FOCUS by skinobs

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Testing expert discussion around hydration evaluation

They contribute to this expert panel

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CORNEOCYTES 3D ANALYSIS - HYDRATION CLAIMS - BARRIER FUNCTION

VISUALIZE SKIN HYDRATION

A new structural proof for **hydration claims**

Hydration is more than a conductance value. With XFluo® 3D, Kamax visualizes fresh corneocytes collected by stripping and quantifies their surface roughness (Rq), providing a new structural reading of the stratum corneum.

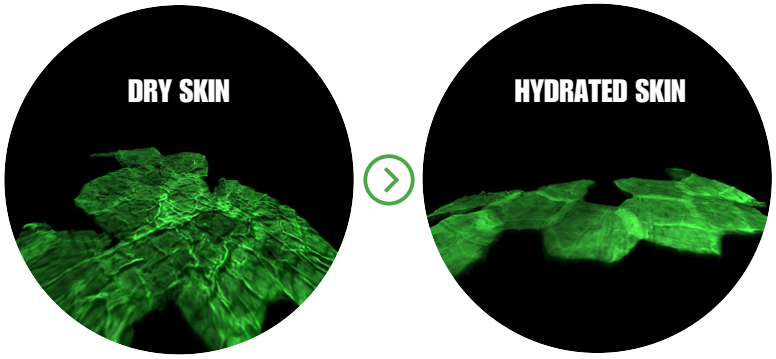
3D / 4K Imaging
High-resolution reconstruction of fresh corneocytes

Rq quantification
Surface roughness measured in µm

Non-denaturing
Fluorescent labelling preserving cellular integrity

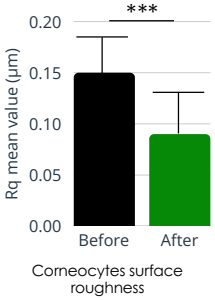
Fast workflow
Fresh strip analysis, custom views and video output

WHAT YOU SEE

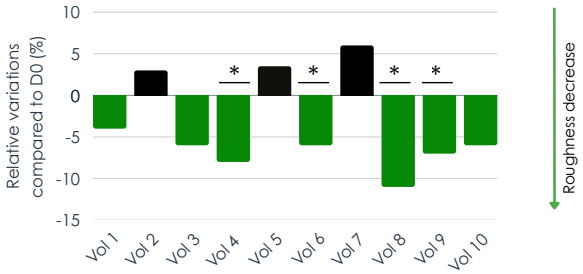


- ✓Corneocyte morphology and cohesion
- ✓Barrier function-related information
- ✓Dry skin vs hydrated skin signatures

WHAT YOU MEASURE



UP TO 40% DECREASE IN SURFACE ROUGHNESS



Scientifically supported claims

Skin hydration
Barrier restoration
Skin smoothness
Nourishing effect

Applications

- Active ingredient screening
- Finished product evaluation
- Preventive or corrective efficacy studies
- Suitable for skincare, hygiene products and nutraceuticals

XFluo® 3D goes beyond conductance-based measurements. It documents the structural response of the stratum corneum to your formula, adding a new layer of evidence to support hydration and barrier-function claims.

kamax innovative system

Scan to learn more about XFluo® 3D

Kamax is a young, innovative company founded in 2013 in Limoges, France. The company develops technologies derived from research conducted by CNRS-XLIM and the University of Limoges.
contact@kamax-innovative.com

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Skin hydration: when innovation meets the gold-standard claim

SKINOBS

Anne Charpentier - CEO & Founder

Ilona Salomon - Communication manager

Why has the most universally sought-after claim in cosmetics never ceased to reinvent the way in which it can be scientifically substantiated?

