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A novel clinical skin evaluation approach reflecting systemic longevity: restoring multiple signs of vitality and regeneration targeting young and healthy skin parameters by only using a cosmetic formulation containing a specific DNA.

Sophie VANN-GUILLON [1], Laura NUCIBELLA [2], Anneleen LAVIGNE [3], Clara CHARLOT[3] , Marie LE CORRE[3]

[1]CEO, [2]Research & Development Deputy Director, [3]Research and Development Project Managers, CVL COSMETICS SA, VALMONT GROUP, 1 place du port, 1110 Morges, Switzerland

1. Introduction

Consumers are increasingly seeking skincare products that go beyond hydration or wrinkle reduction, aiming instead to support regeneration, resilience, and long-term skin health. In response, scientific and cosmetic research is shifting toward skin longevity, a field that focuses on maintaining biological function and preventing cellular decline linked to aging. This reflects a broader understanding of aging as a complex, multifactorial process driven by intrinsic mechanisms and extrinsic exposomal factors [1–4].

Skin aging is marked by the gradual decline of homeostasis, metabolism, and regeneration, governed by key hallmarks such as mitochondrial dysfunction, genomic instability, and stem cell exhaustion [1–3]. These mechanisms are exacerbated by the exposome, UV radiation, pollution, oxidative stress, poor sleep, diet, psychological stress, and smoking, which accelerates biological aging and affects both appearance and function [3,4].

Clinically, aging manifests through reduced hydration and radiance, deeper wrinkles, and diminished firmness and elasticity [5–7], all of which result from biological alterations like dermo-epidermal thinning, ECM remodeling, impaired cell renewal, and barrier dysfunction [6,8,9]. These parameters are essential markers for assessing both the progression of aging and the efficacy of cosmetic interventions.

Vital skin is defined by active metabolism, efficient hydration, continuous renewal, and a strong barrier, contributing to firmness and resilience. Preserving this equilibrium is central to any longevity-oriented cosmetic approach. To target aging at its molecular roots, a next-generation active was developed—silicon-derived DNA integrated into a micronutrient-rich environment (sDNA). sDNA was characterized by high-resolution proteomics and shown to modulate six major biological processes linked to skin health: mitochondrial metabolism, autophagy,

DNA repair, antioxidant defense, proteostasis, and epidermal differentiation [10]. These actions mirror several hallmarks of aging and highlight sDNA's ability to boost metabolic activity and regeneration.

Based on this rationale, a 28-day *in vivo* study was conducted using an sDNA-based cosmetic formulation in mature subjects exhibiting signs of chrono- and photoaging and exposed to lifestyle-related stressors (pollution, smoking, stress).

Clinical endpoints included hydration, radiance, wrinkle depth, surface smoothness, elasticity, firmness, and dermo-epidermal thickness. In addition to monitoring changes over time, we compared the test group with a youthful reference panel: healthy young women with optimal lifestyles and minimal exposure to exposomal stressors. This "perfect skin" group provided a physiological benchmark for evaluating not just the direction, but the magnitude of biological restoration, thus offering a robust framework for assessing the potential of sDNA as a longevity-supporting cosmetic innovation.

2. Materials and Methods

2.1. Study design and subjects

A monocentric, open-label clinical study was conducted to evaluate the efficacy and tolerance of a cosmetic formulation containing the specific DNA (sDNA). The study involved two groups of healthy female volunteers, selected under the supervision of a board-certified dermatologist, according to predefined inclusion and exclusion criteria.

- **Test group**: 22 women aged 30–55 years (mean age: 43.8), with all skin types and visible signs of chrono- and photoaging (e.g., fine lines, loss of firmness). All reported lifestyle-related stressors (e.g., poor sleep, pollution, smoking, psychological stress). The sDNA-based cream was applied twice daily to the face for 28 days. Clinical assessments were performed at baseline (D0) and Day 28 (D28), including instrumental measurements, standardized photography, and dermatological evaluation.
- **Reference group ("Perfect skin")**: 20 women aged 19–29 years (mean age: 23.7), with no major exposomal stressors and visibly healthy skin. Participants were non-smokers, reported no sleep deprivation or stress, and followed a balanced diet. No product was applied. Instrumental assessments evaluated hydration, radiance, firmness, elasticity, and surface structure to define objective benchmarks for optimal skin quality.

