applications*, **15**, 1-23.
https://doi.org/10.4236/jcdsa.2025.151001

Received: December 12, 2024
Accepted: January 18, 2025
Published: January 21, 2025



Abstract

Background: Continuous hydration is one of the essential factors in maintaining skin health. Despite the knowledge that skin hydration is essential for all major skin protection and repair processes, and the widespread prevalence of moisturizers, skin dryness continues to present an ongoing problem to skin health, with solar skin damage being a major cause of surface dryness and deeper moisture loss. **Objective:** To evaluate the skin hydration effectiveness of a comprehensive skincare regimen embracing both daily solar protection from ultraviolet through to near-infrared radiation and nightly solar repair in Fitzpatrick skin types I to IV. **Materials and methods:** Multiple studies were performed on a 3-dimensional human skin model composed of keratinocytes and fibroblasts and *in-vivo* on patients with Fitzpatrick skin types from I to IV. Solar specific topical skincare formulations (The Essential Six, RATIONALE, Victoria, Australia) were assessed. *In-vivo* studies ran from 28 days to 12 weeks and multiple skin assessments have been performed before and after using the formulations. **Results:** The results presented in this paper confirm a potential link between increased skin hydration and radiance via a mechanism of preventing and repairing solar skin damage. By addressing both the prevention and repair of sun damage, increased levels of hydration as well as skin barrier function maintenance are observed to correlate to increased skin radiance. **Conclusion:** The results of this study indicate that the specific solar skincare formulations, focused on the daily solar protection and nightly repair of photodamage provide a safe and highly effective pathway to increased skin hydration and rejuvenation.

Keywords

Hydration, Photoprotection, Rejuvenation, Skin Hydration, Sunscreen

1. Introduction

The skin is a vital organ of the human body, providing essential functions such as hydration protection, sensation, and metabolism [1]. The barrier function of the skin is mostly secured by its outermost layer, the stratum corneum (SC), which consists of inanimate keratin-filled cells and corneocytes, embedded in a multilamellar lipid matrix [2]-[4].

As for most of the human body, water is a critical component to keep the skin and especially the SC, fully functional [5]. The process of supplying the skin with water is called cutaneous or skin hydration and can be measured objectively using a Corneometer as well as visual examination through detailed imagery. However, channeling water throughout the skin is not enough to maintain SC hydration. Once supplied, moisture must also be retained within the outermost layers of the skin with minimum loss through evaporation, commonly named Trans Epidermal Water Loss (TEWL). Maintaining optimal TEWL levels is correlated with two complexes responsible for the homeostasis of skin hydration: the Natural Moisturising Factor (NMF) composed of hygroscopic agents (e.g. lactates, urea, hyaluronic acid) and intercellular lipids composed of complex (e.g. ceramides) and free fatty acids (e.g. behenic acid) [5].

Regardless of age and skin type, insufficient skin hydration or dehydration can lead to dryness, shedding of the stratum corneum, a decrease in skin barrier function and inflammation [1]. Therefore, maintaining or improving skin hydration is critical in promoting optimal skin health [1].

Sun damage is a major cause of skin dehydration caused by ultraviolet, visible light and near-infrared radiation. Despite widespread sunscreen use globally, motivated by the desire to prevent skin damage, unwanted photoageing, including skin dryness and barrier disruption, solar radiation continues to pose a health threat worldwide [6]-[21]. Over 90% of solar radiation affecting the Earth consists of visible light (VL) and near-infrared (NIR), and intensive or ongoing exposure to VL and NIR, when combined with ultraviolet (UV), also contributes to tissue damage and photoageing [6]-[21]. It must be noted that standard sunscreen formulations filter only UV and will not prevent photoageing induced by VL and NIR [6]-[21].

Based on the fact that 80% of facial ageing is caused by the sun, the authors examined the concept proposed by Australian skincare company RATIONALE that a comprehensive approach to daily skincare embracing daily solar protection and nightly repair of photodamage incorporating topical immune boosters, antioxidants, UV + VL + NIR solar filters, barrier repair lipids, hydroxy acids, DNA repair enzymes and retinoids would enhance skin health and beauty through the prevention and rejuvenation of solar skin damage, including dehydration and barrier disruption. The authors evaluated the efficacy of The RATIONALE "Essential Six" formulations in achieving these objectives using objective digital facial surface analysis and skin hydration levels and evaporation.

2. Materials and Methods

2.1. Topical Formulations

The Essential Six (RATIONALE, Victoria, Australia) skincare formulations were used in this study. The Essential Six represents a comprehensive topical dermatologic approach to skin environmental protection and repair. Formulations 1, 2 and 3 are used every morning for solar and broader environmental protection, while formulations 4, 5 and 6 activate solar and environmental repair. The Essential Six has six individual "collections" of skincare products, targeting specific skin concerns (Table 1). Each collection is composed of multiple Formulations containing a common set of active ingredients focused on addressing specific skin conditions or concerns (Table 3), all designed to deliver a final result of enhanced skin radiance and luminosity. This paper will investigate the abilities of multiple formulations (identified in bold in Table 1) to provide skin hydration related to skin radiance as a stand-alone benefit within the skin care regimen (Table 2).

Table 1. Formulations per collection.

Solar Protection Formulations			**Solar Repair Formulations**		
#1 Resilience	#2 Vitality	#3 Brilliance	#4 Integrity	#5 Clarity	#6 Renewal
Targets skin immunity, calming and soothing	*Targets skin protection against oxidation, revitalizing*	*Targets skin protection against environmental damage including photodamage*	*Targets deep skin hydration, nourishment and barrier repair*	*Targets skin texture enhancement, evening skin tone and rebalancing pH*	*Targets skin cell renewal and rejuvenation*
#1 The Serum	**#2 The Serum**	**#3 The Tinted Serum SPF50+**	**#4 The Cleanser**	**#5 The Serum**	**#6 The Night Crème**
#1 The Hydragel	**#2 The Light Crème**	**#3 The Enriched Crème**	**#4 The Crème**	#5 The Milk Concentrate	**#6 The GelCrème**
#1 The Mask	#2 The Mask		#4 The PreCleanse Balm	#5 The GelCrème	
#1 The Crème	#2 The Hydragel		#4 The Balm	#5 The Mask	

a. See Appendix A: Detailed ingredients complexes per collection.

Table 2. Skincare regimens tested.

Regimen A		**Regimen B**	
Solar Protect (Morning)	**Solar Repair (Evening)**	**Solar Protect (Morning)**	**Solar Repair (Evening)**
#1 The Serum	#4 The Cleanser	#1 The Serum	#4 The Crème
#2 The Light Crème	#5 The Serum	#2 The Serum	#5 The Serum
#3 The Tinted Serum SPF50+	#6 The Night Crème	#3 The Tinted Serum SPF50+	#6 The Night Crème

Table 3. Active ingredients complexes per collection.

Solar Protection Collections			Solar Repair Collections		
#1 Resilience	**#2 Vitality**	**#3 Brilliance**	**#4 Integrity**	**#5 Clarity**	**#6 Renewal**
Vitamin B, E	Vitamin A, C, E	Vitamin B, E, D presursor	Vitamin C, E	Minerals, AHA, BHA, Piroctone Olamine	Vitamin A, E
Complex and Essential Fatty Acids	Complex and Essential Fatty Acids	Complex and Essential Fatty Acids	Complex and Essential Fatty Acids		Complex and Essential Fatty Acids
15 Amino Acids	15 Amino Acids	15 Amino Acids	15 Amino Acids	15 Amino Acids	15 Amino Acids
Minerals, Peptides, Ferments	Enzymes, Minerals, Protein	UV Filter, Protein, Acids, Minerals, Sugars, Extracts	Minerals, Peptides, Sugars		Extracts, Ferments, Minerals
Australian Botanicals Extracts and other plant extracts	Australian Botanicals Extracts and other plant extracts	Australian Botanicals Extracts and other plant extracts	Australian Botanicals Extracts and other plant extracts	Australian Botanicals Extracts and other plant extracts	Australian Botanicals Extracts and other plant extracts

See Appendix A: Detailed ingredients complexes per collection.

It must be noted that the active ingredient complexes for each collection are similar for each product of that collection. Products can be interchangeable, with the difference between formulations relating to delivery systems that address the dryness or oiliness of individual patients' skin.

2.2. Skin Model and Gene Expression

A standardized gene expression test method was performed using a Mattek EFT-400 (a commercially available in vitro 3-dimensional skin model). This test tissue contains both dermal fibroblast and epidermal keratinocytes. Tissue samples were stabilized prior to inoculation with 15 µL of TM (Test Materials). Four tissue samples were included for each treatment group. Post inoculation, tissue samples were incubated for 8 to 16 hours at 37˚C with 5% CO_2 and ~95% relative humidity. Following this, samples were washed to remove TM and re-incubated for 24 hours at 37˚C with 5% CO_2 and ~95% relative humidity. Sixteen to twenty-four hours later, gene expression was assessed using Genemarkers qPCR-based Standard Skin Panel which measures 107 target genes. At the conclusion of incubation, tissue samples were washed and each culture was placed in contact with RNAlater solution to prepare for RNA isolation (**Figure 1**).