Hydration remains the most systematically supported claim in clinical studies, regardless of product category, country, or consumer target. Brands developing **anti-ageing, soothing, radiance-enhancing, anti-pollution or barrier-repairing** formulas all ultimately face the same fundamental question: **how does this product act on skin hydration, and how can it be scientifically proven?**

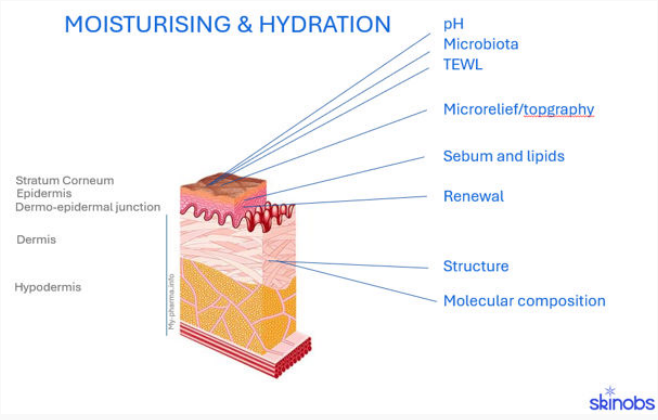
It is the proof itself, its nature and its scientific component, that concentrates all the complexity of evaluating this product's performance. Skin hydration is not a surface phenomenon occurring in isolation. It traverses **all layers,** stratum corneum, epidermis, dermis, from the surface to the dermal matrix, and contributes to the overall equilibrium of the skin. Essential to life, **water homeostasis** maintains the water gradient from depth to surface and contributes to barrier function. It is interdependent with various essential mechanisms such as epidermal renewal, pH regulation, temperature regulation, microbiome balance, immune and inflammatory equilibrium, and hormonal and neuroendocrine homeostasis. The importance of the skin's response to environmental stress and the overall impact of the exposome must also be considered. Measuring "hydration" in a meaningful way requires deliberately choosing which layer and which mechanism one intends to capture.

Towards a Multi-Modal Approach

The modern beauty routine is perceived in an integrative manner, encompassing **quantified performances, emotional balance, and lifestyle.** Within this holistic vision, hydration is both a visible indicator of skin condition and balance, and a symbolic expression of vitality. Consumers seek measurable structural improvements, neurosensory pleasure, and enhanced self-esteem.

In *in-vivo* volunteer studies, whether clinical protocols with expert evaluation or biometric measurements, descriptors such as "hydrated" must be translated into intelligible, meaningful, and reproducible outcomes. The *in-vivo* assessment of hydrating effects relies on the use of various methodologies:

1. **Consumer tests with self-assessment:** these tests reflect the users' perception of the product. Participants indicate their perception of hydration using structured questionnaires and rating scales. These tests capture the subjective improvement expected by consumers and are essential for substantiating claims.
2. **Clinical evaluation by scoring:** semi-quantitative assessment carried out by qualified evaluators. Trained dermatologists or cosmetologists assess hydration using validated scales under standardised lighting and imaging conditions. This method reduces, though does not eliminate, subjectivity.
3. **Sensory analyses and neurosensory measurements:** these capture unconscious or emotional responses. The study of emotional processes represents an inexhaustible source of innovation for the cosmetics industry. It is essential to combine the study of the three emotional components: behavioural, physiological, and cognitive, and to pay particular attention to methodological rigour. Emerging methods such as facial expression analysis, eye-tracking, and EEG measure unconscious reactions.
4. *in-vitro/ex-vivo* assays and specific biomarker analysis.
5. ***in-vivo* biometrological measurements:** objective and instrumental measurements of the optical properties of the skin. A broad range of optical and imaging devices enables the objective quantification of hydration.



The Reference: Instrumental Dielectric Measurement

Since the 1980s, the reference approach has been based on the electrical behaviour of the skin. The Corneometer was the first device to be commercialised by the German company Courage & Khazaka and has become the universal standard for the evaluation of skin hydration.

Today, the Corneometer CM 825 measures capacitance

over the first 10 to 20 µm of the stratum corneum and serves as the benchmark; other hydration measurement instruments being calibrated by comparison with it.