2.2. Ethical principles

All study procedures complied with the ethical principles of the Declaration of Helsinki (18th WMA General Assembly, 1964, and subsequent amendments). According to local and European regulations (Official Journal of the EU, 10 March 2010, §1.2.9), ethics committee approval was not required for trials involving marketed cosmetics. Participants were instructed to report any adverse effects; no serious adverse reactions were observed.

2.3. Tested product

The tested product is a topical face cream applied twice daily (morning and evening) to the entire face until fully absorbed. It complies with Regulation (EC) No 1223/2009 on cosmetic

products and is deemed safe under normal or reasonably foreseeable conditions of use. Its key active is a next-generation ingredient: enriched silicon-derived DNA, combined with a natural catalytic environment (sDNA). This design aims to enhance its bioavailability, and optimize its effects on skin cells. Prior proteomic studies have shown that sDNA supports cellular energy metabolism and positively modulates several hallmarks of aging in keratinocytes, including regeneration, homeostasis, and metabolic pathways [10]. Designed to be biomimetic as a healthy microenvironment for the skin, the complete formulation includes humectants, emollients, botanical extracts, peptides, and antioxidants—all working together to support hydration, strengthen the skin barrier, and promote overall skin health.

2.4. Instrumental evaluations

Instrumental evaluations were performed on the test group at baseline (D0), and after 14 and 28 days of product use (D14, D28), with a reference group of young healthy individuals representing “perfect skin” used as a benchmark. Hydration was measured on the cheek with the Corneometer® (Courage + Khazaka), based on stratum corneum dielectric properties. Radiance was assessed using the CM-700D spectrophotometer (Konica Minolta), analyzing light reflection. Wrinkle depth and skin smoothness (Sa) at the crow’s feet were evaluated using PrimosCR SF, a 3D structured light system. Elasticity and firmness (R0, R2, R9) were measured on the cheek with the Cutometer® MPA 580, based on suction-induced viscoelastic response. Skin thickness and density at the cheekbone were assessed with the DUB® SkinScanner, a high-resolution 50 MHz ultrasound. Standardized photography was performed with Visia®-CR to document visible changes. Dermatological tolerance was clinically evaluated at D0 and D28, based on signs (erythema, dryness) and subjective symptoms (tightness, stinging, itching). Finally, a self-assessment questionnaire was completed after 28 days, rating hydration, radiance, comfort, and vitality on a 4-point scale, with results expressed as the percentage of positive responses.

2.5. Results and statistical analysis

All instrumental data are presented as mean values per timepoint. Percentage change from baseline (Day 0) to Day 28 was calculated using the formula: % Variation = [(pt - p0) / p0] × 100, where pt is the value at Day 28 and p0 the value at baseline. The Standard Error of the Mean (SEM) was used to indicate variability and precision. Self-assessment results were expressed as the percentage of participants selecting each response.

All data were processed using Microsoft® Excel. Paired Student’s t-tests evaluated intra-group changes (D0 vs D14/D28), and unpaired t-tests compared the test group to the youthful reference group at D0 and D28. Statistical significance was set at $p < 0.05$.

3. Results

The efficacy of the sDNA-based face cream was assessed by comparing key biophysical skin parameters measured at baseline (Day 0) and after 28 days of twice-daily application (Day 28). The results obtained in the test group were analyzed in terms of absolute values and

percentage variation over time, and were compared, to the values observed in the youthful reference group representing “perfect skin”.

3.1. Deep rehydration for visibly plumper and more comfortable skin

Skin hydration was measured on the cheek using the Corneometer® in both the test group and the youthful reference group representing “perfect skin.” At baseline, the test group showed significantly lower hydration (-8.8% *vs* reference), confirming its relevance as a model of lifestyle-related skin aging (*Table 1*). After 28 days of twice-daily application of the sDNA-based cream, hydration increased by 22.6% compared to baseline, reaching 110.6% of the “perfect skin” benchmark. Improvement was already notable by Day 14 (+13.6% *vs* baseline), with continued progress thereafter (*Table 1*).