2.3. *In-Vivo* Clinical Evaluation

Study Participants

The recruiting for each study was performed independently per product and

regimen. The inclusion and non-inclusion criteria are disclosed in Table 4(a) and Table 4(b).

When testing a formulation as a stand-alone, the participants were instructed to continue with their current skincare regimen, replacing either the morning or evening moisturizer with the test formulation. When assessing the *in-vivo* efficacy of a skincare regimen, the participants were required to substitute their original skincare routine for the new regimen.

For each *in-vivo* study, the participants were required to cleanse their skin with the prescribed cleanser in the evening and only with light water rinsing in the morning. This approach prevents stripping the skin of essential nutrients and lipids produced overnight.

Kinetics

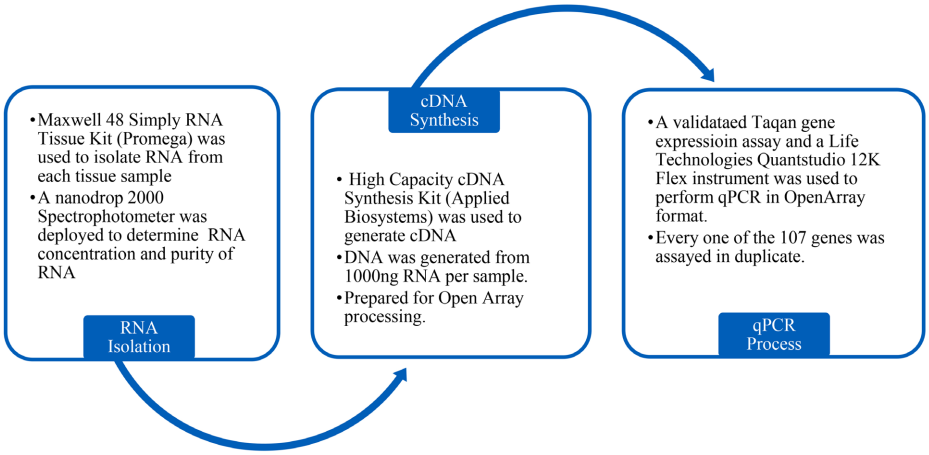


Figure 1. The process of Gene Expression from inoculated tissues to raw data generation. Following a qPCR process using a relative quantitation (RQ) method and converting any linear relative RQ values into linear fold-change values, statistical data analysis was obtained.

Table 4(a). Inclusion criteria.

Inclusion Criteria	Non-Inclusion Criteria
	• Female Specific—pregnant or nursing women or women planning to get pregnant during the study.
	• Cutaneous pathology on the study zone (eczema, etc.).
	• Subject with make-up on the day of the visit to the laboratory.
	• Use of topical or systemic treatment during the previous weeks is liable to interfere with the assessment of the cutaneous acceptability/efficacy of the study product
General	– change in anti-wrinkle, smoothing, firming and/or brightening topical products within previous week on the studied zones,
• Healthy subject.	– non-invasive procedures within previous month on the studied zones,
• Subject having given his/her free informed, written consent.	– intake of food supplements acting on skin within the three previous months,
• Subject willing to adhere to the protocol and study procedures.	– invasive procedures:
	+ deep chemical peeling within previous 3 months on the studied zones,
	+ mesotherapy, dermapen, laser within previous 6 months on the studied zones,
	+ botox and/or hyaluronic acid injections within previous 12 months in the studied zones.
	• Subject having undergone surgery under general anesthesia within the previous month.
	• Excessive exposure to sunlight or UV-rays within the previous month.
	• Subject enrolled in another clinical trial during the study period (affecting the studied zone).

Table 4(b). Specific inclusion criteria.

Specific Inclusion Criteria											
	#1 The Serum	#2 The Serum	#2 The Light Crème	#3 The Enriched Crème	#3 The Tinted Serum	#4 The Cleanser	#4 The Crème	#5 The Serum	#6 The Night Crème	#6 The Gel Crème	Regimen A
Number of Participants	22	19	21	20	20	22	19	21	21	21	30
Genders	Female	Female	Male + Female	Female	Male + Female	Male + Female	Female	Male + Female	Male + Female	Male + Female	Male + Female
Age Range	18 - 65	40 - 65	45 - 65	35 - 65	18 - 65	19 - 63	18 - 65	18 - 65	30 - 65	35 - 65	35 - 65
Phototypes	II - IV	II - III		I - IV	II - III	II - IV	II - IV	II - III	I - II	II - IV	I - II
Skin Types	Dry	Dry	Normal Dry Combination	Normal Dry			Dry	Normal Dry Combination	Normal Dry Combination	Dry	

Each formula was assessed for specific kinetics at day 0, 28 and/or 56. The skin-care regimen was conducted over 12 weeks, with intra-study assessments occurring at 2-, 6- and 12-week time points. Table 5(a) and Table 5(b) summarize each test performed on each formulation and assessed at different time points.

Table 5(a). Summary of test condition per product.

	Cutaneous Hydration		Self Assessment		VISIA Imagery	
	28 days	56 days	28 days	56 days	28 days	56 days
#1 The Serum	x	x	x	x	x	x
#2 The Serum	x	x	x	x	x	x
#2 The Light Crème	x	x	x	x	x	x
#3 The Tinted Serum SPF50+			x		x	
#3 The Enriched Crème		x		x	x	x
#4 The Cleanser			x		x	
#4 The Crème	x	x	x	x	x	x
#5 The Serum			x	x	x	x
#6 The Night Crème	x	x	x	x	x	x
#6 The GelCreme	x	x	x	x	x	x

Table 5(b). Summary of test condition per regimen.

		Gene Expression	Cutaneous Hydration			Subjective Assessment			Dermatologist Assessment			VISIA Imagery		
			2 w	6 w	12 w	2 w	6 w	12 w	2 w	6 w	12 w	2 w	6 w	12 w
Regimen A	Morning		x	x	x	x	x	x	x	x	x	x	x	x
	Evening		x	x	x	x	x	x	x	x	x	x	x	x
Regimen B	Morning	x												
	Evening	x												

3. Results

3.1. Gene Expression

Changes in gene expression for Regimen B are shown in Table 6. Out of 14 genes related to skin hydration and barrier function, 10 have shown significant change influencing potential improvement in terms of skin moisture retention and promoting elevated hydration levels.

Table 6. Gene expression linear fold change variations for Regimen B Solar Protection and Repair routines. Statistically significant linear fold change variations greater than 1.5 are shown in bold and are typically considered biologically relevant in the industry.

REGIMEN B							
		Morning		Evening		Skin Function	Results
Gene ID	Gene Name	Fold Change Variation	Variation %	Fold Change Variation	Variation %		
CLDN7	Claudin 7	4.88	388%	4.34	334%	Epidermal Barrier	Transmembrane protein coding gene, interacting with the tight junction proteins. Regulates cell to cell permeability and intercellular barrier integrity.
KRT1	Keratin 1	−5.41	−82%	−2.76	−64%	Epidermal Barrier	Early markers of cellular differentiation, they promote epidermal stability.
KRT10	Keratin 10	−3.91	−74%	−2.77	−64%	Epidermal Barrier	Reduction in their expression suggests low levels of oxidative stress and cellular regeneration.
LCE3D	Late Cornified Envelope 3D	1.91	91%	5.09	409%	Epidermal Barrier	Protein coding gene. Regulates keratinization and barrier repair.
OCLN	Occludin	1.37	37%	2.38	138%	Epidermal Barrier	Regulates intercellular communication and enhances epidermal barrier repair in response to environmental damage
TGM1	Transglutami—nase 1	1.19	19%	2.44	144%	Epidermal Barrier	Promotes epidermal barrier integrity
TIMP1	TIMP Metallopepti—dase Inhibitor 1	2.09	109%	2.38	138%	Extracellu—lar Matrix Integrity	Controls the effects of collagenase activity in the skin. When upregulated, it protects the skin from photo-ageing through maximising matrix integrity and preventing connective tissue degradation
AQP3	Aquaporin 3	1.14	14%	1.65	65%	Hydration	Protein is responsible for transporting water and glycerin through the epidermal barrier tight junctions, increasing hydration in the skin.
GBA	Glucosylcera—midase Beta	1.16	16%	1.96	96%	Hydration	This gene is responsible for the conversion of sphingolipids to ceramides in the matrix, which lock moisture beneath the barrier lipid layer.
SMPD1	Sphingomyel—inphosphod—iesterase 1	1.62	62%	2.05	105%	Hydration	Enzyme coding gene, responsible for the conversion of sphingomyelin into ceramides (lipids of the stratum corneum), plays an important role in retaining skin moisture.

The quantitative real-time PCR study identified that, in comparison to the control, the genes encoding for hydration protein markers Aquaporin 3 (AQP3), Glucosidase beta acid (GBA) and Acid sphingomyelinase (SMPD1) have been up-regulated following usage of the photoprotection formulations, 1.14, 1.16, and 1.62, respectively. Additionally, AQP3, GBA and SMPD1 were up-regulated following use of the photo-repair formulations, 1.65, 1.96, and 2.05, respectively (**Table 6**). These genes play a major role in skin hydration and associated processes.