Currently, a large number of probes (17 referenced to date on the Skinobs platform) measure capacitance, impedance or permittivity to quantify the water content of the skin, with devices adapted to each depth:

• The stratum corneum: Corneometer CM825, Dermalab, Epsilon, MoistureMeter SC, Skicon-200, DPM 9003, EveKey Skin
• The epidermis: MoistureMeterEpiD, Nevisense
• The dermis: MoistureMeterD

New devices based on this same technology are regularly emerging, such as the Nevisense (Scibase), Z-Pen (Clarins-Piwio), and particularly for novel nomadic applications intended for home diagnostic devices. The value of these devices is as much operational as scientific: rapid, reproducible, usable in all climatic conditions and across all skin ethnicities, and well understood by regulators, testing laboratories, cosmetics brands, and ingredient manufacturers alike.

Alternative Measurements of Interest

The **measurement of transepidermal water loss** (TEWL) takes an indirect route by monitoring the moisture gradient escaping from the skin surface. Particularly useful for measuring long-term effects and lipid-rich formulas, TEWL serves as a **general marker of barrier function.** Indeed, barrier integrity will determine whether hydration is maintained over time, and not merely at the moment of application. The devices used (6 referenced on the platform and used by more than 100 CROs): Tewameter 330, Tewameter HEX, Tewameter Nano, DermaLab, Aquaflux, Vapometer, RG1 Evaporimeter.

The skin microbiota and skin hydration maintain a close interdependent relationship. A well-hydrated stratum corneum provides a favorable environment for commensal bacteria, notably Staphylococcus epidermidis, which contributes to maintaining the acidic pH of the cutaneous mantle. This acidic pH in turn governs the activity of lipid enzymes involved in the synthesis of the intercorneocyte cement, thereby reinforcing the barrier and limiting transepidermal water loss. Conversely, dysbiosis impairs barrier integrity and promotes skin dryness. Jointly assessing microbiota and hydration through in vivo collection methods (swabbing/stripping/curling, etc.) coupled with multi-omic analyses opens new perspectives for objectively demonstrating efficacy in dermato-cosmetics.

Furthermore, a broader palette of tools has been developed, quantifying and/or visualising directly the quantity of water, lipids, and their impact on skin structure through optical and spectroscopic methods:
• In vivo microtopography (MoistureMap 100-200, Epsilon E100), with a conversion of conductivity measurements into a greyscale image
• Microtopography from stripping: XFluo-3D Fluorescence technology or Atomic Force Microscopy
• Near-infrared spectroscopy, NIRS, Dermo
• Confocal Raman spectroscopy: Raman spectroscopy gen2-SCA, LabRam 800, Aqualog
• Opto-thermal emission radiometry (OTTER)
• 2D surface imaging: Visioscan VC, C-Cube, EvaSurf, Dermalab, SkinCam, DigiCam, SpectraFace, Derma Reader/Scope, LifeViz, Hirox, VideometerLab, etc.
• 3D surface imaging: Antera 3D, Visia 3D
• Study of lipids, their quantity, distribution, and composition to better assess skin hydration equilibrium phenomena, via HPLC measurements, transmission electron microscopy, etc.

High-Resolution and Molecular Readings

The frontier of measurement has shifted towards non-invasive techniques that directly visualise skin structure rather than inferring it from surface signals. Multiphoton tomography, confocal microscopy, and Raman spectroscopy now make it possible to observe water distribution and molecular composition in situ, layer by layer.

Among these, LC-OCT (Line-field Confocal Optical Coherence Tomography) merits particular attention. Initially developed for dermatological diagnosis (detection of skin cancers, characterisation of lesions), LC-OCT delivers 3D imaging combining quantitative depth data with a genuinely visual, almost histological, non-invasive and biopsy-free reading of the skin. What is now emerging is its extension towards the substantiation of cosmetic claims: a diagnostic-grade instrument finding a second application by associating quantified hydration data with visual proof, complementing the numerical result expected by both regulators and marketing teams. This is a compelling example of how clinical evaluation is no longer limited to producing a figure: it now produces a figure that can be visualised.

The Mechanistic In Vitro Approach

All this instrumental evidence means little without an understanding of what occurs at the cellular scale; this is where in vitro and ex vivo work finds its place, not as a substitute for the clinical study, but as a mechanistic explanation.