This sustained and progressive rehydration demonstrates the product’s ability not only to restore moisture in aged and stressed skin, but to exceed hydration levels typical of youthful skin. As hydration is a fundamental marker of vitality, these findings support the formula’s positioning as a longevity-focused skincare solution that meets both biological and cosmetic expectations.

Table 1. Skin hydration (mean ± SE, a.u.) in the “perfect skin” group (D0) and the test group at D0, D14, and D28. The last column shows test group values as % of the “perfect skin” reference (set at 100%). ***p < 0.001 *vs* D0; †p < 0.05 *vs* “perfect skin” at D0; ‡p < 0.01 *vs* “perfect skin” at D28.

	"Perfect skin" group	**Test group**	**% of perfect skin value (reference = 100%)**
D0	59.2 ± 2.3	54 ± 1.6†	91.2%
D14	–	60.8 ± 1.4*** (+13.6% *vs* D0)	102.70%
D28	–	65.5 ± 1.1***‡ (+22.6% *vs* D0)	110.60%

3.2. Radiance recovery: a visual signature of skin revitalization

Skin radiance, measured using a spectrophotometer (gloss parameter), was significantly reduced in the test group at baseline compared to the youthful reference (-22.3%), illustrating the loss of luminosity commonly associated with age and lifestyle factors such as stress, pollution, or smoking (*Table 2*). After 28 days of twice-daily application of the sDNA-based cream, radiance increased by 25.1% compared to baseline, reaching 96.7% of the youthful benchmark. A significant improvement was already noted at Day 14 (+15.1%), highlighting the product’s rapid efficacy (*Table 2*).

These results demonstrate that the formulation effectively restores the skin’s ability to reflect light, a key visual marker of vitality, to a level comparable with youthful and healthy skin, confirming its relevance as a longevity-supporting cosmetic strategy.

Table 2. Skin radiance (mean ± SE, a.u.) in the "perfect skin" group (D0) and the test group at D0, D14, and D28. The last column shows test group values as % of the "perfect skin" reference (set at 100%). **p < 0.001 *vs* D0; †p < 0.05 *vs* "perfect skin" at D0.

	"Perfect skin" group	Test group	% of perfect skin value (reference = 100%)
D0	13.08 ± 0.36	10.17 ± 0.32†	77.70%
D14	–	11.67 ± 0.34*** (+15.1% *vs* D0)	89.20%
D28	–	12.65 ± 0.37*** (+25.1% *vs* D0)	96.70%

3.3. Reduction of visible wrinkles and smoothing of facial features

Skin profilometry on the crow's feet area, using the PrimosCR SF system, assessed two morphological indicators of aging: wrinkle depth and surface roughness (Sa). At baseline, both parameters were markedly elevated in the test group, with wrinkle depth increased by 71.1% and roughness by 35.1% compared to the youthful reference, reflecting the cumulative impact of age and lifestyle-related stressors on skin topography (*Table 3*). Following 28 days of twice-daily application of the sDNA-based cream, wrinkle depth decreased by 10.5% and roughness by 8.1%. Improvements were already visible at Day 14, with significant reductions of 5.1% and 6.8% respectively. While the values did not fully return to youthful levels, both markers moved substantially closer to the reference range (*Table 3*).

These data demonstrate that the formulation exerts a dual action on cutaneous surface quality: reducing deep and shallow microrelief alterations and improving skin smoothness over time. By targeting key morphological markers of aging, this cosmetic intervention supports the restoration of youthful skin architecture, a visible expression of skin vitality, and reinforces its potential as a longevity-promoting skincare solution.

Table 3. Skin profilometry (mean ± SE, µm) in the "perfect skin" group (D0) and the test group at D0, D14, and D28. Wrinkle depth and surface roughness (Sa) were assessed using PrimosCR SF. The last column shows test group values as % of the "perfect skin" reference (set at 100%). ***p < 0.001 *vs* D0; †p < 0.05 *vs* "perfect skin" at D0.