AQP3 is the most abundant skin aquaporin that facilitates water and glycerin transport into the stratum corneum (SC) to help optimize hydration [22]. UV exposure, aging, and low temperatures are among those factors that affect skin ceramide composition, potentially leading to increased transepidermal water loss and negatively impacting skin hydration [23]. Vitamin C, collagen, and probiotics may increase ceramide production and improve endogenous skin moisturization [23]. The increased activity of AQP3 expression may indicate potent hydration ability and may be beneficial for overall skin health and rejuvenation.

GBA is responsible for the conversion of sphingolipids to ceramides in the intercellular lipid network which locks moisture beneath the barrier lipid matrix [24] [25]. The increased activity of GBA expression appears to be beneficial for skin moisturization.

SMPD1 is an enzyme active in the upper granular layer of the skin. It converts sphingomyelin into ceramides, the lipids present in the SC responsible for maintaining skin moisture and a healthy epidermal skin barrier [26] [27]. The increased activity of SMPD1 reinforces the skin's ability to retain moisture and maintain hydration and is thought to be associated with skin anti-ageing potential.

As described above, improving skin hydration alone is not enough to ensure optimal replenishment of water levels within the various skin layers. Preventing Trans Epidermal Water Loss is critical to maintain vital skin functions. Quantitative real-time PCR highlighted the activation of key genes encoding for proteins involved in maintaining a healthy skin barrier function: Claudin 7 (CLDN7), Late Cornified Envelope 3D (LCE3D) and TIMP Metallopeptidase Inhibitor 1 (TIMP1). Each of these genes was upregulated following the usage of the photoprotection skincare regimen by 4.88, 1.91 and 2.09, respectively and 4.34, 5.09 and 2.38 following the usage of the photo-repair skincare routine.

CLDN7 are transmembrane proteins playing a key role in cell-to-cell permeability and intercellular barrier integrity. They are found in all layers of the epidermis. They are found in all layers of the epidermis.

LCE3D are keratinization proteins and precursors of the stratum corneum cornified envelope impacting the quality of the skin barrier. It is a key component in the epidermal differentiation complex regulating epidermal barrier formation and integrity. LCE gene expression can be altered by exposure to UV radiation. Its up-regulation is critical in maintaining healthy skin and enhancing innate photoprotection mechanisms.

TIMP Metallopeptidase Inhibitor 1 (TIMP1) controls the effects of collagenase activity in the skin. This enzyme, when upregulated, is considered to be a marker

of enhanced matrix integrity in addition to protecting from the connective tissue degradation effects of increased MMPs related to photoaging.

3.2. Cutaneous Hydration

Cutaneous hydration (measured as skin water content) was measured with a Corneometer (**Figure 2**). Results were compared before and after (at different time points) using each product or skincare regimen for up to 12 weeks (approximately 84 days).

Each formula and skincare regimen resulted in a significant increase in skin hydration from 6 to 48%, with the peak being reached by the skincare regimen A [28].

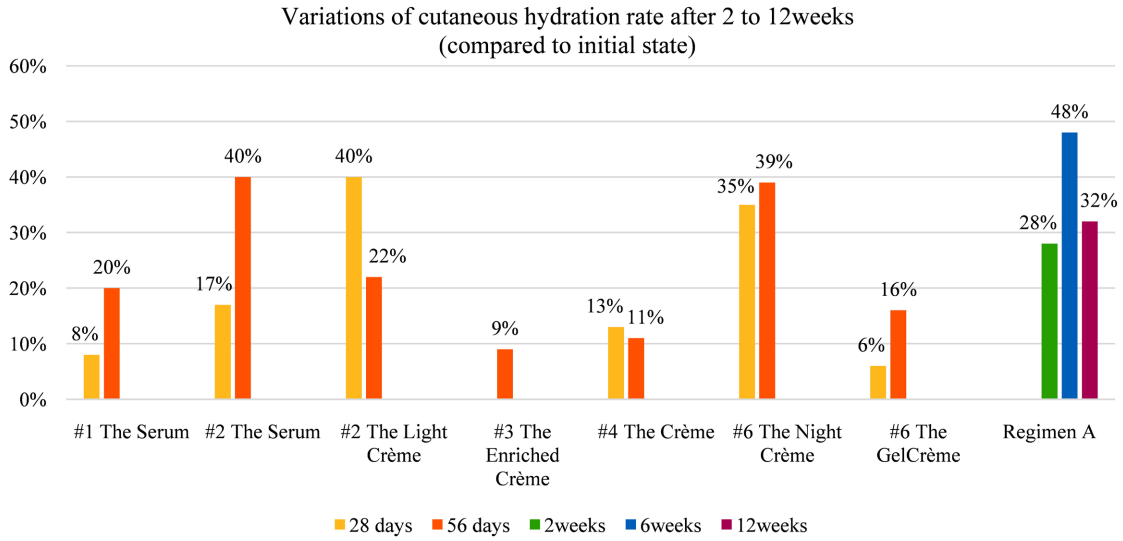


Figure 2. Variations of cutaneous hydration rate measured with a corneometer (in arbitrary units) after using individual Formulations for up to 12 weeks compared to baseline. A significant increase in hydration levels indicates enhanced moisturizing effect, no change in hydration levels indicates a baseline non-drying effect.

3.3. Dermatologist Assessment

Results collected from objective dermatology assessment on 30 participants using Regimen A have been collated and summarized in **Figure 3** [28].

The Dermatologist Investigator assessed skin radiance/brightness/luminosity, tactile roughness and visual roughness on a 5-point scale (from 0 = none to 4 = severe). The results confirmed that cutaneous radiance, tactile and visual roughness improved significantly, as graph data confirms.

3.4. Self Assessment Questionnaire

19 - 22 participants trialed one of the test formulations for 28 to 56 days. Upon completing the study, each participant was requested to complete a questionnaire about perceived efficacy of the formulation they trialed based on various criteria. Affirmations were proposed and patients were asked to rate their degree of agreement with the statement on a four-point scale from agree to disagree (**Figure 4**).

Where patients agreed or strongly agreed, the results were considered positive with an acceptance criteria of 71% of patients agreeing or strongly agreeing with the statement.

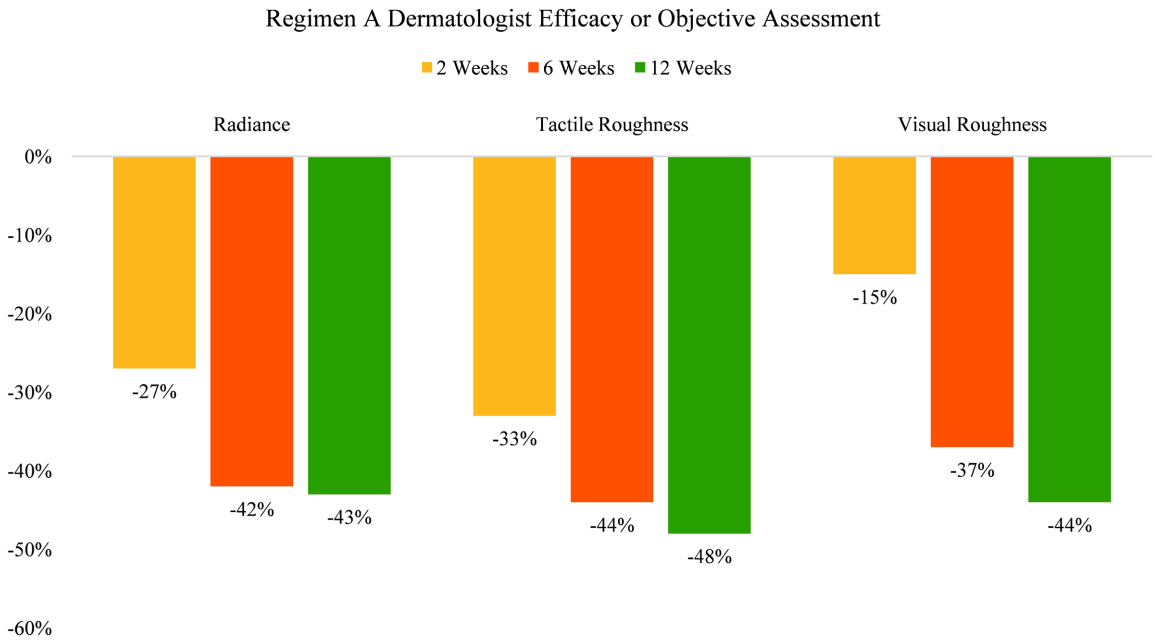


Figure 3. *In-vivo* variations (also referred to as mean % change from baseline) of cutaneous radiance and roughness (visual and tactile) measured by a dermatologist investigator after using Regimen A for up to 12 weeks compared to the baseline using a rating system. A significant decrease in rating percentage indicates an improvement in the cutaneous parameter.