Hyaluronic acid remains the reference molecule, prized for its almost unrivalled capacity to bind water within the extracellular matrix. The **natural moisturising factor (NMF),** those free amino acids released by the degradation of filaggrin, governs flexibility, desquamation, and the overall homeostasis of the barrier at the level of the stratum corneum. Aquaporins, those membrane proteins forming water channels, decline with age, a phenomenon increasingly recognized as a direct driver of progressive skin dehydration; this also explains why anti-ageing actives that support aquaporin expression carry a hydrating benefit almost by mechanism, and not merely by association.

Other markers merit monitoring: glycosaminoglycans and proteoglycans, which help retain water within the dermal matrix; CD44, the principal membrane receptor for hyaluronic acid; caspase-14, which drives the proteolysis of filaggrin into NMF precursors; ceramides and phospholipids, whose physical organisation within the lipid bilayers of the stratum corneum is itself a determinant of hydration status; and matrix metalloproteinases, involved in the remodeling that either sustains or weakens the density of the extracellular matrix over time.

These markers can be **monitored on several type of assay supports** 2D cell lines, co-cultures, iPS-derived models, 3D organoids, or complete reconstructed skin models, bioprinted or otherwise, by gene expression, histology, or protein assays (ELISA, Western Blot). Dehydration itself can be simulated in vitro, typically by increasing salt concentration or withdrawing culture medium, enabling protective or reparative ingredients to be tested well before the design of a full clinical study.

Designing the Right Protocol

Hydration claims can be substantiated across very different time horizons: short-term effects between 30 minutes and one hour, intermediate effects over one day, or sustained effects over one to four weeks. The choice of device, panel size and inclusion criteria, and acclimatization protocol depends entirely on the objectives defined by the product claims. A formula rich in electrolytes or small humectant molecules may artificially inflate impedance-based readings, just as a lipid-rich formula may underestimate them; these are not flaws in the method, but reasons to select the appropriate combination of methods suited to the formula. This is precisely where early and detailed exchanges with testing laboratories prove their worth, by defining inclusion criteria, measurement schedule, treatment conditions, and instrumentation before the protocol is finalized.

The Next Step: Combining Biomarkers and AI

The truly prospective development is not a new standalone device; it is what occurs when this molecular evidence is combined with artificial intelligence. Rather than reading biomarker panels, images, and biophysical measurements as separate, siloed datasets, AI-driven analysis can cross-reference them, revealing correlations that would remain invisible to a researcher examining each technique in isolation. For hydration in particular, this means models trained to link, for instance, aquaporin or filaggrin expression to TEWL trajectories and structural changes observed in imaging, with the possibility of **predicting which formulations will perform clinically** before even launching a full in vivo study.

The practice remains emergent rather than standardized, but it signals the direction in which claims substantiation is heading: a multimodal approach combining biological mechanisms, biophysical measurements, and visual evidence, all interpreted in light of all the data generated.

Key Takeaways

Hydration testing has not become simpler as the palette of available tools has expanded; if anything, the reverse is true. Yet these technological advances are good news for brands and ingredient manufacturers: the current combination of instrumented biophysics, imaging techniques such as LC-OCT, compositional techniques such as Raman spectroscopy, and the nascent coupling of molecular biomarkers with **AI-driven analysis** now offers the means to substantiate a hydration claim with a scientific depth and credibility that simply did not exist ten years ago. The brands that make the best use of this field of investigation are not necessarily those that multiply tests; they may rather be those that choose the right combination, conceived from the outset in relation to their primary and secondary claims.

In conclusion, hydration is defined by a multidimensional synergy of biological, optical, and perceptual determinants. Its validation requires an **integrated framework combining** the study of in vitro mechanisms, subjective consumer feedback, expert evaluation, and advanced biometrology. Modern assessment favors 2D/3D imaging, non-invasive microscopy, and measurements of the dielectric component of the skin. Ensuring data integrity demands standardized protocols focused on precise spatial repositioning and robust acquisition (technician/machine). The future of this performance lies in the convergence of high-definition optical sensors and AI algorithms, which bridge the gap between neurosensory perception and physiological parameters.