Parameter	Timepoint	"Perfect skin" group	Test group	% of perfect skin value
Wrinkle depth	D0	123.1 ± 10.1	210.6 ± 21.1†	171.10%
	D14	–	198.7 ± 19.4*** (-5.1% *vs* D0)	161.40%
	D28	–	184.9 ± 17.2*** (-10.5% *vs* D0)	150.3%
Skin roughness (Sa)	D0	24.37 ± 0.78	32.93 ± 2.20†	135.10%
	D14	–	30.68 ± 2.12*** (-6.9% *vs* D0)	125.90%
	D28	–	30.48 ± 2.33*** (-8.1% *vs* D0)	125.1%

3.4. Rejuvenating skin biomechanics: enhanced elasticity, restored firmness, and boosted resilience

Biomechanical parameters, elasticity (R2), firmness (R0), and resilience (R9), were evaluated using the Cutometer®. At baseline, the test group exhibited clear signs of biomechanical aging: elasticity was reduced by 9.5%, while firmness and residual deformation were increased by 6.9% and 12.7% respectively compared to the youthful reference, indicating both structural laxity and reduced recovery capacity (*Table 4*). After 28 days of twice-daily application, elasticity improved by 5.2%, reaching 94.7% of the youthful benchmark, with a first significant gain already visible by Day 14 (+2.3%). Firmness progressively normalized, decreasing by 6.5% to align with the reference value. Similarly, resilience improved with a 5.3% reduction in residual deformation, approaching youthful levels (*Table 4*).

Together, these improvements confirm the cream's efficacy in restoring the mechanical behavior of the skin, enhancing its ability to stretch and recover: two hallmarks of youthful, healthy skin. These biomechanical benefits support the product's positioning as a pro-longevity skincare solution targeting both functional and visible signs of skin aging.

Table 4. Skin biomechanics (mean ± SE): R2 (elasticity), R0 (firmness), and R9 (resilience) measured with the Cutometer® in the "perfect skin" group (D0) and the test group at D0, D14, and D28. The last column shows test group values as % of the youthful reference (set at 100%). *$p < 0.05$ *vs* D0; ***$p < 0.001$ *vs* D0; †$p < 0.05$ *vs* "perfect skin" at D0.

Parameter	Timepoint	"Perfect skin" group	Test group	% of perfect skin value
R2 (Ua/Uf) (Elasticity)	D0	0.7005 ± 0.0050	0.6335 ± 0.0177†	90.50%
	D14	–	0.6460 ± 0.0160* (+2.3% *vs* D0)	92.20%
	D28	–	0.6635 ± 0.0140*** (+5.2% vs D0)	94.7%
R0 (Uf) (Firmness)	D0	0.3779 ± 0.0156	0.4040 ± 0.0119†	106.90%
	D14	–	0.3913 ± 0.0123* (-3.2% *vs* D0)	103.60%
	D28	–	0.3783 ± 0.0126*** (-6.5% *vs* D0)	100.1%
R9 (R3-R0) (Resilience)	D0	0.0308 ± 0.004.	0.0347 ± 0.0012†	112.70%
	D14	–	0.0331 ± 0.0011*** (-4.4% *vs* D0)	107.50%
	D28	–	0.0328 ± 0.0010*** (-5.3% *vs* D0)	106.5%

3.5. Skin density & thickness: reinforcing structural integrity

Skin thickness was measured on the cheekbone using high-frequency ultrasound. After 28 days of twice-daily application of the sDNA-based cream, dermis + epidermis thickness increased significantly by 5.1% compared to baseline. This gain, observed in most subjects

(with a maximum individual increase of +234 µm, or +21.7%), reflects dermal matrix reinforcement and visible tissue densification, both associated with enhanced regenerative capacity. These results suggest that the sDNA-based formula supports structural remodeling, contributing to improved firmness and long-term skin resilience.

Table 5. Dermis + epidermis thickness (mean ± SE, µm) in the test group at baseline (D0) and Day 28 (D28), measured on the cheekbone using high-frequency (50 MHz) ultrasound.

Timepoint	Test group (µm)
D0	1447.8 ± 40.0
D28	1522.0 ± 39.4*** (+5.4% *vs* D0)

3.6. High subjective satisfaction, Standardized VISIA® images and excellent dermatological tolerance

Self-assessment after 28 days showed high levels of satisfaction (*Table 6*).