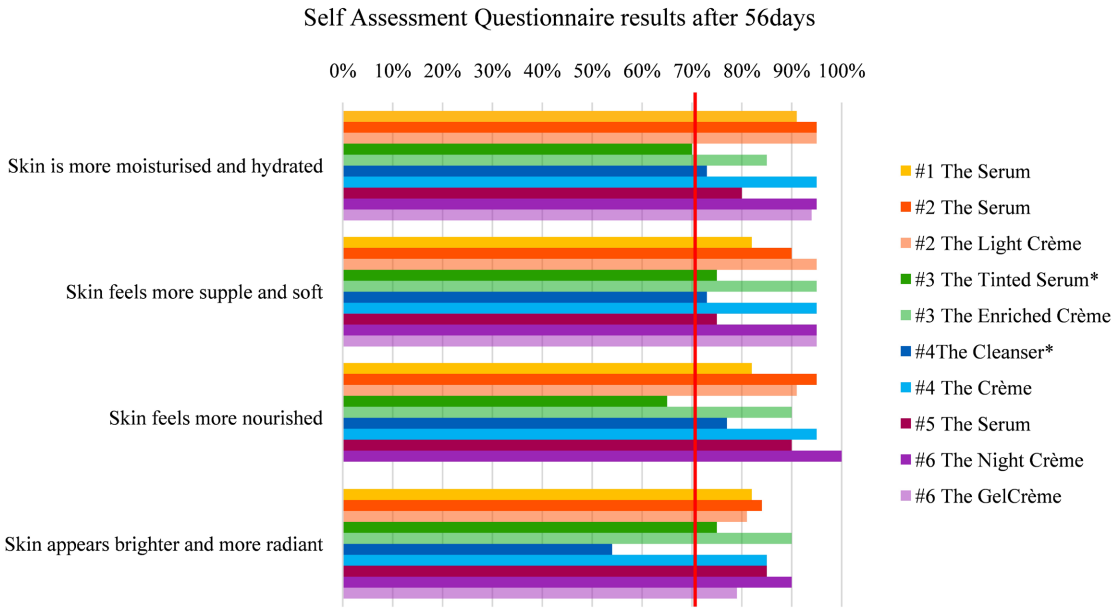


Figure 4. Results of self assessment questionnaire after 56 days of use on panels comprised of 19 - 22 participants. *Results were assessed after 28 days. **Not significant.

3.5. Regimen A Subjective Assessment

Results collected from the self-assessment or subjective assessment of 30 participants using Regimen A have been collated and summarized in **Figure 5** [28].

Participants assessed skin radiance/brightness/luminosity, tactile roughness and visual roughness on a 5-point scale (from 0 = none to 4 = severe). The results confirmed that participants noted a significant improvement ($p = or < 0.001$) in their cutaneous radiance and tactile roughness, while visual roughness improved significantly as demonstrated in the graph.

3.6. Canfield VISIA Images

Photographs of all patients were taken using the Visia CR 4.3 set up on standard lighting 1 and cross polarized light of the central, right, and left face. Only central face is presented in this paper (**Figure 6**). For each of the participants highlighted in this study, a clear reduction in redness can be observed and the participants skins appear more hydrated, radiant and plumped.

4. Discussion

The skin is an important, biologically active organ which provides protection against many environmental aggressors including UV radiation, heat, toxins, etc., by deploying a tight balance of water, lipids and proteins to enhance metabolic and physiological processes. A healthy Stratum Corneum (SC) constitutes a powerful barrier against external environmental challenges and ensures the skin remains adequately hydrated by maintaining optimum water levels within the cutaneous layers.

At the center of keeping the SC functional is a complex composed of endogenous hygroscopic molecules forming the Natural Moisturizing Factor (NMF), intercellular lipids, epidermal hyaluronic acid and endogenous glycerin [5].

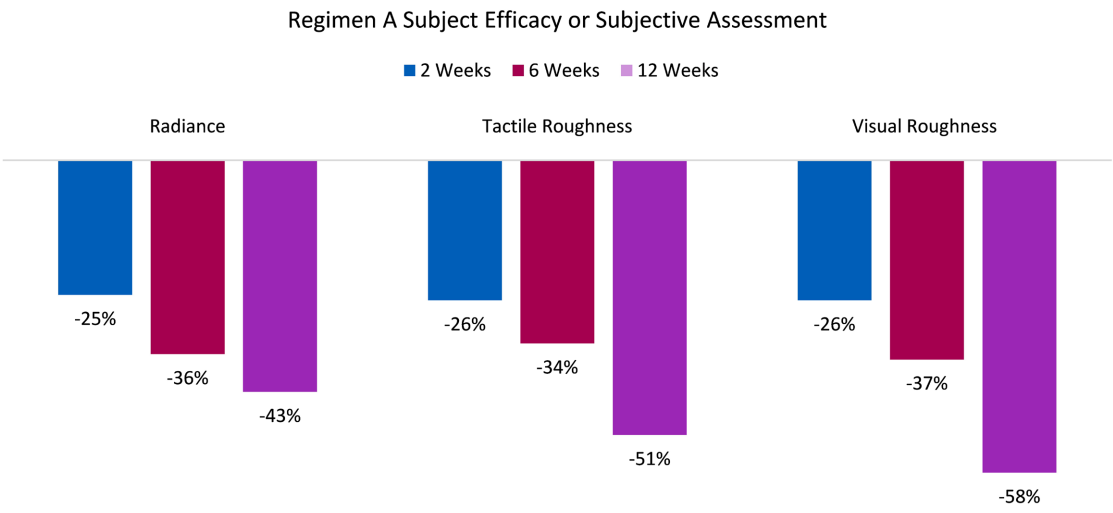


Figure 5. *In-vivo* variations of cutaneous radiance and roughness (visual and tactile) self rated by participants after using Regimen A for up to 12 weeks compared to baseline using a rating system. A significant decrease of rating indicates an improvement in the cutaneous parameter.

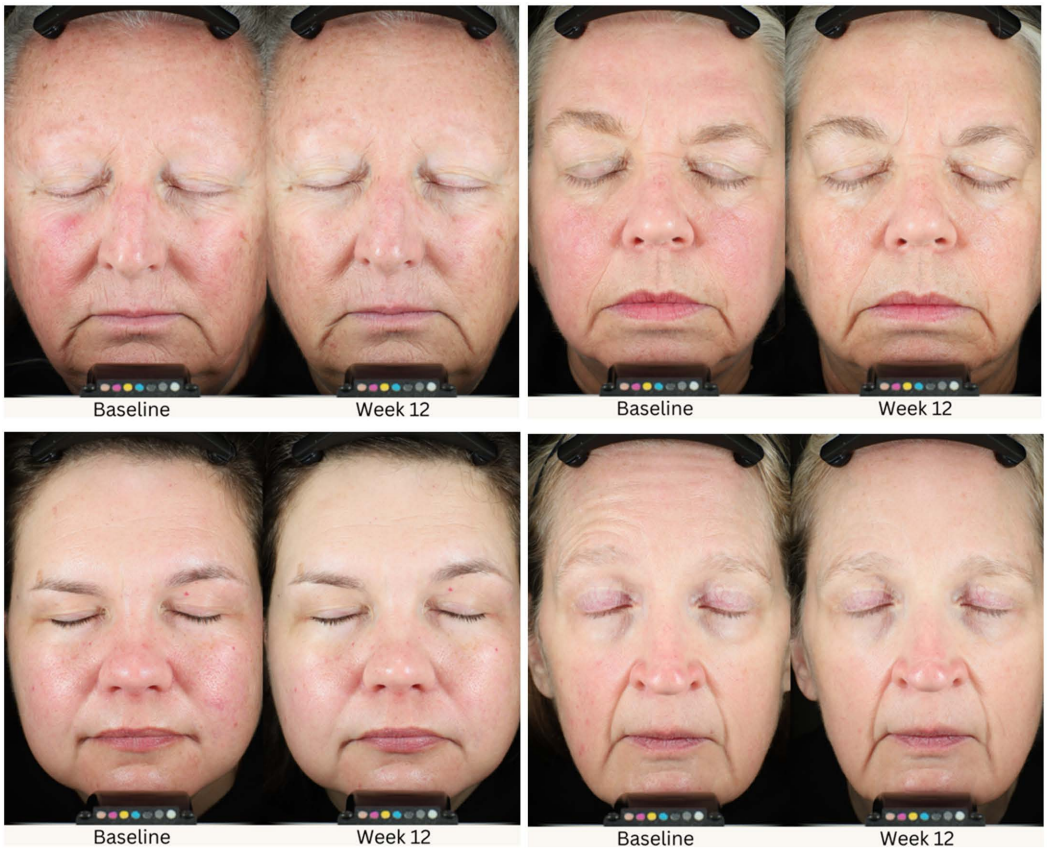


Figure 6. Visia images of 4 patients before using the skincare Regimen A and after 12 weeks.

The studies carried out in this paper aim to demonstrate that supplementing the skin with solar protection and solar repair skincare regimen loaded with a daily dose of skin-identical photoprotective and photo repair molecules may improve skin hydration and rejuvenation. This strategy seems to assist in reducing skin dryness and sensitivity while improving skin radiance and luminosity, indicating a universal improvement in skin health and function.

By supplementing the cutaneous layers with skin-identical components such as amino acids, essential fatty acids, ceramides minerals, hyaluronic acid, glycerin, peptides and saccharides, the Formulations seem to be activating essential mechanisms of action related to skin hydration and barrier functions as suggested through the gene markers expression study.