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TYPE OF METHODS	STUDIED EFFECT	ROLE	DEPTH IN THE SKIN	IMAGING	IMAGING & QUANTIFICATION	QUANTIFICATION
Hydration evaluation	Dielectric component of the Stratum Corneum	Evaluation of the Hydration content via the relation of the hydration rate and the response of the dielectric component of the tissue through the capacitance, permitivity...	Stratum corneum | Epidermis		Epsilon, Skicon-200	Corneometer (C+K), DPM 9003 , Moisturemeter SC/D/epiD, Dermo, Epsilon, DermaLab (Cortex); Nevisense, Skicon-200
	Spatial distribution & surface microtopography	Evaluation of the Hydration by reflexion of the Near Infra-red closed to the hydration transmission bands	Stratum corneum		MoistureMap (C+K), SkinChip (L'Oréal)	NIR Spectroscopy
	Hydration gradient	Evaluation of the Hydration content via the response of the capacitance.	Stratum corneum | Epidermis			Opto-thermal emission radiometry (OTTER)
	Optical by Infra-red	Optical technologies via Laser excitation and thermal analyse	Stratum corneum			
Composition of the skin	Biomarkers of the Stratum Corneum	General biomarkers(NMF...) involved in the hydration balance after skin strippings	Stratum corneum			SquameScan, Genomic, metabolomic, proteomic, multi-omics, HPLC...
	Collagen content	The water contained in the collagen network gives the dermis its viscoelastic properties. It maintains an interstitial pressure gradient that directs the flow of water towards the upper layers.	Dermis	Scanning electron microscopy (SEM)	SIAScope - Dermo	
	Molecular content & distribution in the skin	For specific molecules, keratin, collagen, lipids, water, hyalutonic acid involved in the Hydration balance	Stratum corneum | Epidermis | Dermis		LC-OCT	Aqualog, Sonde Raman (Horiba), Raman spectroscopy gen2-SCA,Genomic, metabolomic, proteomic, multi-omics...
Sensory & perception	Softness & tribology of the skin surface	The surface, the roughness and the shape of the keratinocytes give information of the quality of the Stratum corneum.	Stratum corneum			
Surface of the skin	Nanotopography of the corneocytes via stripping	The surface, the roughness and the shape of the keratinocytes give information of the quality of the Stratum corneum.	Stratum corneum		ECTI, CNOs (Loretta), Xfluo	
	Surface visualization and Microrelief network	General evaluation of the skin conditions	Stratum corneum	Videomicroscope, Dermascope, DermLite DL100, Videometer Lab, VEOS DS3, DermaLab Videoscope (Cortex)	Antera 3D (Miravex), DermaTOP-HE-60, EvaSurf (Eotech), SpectraCam, SkinCam , Visioscan (C+K), Visia CR, C-Cube (Pixience)...	
	Surface caracterisation	General evaluation of the skin conditions	Stratum corneum			Scorage, sensory panel trained or naive panel, neuro-pshycosensorial (EEG, mood board, f-IRM...)
Structural mechanisms	Epidermis renewal	Keratinocyte turnover is a major determinant of skin hydration because it conditions both the quality of the stratum corneum, the effectiveness of NMF and the integrity of the lipid barrier.	Epidermis			DHA or Dansyl Chloride marking and Skin color analysis
	Lipids fractions & distribution	The main function of skin lipids (ceramids, cholesterol, in hydration is a barrier function that directly conditions water retention in the intercorneocytar space and all skin layers.	Stratum corneum		Transmission electron microscopy (TEM), Immune-fluorescence Microscopy, Fluorescence Light microscopy, HPTLC	Fourier transform infrared spectroscopy (FTIR ATR), Chromatography (HPTLC, LC/MS), OTTER
	Structure : visualization by Microscopy	Direct and non-invasive 3D observation of the skin structure, the different cell layers and the cells.	Stratum corneum | Epidermis | Dermis	Vivascope , Vivosight	LC-OCT	
	Structure : visualization by Ultrasound	Direct and non-invasive 2D observation of the skin structure, the different cell layers and the cells.	Stratum corneum | Epidermis | Dermis		Dermascan, Dermcup, Dermalab (Cortex), DUB®SkinScanner 50/22 (Eotech), Utrasound WED-2018	
	Transepidermal Water Loss by TEWL	The water evaporation of the skin evaluate the skin barrier's ability to retain skin water and maintain the hydration gradient	Stratum corneum			Aquaflux, Vapometer , RG1 Evaporimeter ,Tewameter 330, Tewameter HEX, Tewameter Nano (C+K), Dermalab-TEWL (Cortex)