Table 6. Summary of perceived skin benefits after 28 days and their correspondence with clinically measured parameters. The alignment between subjective responses and objective markers (hydration, radiance, firmness, thickness, elasticity, wrinkle reduction) highlights the dual efficacy, perceived and measurable, of the sDNA-based formulation.

Perceived benefit	% Positive responses	Associated measured clinical parameter
Improved hydration	100%	↑ Hydration (+22.6%, D28 *vs* D0)
More luminous skin	95.50%	↑ Radiance (+25.1%, D28 *vs* D0)
More revitalized skin	90.90%	↑ Resilience (R9: -5.3%, D28 *vs* D0)
Skin feels more replenished / toned / replumped	95.50%	↑ Firmness (R0: -6.5%, D28 vs D0) ↑ Elasticity (+5.2%, D28 *vs* D0) ↑ Thickness (+5.4%, D28 vs D0)
Skin looks healthier and more smoothed	100% 95.5%	↑ Surface smoothness (-8.1% roughness, D28 *vs* D0) ↓ Wrinkle depth (-10.5%, D28 *vs* D0)

Standardized VISIA® imaging further confirmed visible benefits in tone uniformity, surface texture, and wrinkle appearance after 28 days (*Figure 1*), reinforcing the convergence between clinical evaluations, instrumental data, and subjective experience. Together, these findings highlight the global efficacy and strong consumer relevance of this sDNA-based pro-longevity skincare innovation.