Focusing on the *in-vivo* study performed using the skincare regimen A, corneometry revealed a significant increase in skin water content during all follow-up time points, which indicates excellent moisturization effects induced by the skin care regimen (Appendix B). It is reasonable to hypothesize that long-term usage of this skincare regime will also induce significant improvements in skin hydration, certainly in Caucasian skin, as revealed in this study.

All investigated efficacy parameters, with the exception of deeper wrinkles, improved significantly and visibly and by Week 12, representing a strong product regimen performance (Appendix C). No tolerability issues were identified by the

dermatologist investigator in terms of dryness, peeling, erythema or edema (Appendix D) demonstrating an excellent safety profile of each formulation and their combined effects. Several patients noted dryness around the nose, mouth and nasolabial fold. This was not observed by the dermatologist investigator, suggesting that the dryness was short-lived, non-visible and subtle. Due to the use of mild hydroxy acids in this regime, some patients reported mild, transient stinging, which disappeared with continued product use and is consistent with topical hydroxy acid therapy. Overall, the regime's skin tolerance confirms skin rejuvenation benefits without trauma.

Patients self-rated statistically significant improvement in all efficacy attributes, judging the product performance to be excellent (Appendix E). These findings are remarkably similar to the dermatologist investigator's observations, confirming internal study consistency.

The skincare regime evaluated here is pain-free and convenient, with results that parallel invasive medical treatments. Although significant improvements in skin conditions were observed following this skincare approach, further studies on protein expression could potentially confirm the physiological effect of the skincare regimens.

Among the most frequently requested improvements requested by patients seeking skin rejuvenation are enhanced skin hydration, texture and luminosity. The regimen and individual skincare Formulations tested in this study provide all of these benefits related to improved skin hydration, as confirmed by dermatologist investigators and patient self-assessments [11] [12].

Understanding the science of skin hydration is not only essential for achieving radiant and healthy skin but also for maintaining overall well-being [27]. A well-hydrated skin not only looks youthful but also functions optimally as a protective barrier against environmental stressors [27].

5. Limitations

The absence of a control group and a comparison study may limit the significance of these findings.

6. Conclusions

Premature skin aging caused by solar damage has various physical and mental health implications, increasing the imperative for daily home-based, non-invasive, preemptive skin care. The advantages of this skincare approach focus on comprehensive solar protection and repair, including skin hydration and rejuvenation, with high safety and efficacy outcomes as demonstrated through objective digital facial surface analysis in Fitzpatrick type I to IV skins. Objectively, outcomes were demonstrable, repeatable and irrefutable, with patients reporting a high level of satisfaction with almost no side effects or discomfort.

Unlike conventional procedures, including medical treatments and conventional sunscreen use, this skincare approach represents a safe, comprehensive and

highly efficacious treatment for solar damage and photoaging without tissue damage or trauma. The advantages and clinical benefits of this regimen would suggest that it would be easily adopted by proactive, skin-health-aware people and achieve widespread acceptance by patients regardless of age, sex, or skin type.

Disclosure

The authors disclose that this study was entirely funded by RATIONALE Skincare Pty Ltd., Victoria, Australia.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Chen, Y., Tzeng, S., Yen, Y., Cheng, N. and Tseng, S. (2023) Non-Invasive Assessment of Skin Hydration and Sensation with Diffuse Reflectance Spectroscopy. *Scientific Reports*, **13**, Article No. 20149. https://doi.org/10.1038/s41598-023-47349-5

[2] Elias, P.M. and Friend, D.S. (1975) The Permeability Barrier in Mammalian Epidermis. *The Journal of Cell Biology*, **65**, 180-191. https://doi.org/10.1083/jcb.65.1.180

[3] Scheuplein, R.J. (1976) Permeability of the Skin: A Review of Major Concepts and Some New Developments. *Journal of Investigative Dermatology*, **67**, 672-676. https://doi.org/10.1111/1523-1747.ep12544513

[4] Pham, Q.D., Gregoire, S., Biatry, B., Cassin, G., Topgaard, D. and Sparr, E. (2021) Skin Hydration as a Tool to Control the Distribution and Molecular Effects of Intermediate Polarity Compounds in Intact Stratum Corneum. *Journal of Colloid and Interface Science*, **603**, 874-885. https://doi.org/10.1016/j.jcis.2021.06.097

[5] Verdier-Sévrain, S. and Bonté, F. (2007) Skin Hydration: A Review on Its Molecular Mechanisms. *Journal of Cosmetic Dermatology*, **6**, 75-82. https://doi.org/10.1111/j.1473-2165.2007.00300.x

[6] Tanaka, Y. (2012) Impact of Near-Infrared Radiation in Dermatology. *World Journal of Dermatology*, **1**, 30-37. https://doi.org/10.5314/wjd.v1.i3.30

[7] Tanaka, Y. and Gale, L. (2013) Beneficial Applications and Deleterious Effects of Near-Infrared from Biological and Medical Perspectives. *Optics and Photonics Journal*, **3**, 31-39. https://doi.org/10.4236/opj.2013.34a006

[8] Tanaka, Y. and Gale, L. (2015) Protection from Near-Infrared to Prevent Skin Damage. *Optics and Photonics Journal*, **5**, 113-118. https://doi.org/10.4236/opj.2015.54010

[9] Tanaka, Y. and Nakayama, J. (2016) Upregulated Epidermal Growth Factor Receptor Expression Following Near-Infrared Irradiation Simulating Solar Radiation in a Three-Dimensional Reconstructed Human Corneal Epithelial Tissue Culture Model. *Clinical Interventions in Aging*, **11**, 1027-1033. https://doi.org/10.2147/cia.s111530

[10] Tanaka, Y., Motomura, H. and Jinno, M. (2016) Biological Defenses against Ultra-Violet, Visible Light, and Near-Infrared Exposure. *Optics and Photonics Journal*, **6**, 8-14. https://doi.org/10.4236/opj.2016.61002

[11] Tanaka, Y. (2019) Long-Term Objective Assessments of Skin Rejuvenation Using Solar Protection and Solar Repair Shown through Digital Facial Surface Analysis and Three-Dimensional Volumetric Assessment. *Clinical, Cosmetic and Investigational Dermatology*, **12**, 553-561. https://doi.org/10.2147/ccid.s218176

[12] Tanaka, Y. (2020) Three-Dimensional Quantification of Skin Surface Displacement Following Skin Rejuvenation Using Solar Protection and Solar Repair. *Journal of Clinical and Aesthetic Dermatology*, **13**, 47-50.

[13] Tanaka, Y. (2023) Photoprotective Ability of Sunscreens against Ultraviolet, Visible Light and Near-Infrared Radiation. *Optics and Photonics Journal*, **13**, 140-146. https://doi.org/10.4236/opj.2023.136012

[14] Tanaka, Y., Parker, R. and Aganahi, A. (2023) Photoprotective Ability of Colored Iron Oxides in Tinted Sunscreens against Ultraviolet, Visible Light and Near-Infrared Radiation. *Optics and Photonics Journal*, **13**, 199-208. https://doi.org/10.4236/opj.2023.138018

[15] Tanaka, Y., Parker, R. and Aganahi, A. (2023) Up-Regulated Expression of ICAM1, MT1A, PTGS2, LCE3D, PPARD, and GM-CSF2 Following Solar Skincare Protection and Repair Strategies in a 3-Dimensional Reconstructed Human Skin Model. *Clinical, Cosmetic and Investigational Dermatology*, **16**, 2829-2839. https://doi.org/10.2147/ccid.s428170

[16] Tanaka, Y., Parker, R., Aganahi, A. and Pedroso, A. (2023) Novel Low Viscosity Zinc Oxide, Iron Oxides and Erioglaucine Sunscreen Potential to Protect from Ultraviolet, Visible Light and Near-Infrared Radiation. *Optics and Photonics Journal*, **13**, 217-226. https://doi.org/10.4236/opj.2023.139020

[17] Tanaka, Y., Parker, R. and Aganahi, A. (2023) Up-Regulated Expression of SOD2 and HPRT1 Following Topical Photoprotection and Photorepair Skincare Formulations in a 3-Dimensional Reconstructed Human Skin Model. *Journal of Cosmetics, Dermatological Sciences and Applications*, **13**, 322-332. https://doi.org/10.4236/jcdsa.2023.134025

[18] Marsh, K., Coppa, B., Matten, K., Parker, R. and Tanaka, Y. (2023) A Non-Invasive Skin Treatment Combining LED with Pharmacologic and Ultrasonic Technologies for Facial Rejuvenation. *Journal of Cosmetics, Dermatological Sciences and Applications*, **13**, 333-344. https://doi.org/10.4236/jcdsa.2023.134026

[19] Marsh, K., Aganahi, A., Parker, R. and Tanaka, Y. (2024) Gene Expression Changes Following Solar Skincare Protection and Repair Strategies in a 3-Dimensional Reconstructed Human Skin Model. *Journal of Clinical & Experimental Dermatology Research*, **15**, 656-663.

[20] Tanaka, Y., Parker, R. and Aganahi, A. (2024) Gene Expression Change Analysis Following Specific Comprehensive Solar Protection SPF50+ after Ultraviolet Light and Blue Light Exposure in a 3-Dimensional Reconstructed Human Skin Model. *Journal of Dermatology and Plastic Surgery*, **5**, Article 1026.