Make your hydration assessments in a controlled environment

VALIDATED
CLAIM SUPPORT

VALIDATED CLAIM SUPPORT

Jane Tervooren - Vice President

Topical hydration evaluation is all about understanding how well the skin holds onto moisture and how strong its barrier function is. Unlike systemic hydration, which looks at the body as a whole, this type of assessment focuses specifically on the outermost layer of the skin, the stratum corneum. This layer plays a critical role in keeping water in and environmental stressors out, so measuring its hydration accurately is key in both dermatology and cosmetic science. However, because the skin is constantly interacting with its surroundings, factors like temperature and humidity can easily influence results. That's why controlling the testing environment is so important.

The stratum corneum is made up of **dead skin cells** (corneocytes) held together by lipids, along with **natural moisturizing factors** that help retain water. When this system is working well, the skin looks smooth, plump, and healthy. When it's compromised, you'll see dryness, flaking, and increased sensitivity. To evaluate this, we use **non-invasive tools** like **corneometers**, which measure skin surface hydration, and transepidermal water loss (TEWL) devices, like **vapometers** or **tewameters** which assess how much water is escaping from the skin.

These tools are highly sensitive, not just to the skin itself, but also to the environment in which the measurements are taken.

Temprature is one of the biggest variables. When the surrounding temperature increases, skin temperature rises as well. This can boost blood flow and increase the movement of water through the skin, which may lead to higher TEWL readings.
At the same time, warmer conditions can trigger mild sweating, even if it's not noticeable, which can temporarily increase surface hydration readings. On the flip side, cooler temperatures can suppress these effects, sometimes making the skin appear less hydrated or more stable than it actually is. Without a controlled setting, it becomes difficult to tell whether changes in readings are due to the skin or just the room conditions.

Humidity is just as influential. In low-humidity environments, water evaporates more quickly from the skin, which can dry out the stratum corneum and increase TEWL. This often results in lower hydration readings, even if the skin hasn't fundamentally changed. In high humidity, the opposite happens, water loss slows down, and the skin retains more moisture, often leading to higher hydration values. This means that the exact same skin could produce very different results depending on whether it's tested in a dry or humid room.

Because of this, conducting topical hydration assessments in a **temperature- and humidity-controlled** space is essential for getting reliable data. Without that control, it's nearly impossible to separate real effects from environmental noise. For example, if you're testing a moisturizer and see an improvement in hydration, you need to be confident that the product is responsible, not a spike in room conditions during the test. Controlled conditions remove that uncertainty and make the results far more meaningful.

In most professional settings, testing is done at a stable temperature, usually around 20–22°C (68–72°F), and a relative humidity between 40–60%. Just as important is giving subjects time to adjust to the environment before taking measurements. Typically, this means sitting in the controlled room and **acclimating for 15–30 minutes**. This acclimation period allows the skin to stabilize after being exposed to outdoor weather, air conditioning, or even body heat from movement. Skipping this step can lead to inconsistent or misleading results.

Consistency also matters when measurements are repeated over time. Many studies look at hydration before and after using a product, or track changes over days or weeks. If each measurement is taken under different environmental conditions, it becomes hard to know whether differences are real or just due to changes in temperature or humidity. Keeping the environment consistent ensures that comparisons are valid and that any trends observed are actually meaningful.