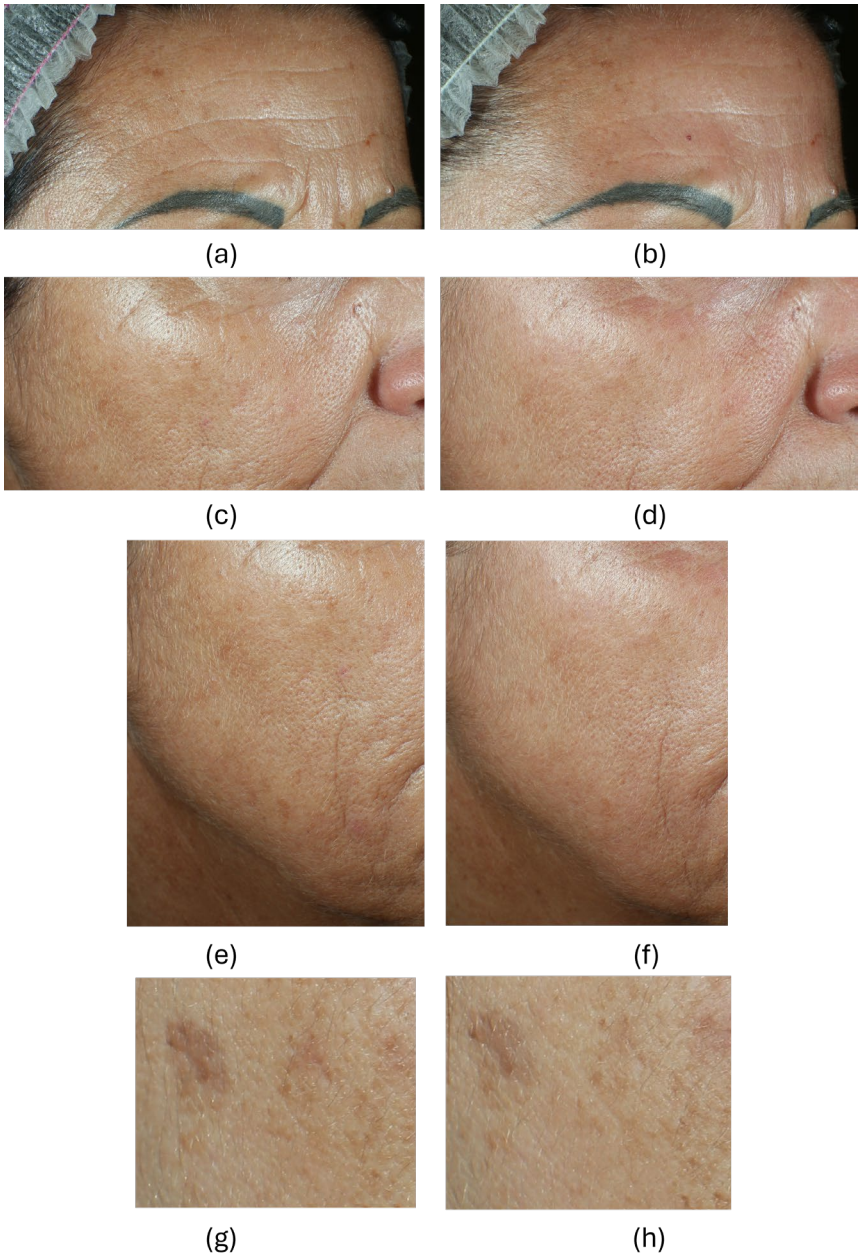

Figure 1. Standardized VISIA® images of “Volunteer 18” (a-f) and “Volunteer 10” (g,h) at Day 0 (left, including (a), (c), (e), (g)) and Day 28 (right, including (b), (d), (f), (h)), captured using parallel polarized light. Visible improvements include reduced frown lines and crow’s feet wrinkles (a *vs* b), enhanced radiance and diminished fine lines in the periorbital area, along with a smoother texture (c *vs* d), increased radiance and a firmer jawline (e *vs* f), and less prominent dark spots (g *vs* h).These results confirm the formulation’s global rejuvenating effect, in line with instrumental and self-assessment data.

Dermatological tolerance was evaluated on Days 0, 14, and 28 by a board-certified dermatologist, monitoring clinical signs. No adverse reactions were reported, confirming the excellent tolerability of the sDNA-based formula, even in individuals exposed to lifestyle-related skin stressors.

4. Discussion

This study supports the emerging paradigm of pro-longevity skincare, which moves beyond masking signs of aging to restoring the skin's biological capacities, metabolic activity, structural integrity, and regeneration, by targeting upstream dysfunctions [12]. The sDNA-based cream evaluated here was designed to activate key pathways of cutaneous vitality and longevity [10].

A key strength of the study is the use of a youthful reference panel as a physiological benchmark, providing a meaningful comparison to assess not just improvement, but the degree of skin recovery, an approach aligned with current expert recommendations [13].

After 28 days, the test group showed significant improvements in hydration (+22.6%), radiance (+25.1%), and firmness (−6.5% in R0), reaching or exceeding youthful reference values. These functional changes were accompanied by increased dermo-epidermal thickness, suggesting deeper structural regeneration, counteracting the thinning associated with aging [14–16]. Radiance recovery to 96.7% of youthful levels further reflects improved oxygenation, turnover, and metabolic balance, all contributors to perceived vitality and attractiveness.

These outcomes are consistent with prior proteomic data showing that sDNA modulates six hallmarks of aging—mitochondrial metabolism, autophagy, antioxidant defense, DNA repair, proteostasis, and epidermal communication [2,4,10]. Mitochondrial function, a key element of regeneration, was particularly enhanced in sDNA-treated keratinocytes, supporting the observed improvements in thickness, firmness, and radiance.

Importantly, results were achieved in mature volunteers exposed to chronic lifestyle-related stressors (e.g., poor sleep, pollution, smoking), confirming the formulation's real-life effectiveness [3,4]. The biomimetic formulation likely helped restore a healthier microenvironment favorable to regeneration.

Finally, high user satisfaction and excellent dermatological tolerance reinforce the product's holistic efficacy and suitability for long-term use, even in stressed skin. By linking molecular activation to visible and structural renewal, and by introducing a benchmark-based evaluation model, this study contributes to a new vision of beauty, defined by functional restoration and lasting vitality at the cellular level.

5. Conclusion

This study introduces a benchmark-based approach to cosmetic evaluation and demonstrates that a topical sDNA-based formulation can restore key skin functions, hydration, radiance, firmness, and elasticity, by targeting upstream aging mechanisms. Results on more mature skin exceeded youthful reference values, even under exposomal stress, confirming sDNA as a pro-longevity active. These findings support a shift toward proactive strategies that preserve skin vitality at both structural and functional levels.

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