[21] Aganahi, A., Parker, R. and Tanaka, Y. (2024) *In vivo* Improvements in Facial Appearance and *in Vitro* Changes in Gene Expression Using a Topical Formulation Designed to Repair Environmentally Induced DNA Damage. *Journal of Cosmetics, Dermatological Sciences and Applications*, **14**, 141-173. https://doi.org/10.4236/jcdsa.2024.142010

[22] Lee, Y., Je, Y., Lee, S., Li, Z.J., Choi, D., Kwon, Y., *et al.* (2012) Changes in Transepidermal Water Loss and Skin Hydration According to Expression of Aquaporin-3 in Psoriasis. *Annals of Dermatology*, **24**, 168-174. https://doi.org/10.5021/ad.2012.24.2.168

[23] Camilion, J.V., Khanna, S., Anasseri, S., Laney, C. and Mayrovitz, H.N. (2022) Physiological, Pathological, and Circadian Factors Impacting Skin Hydration. *Cureus*, **14**, e27666. https://doi.org/10.7759/cureus.27666

[24] Shimoda, H., Terazawa, S., Hitoe, S., Tanaka, J., Nakamura, S., Matsuda, H., *et al.*

(2012) Changes in Ceramides and Glucosylceramides in Mouse Skin and Human Epidermal Equivalents by Rice-Derived Glucosylceramide. *Journal of Medicinal Food*, **15**, 1064-1072. https://doi.org/10.1089/jmf.2011.2137

[25] Bachelor, M., Binder, R.L., Cambron, R.T., Kaczvinsky, J.R., Spruell, R., Wehmeyer, K.R., *et al.* (2014) Transcriptional Profiling of Epidermal Barrier Formation *in vitro*. *Journal of Dermatological Science*, **73**, 187-197. https://doi.org/10.1016/j.jdermsci.2013.11.004

[26] Coderch, L., López, O., de la Maza, A. and Parra, J.L. (2003) Ceramides and Skin Function. *American Journal of Clinical Dermatology*, **4**, 107-129. https://doi.org/10.2165/00128071-200304020-00004

[27] Oda, Y., Uchida, Y., Moradian, S., Crumrine, D., Elias, P.M. and Bikle, D.D. (2009) Vitamin D Receptor and Coactivators SRC2 and 3 Regulate Epidermis-Specific Sphingolipid Production and Permeability Barrier Formation. *Journal of Investigative Dermatology*, **129**, 1367-1378. https://doi.org/10.1038/jid.2008.380

[28] Farris, P.K., Draelos, Z.D., Tanaka, Y., Bucay, V., Biotech, A.A.M., Ribeiro, N., *et al.* (2024) A Novel Protection and Repair Skincare Regimen Shows Efficacy for Improving Environmental Skin Aging. *Journal of Drugs in Dermatology*, **23**, 866-872. https://doi.org/10.36849/jdd.8274

Appendix A. Detailed Ingredients Complexes per Collection

	Solar Protection Formulations			Solar Repair Formulations		
	#1 RESILIENCE	#2 VITALITY	#3 BRILLIANCE	#4 INTEGRITY	#5 CLARITY	#6 RENEWAL
Vitamins	Niacinamide; Panthenol; Cyanocobalamin; Pyridoxine; Tocopherol	Retinol; Ascorbyl Tetraisopalmitateso-dium; Ascorbyl Phosphate; Ascorbyl Glucoside; Tocopherol; Tocopheryl Acetate; Tocotrienols	Niacinamide; Tocopherol, Tocopheryl Acetate, Tocotrienols; 7-Dehydrocholesterol	Panthenol; Retinyl Palmitate; Tetrahexyldecyl Ascorbate; Tocopherol; Tocotrienols; 7-Dehydrocholesterol		Retinal, Retinol; Bakuchiol (Vitamin A Analog); Nicotiana Benthamiana Hexapeptide-40 Sh-Polypeptide-76 (Vitamin A Boosters); Xanthophylls (Vitamin A Boosters); Tocopherol
AHA & BHA					Lactic Acid; Glycolic Acid; Citric Acid; Malic Acid; Tartaric Acid; Salicylic Acid	
Complex and Essential Fatty Acids	Phytosphingosines; Sphingosines; Phospholipids; Ceramide Ap, Eop, Eos, Ng, Np, Ns; Cholesterol; Glycosphingolipids	Phytosphingosines; Sphingosines; Phospholipids; Ceramide Ap, Eop, Eos, Ng, Np, Ns; Cholesterol; Glycosphingolipids	Phytosphingosines; Sphingosines; Phospholipids; Ceramide Ap, Eop, Eos, Ng, Np, Ns; Cholesterol; Glycosphingolipids	Arachidyl Propionate; Ethyl Linolenate; Phytosphingosines; Sphingosines; Phospholipids; Ceramide Ap, Eop, Eos, Ng, Np, Ns; Cholesterol	Phytosphingosines; Sphingosines; Phospholipids; Ceramide Ap, Eop, Eos, Ng, Np, Ns; Cholesterol	Phytosphingosines; Sphingosines; Phospholipids; Ceramide Ap, Eop, Eos, Ng, Np, Ns; Cholesterol; Glycosphingolipids; Linolenic Acid; Linoleic Acid
Amino Acids	Zinc Gluconate; Magnesium Aspartate; Copper Gluconate; Alanine; Lysine; Arginine; Tyrosine; Phenylalanine; Proline; Threonine; Valine; Isoleucine; Sodium Benzoate; Citric Acid; Histidine; Collagen Amino Acids	Glycine; Serine; Aspartic Acid; Leucine	Zinc Gluconate; Magnesium Aspartate; Copper Gluconate; Alanine; Lysine; Arginine Tyrosine; Phenylalanine; Proline; Threonine; Valine; Isoleucine; Sodium Benzoate; Citric Acid; Histidine	Zinc Gluconate; Magnesium Aspartate; Copper Gluconate; Alanine; Lysine; Arginine Tyrosine; Phenylalanine; Proline; Threonine; Valine; Isoleucine; Sodium Benzoate; Citric Acid; Histidine	Zinc Gluconate; Magnesium Aspartate; Copper Gluconate; Alanine; Lysine; Arginine; Tyrosine; Phenylalanine; Proline; Threonine; Valine; Isoleucine; Sodium Benzoate; Citric Acid; Histidine	Zinc Gluconate; Magnesium Aspartate; Copper Gluconate; Alanine Lysine; Arginine; Tyrosine; Phenylalanine; Proline Threonine; Valine Isoleucine; Sodium Benzoate; Citric Acid; Histidine
Minerals	Zinc Gluconate; Magnesium Aspartate; Copper Gluconate	Zinc Gluconate; Magnesium Aspartate; Copper Gluconate	Zinc Oxide; Zinc Glu-conate; Magnesium Aspartate; Copper Gluconate	Zinc Gluconate; Mag-nesium Aspartate; Copper Gluconate	Zinc Gluconate; Magnesium Aspartate; Copper Gluconate; Zinc PCA	Zinc Gluconate; Magnesium Aspartate; Copper Gluconate
Peptides, Proteins and Enzymes	Acetyl Hexapeptide-37; Acetyl Octapeptide-3; Hexapeptide-10; Betaine	Superoxide Dismutase; Glutathione; Carnosine	Keratin; Acetyl Tetrapeptide-22	Oligopeptide-1; Acetyl Hexapeptide-37	Acetyl Hexapeptide-37; Hexapeptide-10	Acetyl Hexapeptide-51 Amide; Tripeptide-10 Citrulline; Hexapeptide-10; Tripeptide-9 Citrulline, Tripeptide-1, Acetyl Tetrapeptide-2

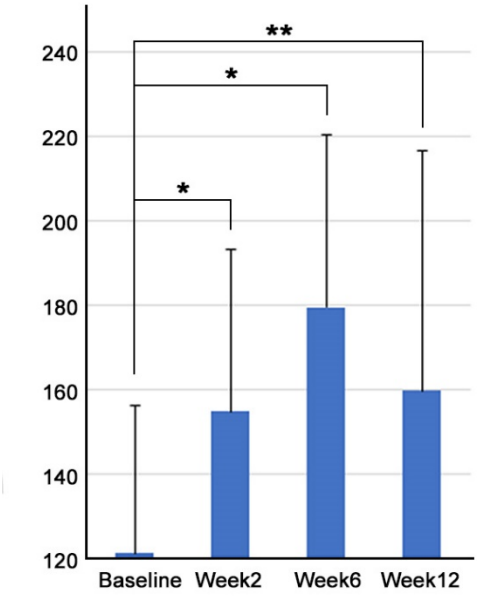
Continued

Ferments & Algae	Leuconostoc/ Radish Root Ferment Filtrate				Yeast Extract	Bifida Ferment Lysate; Pseudoalteromonas Ferment Extract; Micrococcus Lysate; Plankton Extract
Natural Moisturising Factor & Analogs	Sodium Hyaluronate	Sodium Hyaluronate; Betaine	Sodium Lactate; Urea; Sodium Hyaluronate		Zinc Pca; Sodium Hyaluronate	Sodium Hyaluronate; Betaine
Sugar		Diglucosyl Gallic Acid	Fructose; Maltose; Trehalose; Glucose; Inositol	Sorbitol	Saccharide Isomerate	Glucose
Others	Glycyrrhetinic Acid; Allantoin	Ubiquinone; Melanin; Bisabolol; Lycopene	Melanin; Bisabolol; Allantoin		Piroctone Olamine	Bisabolol; Glycyrrhetinic Acid; Allantoin; Hydrolyzed RNA; Hydrolyzed DNA
Australian Botanicals Extracts and Other Plant Extracts	Aloe Barbadensis (Aloe Vera) Leaf Juice; Acacia Melanoxylon Leaf Extract; Banksia Serrata Flower Extract; Borago Officinalis Seed Oil; Brachychiton Acerifolius Flower Extract; Davidsonia Pruriens Fruit Extract; Hibbertia Scandens Leaf Extract; Hibiscus Sabdariffa Flower Extract; Honey Extract; Melaleuca Alternifolia (Tea Tree) Leaf Extract Santalum Spicatum (Sandalwood) Seed Oil; Tasmannia Lanceolata Fruit Extract; Telopea Speciosissima Flower/Leaf Extract; Terminalia Ferdinandiana Fruit Extract	Santalum Spicatum (Sandalwood) Seed Oil; Brachychiton Acerifolius Flower Extract; Banksia Serrata Flower Extract; Telopea Speciosissima Flower/Leaf Extract; Davidsonia Pruriens Fruit Extract; Melaleuca Alternifolia (Tea Tree) Leaf Extract Tasmannia Lanceolata Fruit Extract Terminalia Ferdinandiana Fruit Extract; Hibiscus Sabdariffa Flower Extract; Vaccinium Macrocarpon (Cranberry) Seed Oil, Durvillaea Potatorum Extract, Aloe Barbadensis (Aloe Vera) Leaf Juice; Solanum Lycopersicum (Tomato) Seed Oil; Myrtus Communis Leaf Extract; Kunzea Pomifera Fruit Extract; Jojoba Oil/ Macadamia Seed Oil Esters; Ligustrum Lucidum Seed Extract	Argania Spinosa Kernel Oil; Voandzeia Subterranea Seed Extract; Anigozanthos Flavidus Flower Extract; Davidsonia Jerseyana Fruit Extract; Syzygium Luehmannii Fruit Extract ; Aspalathus Linearis Leaf Extract Camellia Sinensis Leaf Extract	Acacia Decurrens Flower Wax; Banksia Serrata Flower Extract; Santalum Spicatum (Sandalwood) Seed Oil; Telopea Speciosissima Flower/Leaf Extract; Tasmannia Lanceolata Fruit Extract; Zea Mays (Corn) Oil; Hibiscus Sabdariffa Flower Extract; Aloe Barbadensis (Aloe Vera) Leaf Juice; Melaleuca Alternifolia (Tea Tree) Leaf Extract Terminalia Ferdinandiana Fruit Extract; Brachychiton Acerifolius Flower Extract; Davidsonia Pruriens Fruit Extract; Barklya Syringifolia Flower/Leaf Extract; Jojoba Esters	Vaccinium Myrtillus Fruit Extract; Saccharum Officinarum (Sugar Cane) Extract; Santalum Spicatum (Sandalwood) Seed Oil; Acer Saccharum (Sugar Maple) Extract ; Brachychiton Acerifolius Flower Extract; Banksia Serrata Flower Extract; Tasmannia Lanceolata Fruit Extract; Santalum Acuminatum Fruit Extract; Hibiscus Sabdariffa Flower Extract; Telopea Speciosissima Flower/Leaf Extract; Melaleuca Alternifolia (Tea Tree) Leaf Extract; Davidsonia Pruriens Fruit Extract; Terminalia Ferdinandiana Fruit Extract; Pelargonium Graveolens Oil; Melaleuca Alternifolia (Tea Tree) Leaf; Mentha Australis Leaf Extract	Banksia Serrata Flower Extract; Santalum Spicatum (Sandalwood) Seed Oil; Santalum Acuminatum Fruit Extract ; Acacia Victoriae Fruit Extract; Arabidopsis Thaliana Extract

Appendix B. Corneometry

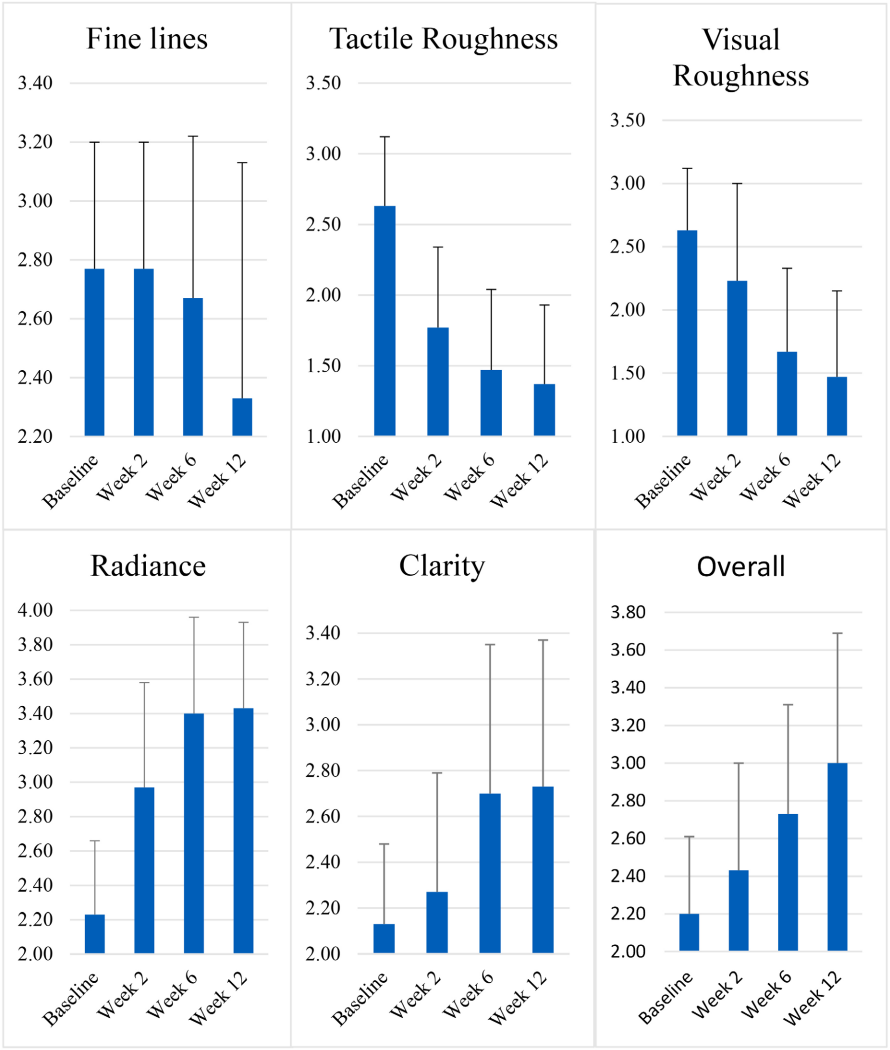
Corneometry examined the water content of the skin with a higher number indicating increased skin water content. The skin water content was significantly increased. *$p < 0.001$, **$p = 0.001$.

Corneometry	Time Point	Mean (± SD)	*p*-value
Reading	Baseline	121.03 ± 35.02	
	Week 2	154.63 ± 38.38	<.001
	Week 6	179.53 ± 40.69	<.001
	Week 12	159.57 ± 57.01	0.001



Appendix C. Investigator Efficacy

All assessments except radiance, clarity and overall were made on a 5-point ordinal scale (0 = none, 1 = minimal, 2 = mild, 3 = moderate, 4 = severe). Assessments of radiance, clarity, overall were made on a 5-point ordinal scale (0 = worse; 1 = little satisfaction or not satisfied; 2 = fairly satisfied; 3 = satisfied; and 4 = very satisfied). Improvements in all evaluated parameters were observed.



Appendix D. Investigator Tolerability

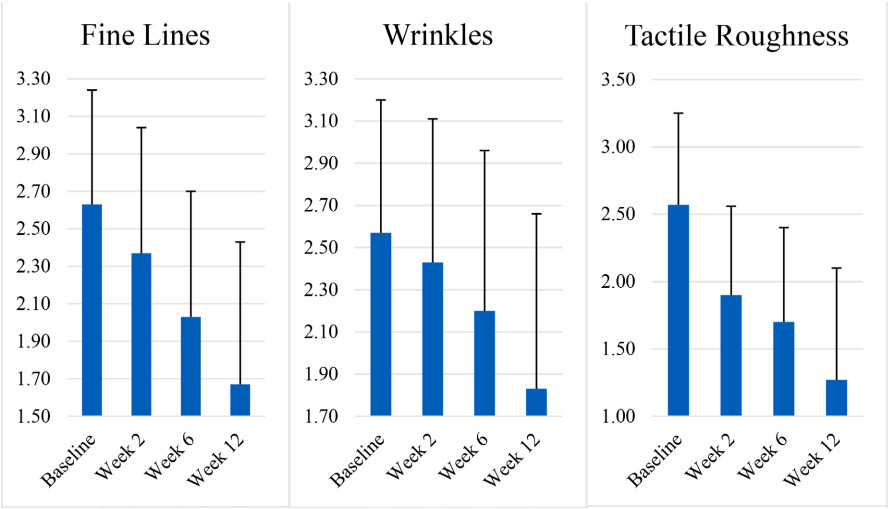
The investigator assessed tolerability in terms of dryness, peeling, erythema, and edema (0 = none, 1 = minimal, 2 = mild, 3 = moderate, 4 = severe). No tolerability issues were identified by the dermatologist investigator in terms of dryness, peeling, erythema, or edema.

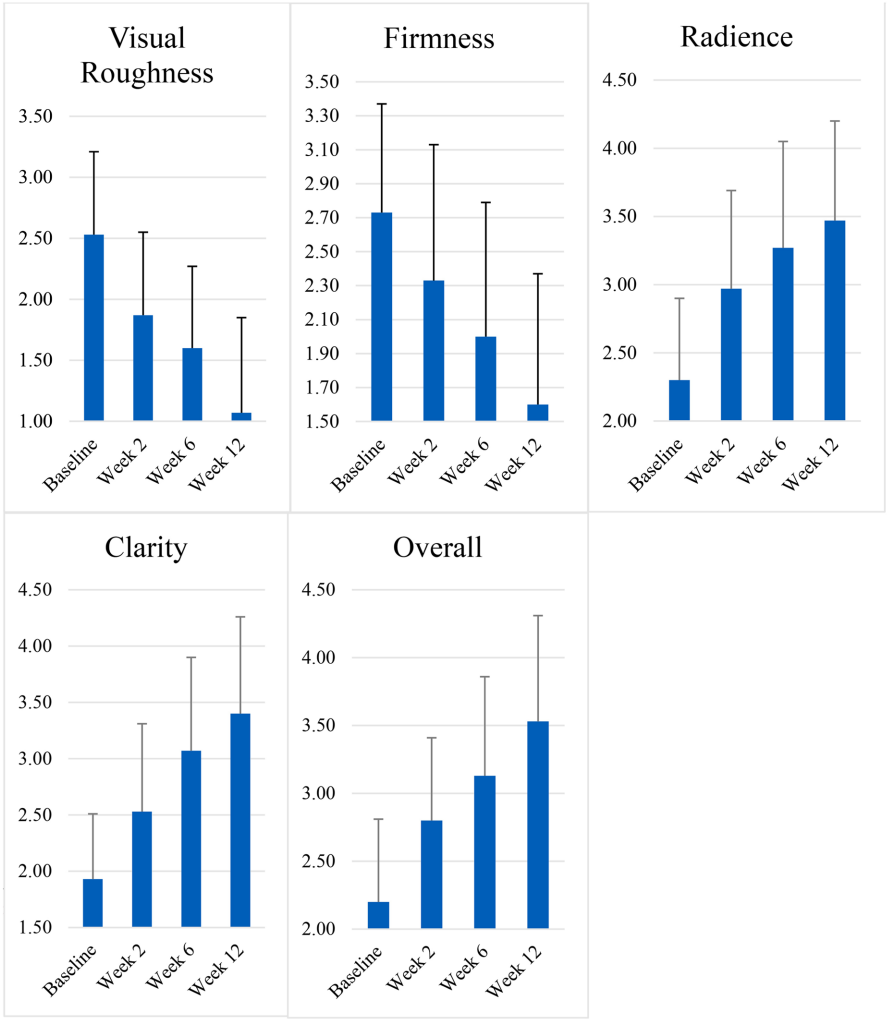
Inv Toler Long	Time Point	N	Mean (± SD)	Mean Change from Baseline (± SD)	Mean % Change from Baseline	p-value
Dryness	Baseline	30	0.00 ± 0.00			
	Week 2	30	0.00 ± 0.00	0.00 ± 0.00	NA	1.000
	Week 6	30	0.00 ± 0.00	0.00 ± 0.00	NA	1.000
	Week 12	30	0.00 ± 0.00	0.00 ± 0.00	NA	1.000
Peeling	Baseline	30	0.00 ± 0.00			
	Week 2	30	0.00 ± 0.00	0.00 ± 0.00	NA	1.000
	Week 6	30	0.00 ± 0.00	0.00 ± 0.00	NA	1.000
	Week 12	30	0.00 ± 0.00	0.00 ± 0.00	NA	1.000
Erythema	Baseline	30	0.00 ± 0.00			
	Week 2	30	0.00 ± 0.00	0.00 ± 0.00	NA	1.000
	Week 6	30	0.00 ± 0.00	0.00 ± 0.00	NA	1.000
	Week 12	30	0.00 ± 0.00	0.00 ± 0.00	NA	1.000
Edema	Baseline	30	0.00 ± 0.00			
	Week 2	30	0.00 ± 0.00	0.00 ± 0.00	NA	1.000
	Week 6	30	0.00 ± 0.00	0.00 ± 0.00	NA	1.000
	Week 12	30	0.00 ± 0.00	0.00 ± 0.00	NA	1.000

Appendix E. Subject Efficacy

All assessments except radiance, clarity, overall were made on a 5-point ordinal scale (0 = none, 1 = minimal, 2 = mild, 3 = moderate, 4 = severe). Assessments of radiance, clarity, overall were made on a 5-point ordinal scale (0 = worse; 1 = little satisfaction or not satisfied; 2 = fairly satisfied; 3 = satisfied; and 4 = very satisfied). Improvements in all evaluated parameters were observed.

Subj Efficacy Long	Time Point	N	Mean (± SD)	Mean Change from Baseline (± SD)	Mean % Change from Baseline	p-value
Fine Lines	Baseline	30	2.63 ± 0.61			
	Week 2	30	2.37 ± 0.67	-0.27 ± 0.45	-10%	**0.008**
	Week 6	30	2.03 ± 0.67	-0.60 ± 0.72	-23%	**0.001**
	Week 12	30	1.67 ± 0.76	-0.97 ± 0.85	-37%	**<.001**
Wrinkles	Baseline	30	2.57 ± 0.63			
	Week 2	30	2.43 ± 0.68	-0.13 ± 0.43	-5%	0.156
	Week 6	30	2.20 ± 0.76	-0.37 ± 0.76	-14%	**0.022**
	Week 12	30	1.83 ± 0.83	-0.73 ± 0.87	-29%	**0.001**
Radiance	Baseline	30	2.70 ± 0.60			
	Week 2	30	2.03 ± 0.72	-0.67 ± 0.76	-25%	**0.001**
	Week 6	30	1.73 ± 0.78	-0.97 ± 0.76	-36%	**<.001**
	Week 12	30	1.53 ± 0.73	-1.17 ± 0.79	-43%	**<.001**
Tactile Roughness	Baseline	30	2.57 ± 0.68			
	Week 2	30	1.90 ± 0.66	-0.67 ± 0.61	-26%	**<.001**
	Week 6	30	1.70 ± 0.70	-0.87 ± 0.86	-34%	**<.001**
	Week 12	30	1.27 ± 0.83	-1.30 ± 1.09	-51%	**<.001**
Visual Roughness	Baseline	30	2.53 ± 0.68			
	Week 2	30	1.87 ± 0.68	-0.67 ± 0.61	-26%	**<.001**
	Week 6	30	1.60 ± 0.67	-0.93 ± 0.83	-37%	**<.001**
	Week 12	30	1.07 ± 0.78	-1.47 ± 1.07	-58%	**<.001**
Firmness	Baseline	30	2.73 ± 0.64			
	Week 2	30	2.33 ± 0.80	-0.40 ± 0.56	-15%	**0.004**
	Week 6	30	2.00 ± 0.79	-0.73 ± 0.78	-27%	**<.001**
	Week 12	30	1.60 ± 0.77	-1.13 ± 0.94	-41%	**<.001**
Clarity	Baseline	30	3.07 ± 0.58			
	Week 2	30	2.47 ± 0.78	-0.60 ± 0.62	-20%	**<.001**
	Week 6	30	1.93 ± 0.83	-1.13 ± 0.90	-37%	**<.001**
	Week 12	30	1.60 ± 0.86	-1.47 ± 0.94	-48%	**<.001**
Overall	Baseline	30	2.80 ± 0.61			
	Week 2	30	2.20 ± 0.61	-0.60 ± 0.56	-21%	**<.001**
	Week 6	30	1.87 ± 0.73	-0.93 ± 0.78	-33%	**<.001**
	Week 12	30	1.47 ± 0.78	-1.33 ± 0.96	-48%	**<.001**




Visual Roughness
3.50
3.00
2.50
2.00
1.50
1.00
Baseline
Week 2
Week 6
Week 12
Firmness
3.50
3.30
3.10
2.90
2.70
2.50
2.30
2.10
1.90
1.70
1.50
Baseline
Week 2
Week 6
Week 12
Radience
4.50
4.00
3.50
3.00
2.50
2.00
Baseline
Week 2
Week 6
Week 12
Clarity
4.50
4.00
3.50
3.00
2.50
2.00
1.50
Baseline
Week 2
Week 6
Week 12
Overall
4.50
4.00
3.50
3.00
2.50
2.00
Baseline
Week 2
Week 6
Week 12