This level of control is especially important in cosmetic testing and claim support. When a brand says a product "improves skin hydration" or "strengthens the skin barrier," those claims need to be backed by solid, reproducible data. Measurements taken in uncontrolled environments are more likely to be questioned because they can be influenced by external factors. Controlled testing, on the other hand, adds credibility and makes the results much more defensible, whether for marketing, regulatory review, or publication.
Another benefit of a controlled environment is reducing variability between individuals. Everyone's skin is a little different, some people naturally lose more water, while others are more sensitive to environmental changes. By **standardizing the testing conditions**, we can better isolate those individual differences and understand how different skin types respond to products or treatments.

Overall, topical hydration evaluation isn't as simple as taking a quick reading. It's a process that requires careful attention to both the skin and the environment. Temperature and humidity can significantly influence the results, sometimes in subtle ways that are easy to overlook. By using a controlled space and allowing proper acclimation, researchers and clinicians can ensure that their data is **accurate, consistent, and truly reflective** of what's happening at the skin level.

VALIDATED CLAIM SUPPORT

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Skin hydration: why imaging is becoming essential in assessment protocols

PIXIENCE

Sébastien Mangeruca - CEO

Skin hydration remains one of the major axes of dermocosmetic evaluation. Whether it is moisturizing, restorative or soothing treatments, the demonstration of effectiveness has historically relied on instrumental measures such as corneometry or insensible water loss (TEWL).
Today, expectations are changing. Beyond biophysical values, brands also want to **objectify the visible consequences** of hydration on the skin: smoother texture, reduced scales, improved skin comfort or surface homogeneity.
In this context, clinical imaging provides an essential complementary dimension.

Hydration: a visual perception

Dehydrated skin does not only result in a decrease in the water level measured by a catheter. It is also accompanied by visible changes:
- **Increased roughness**,
- Appearance of **scales**,
- Loss **of radiance**,
- **Redness** related to an alteration of the skin barrier.

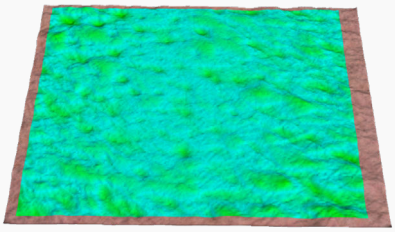
These manifestations have a direct influence on consumer perception. This is why standardized visual analysis is becoming an important issue in efficacy studies.
The goal is no longer just to demonstrate that a product moisturizes, but also to show how this hydration concretely improves **the appearance of the skin**.

The C-Cube: a complementary approach for skin hydration

The **C-Cube Clinical Research** is part of this logic by allowing to analyze the visual consequences of the skin's hydration state.
Thanks to its standardized imaging, the C-Cube evaluates various parameters that visually reflect the skin's moisture state.

Surface roughness: a key indicator

One of the first visible signs of dehydrated skin is an increase in surface roughness. Impaired hydration often results in a more uneven skin surface, with more pronounced contours and a less smooth skin feeling.
Thanks to its 3D analysis by **stereophotometry**, the C-Cube makes it possible to reconstruct the skin surface and extract parameters from the **ISO 25178 standard**: Sa (average roughness), Sq, Sdr.
Improved hydration often results in less roughness and a more even surface.
This data helps support claims such as: «smoothes the skin», «improves skin texture», «reduces surface irregularities».



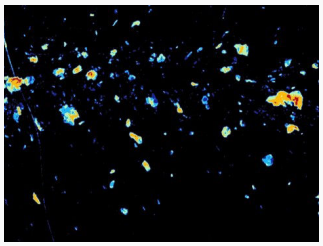
Roughness rendering

Visible flaking and dryness

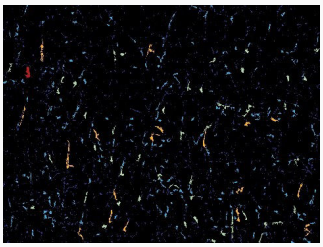
The C-Cube also allows the analysis of desquamation, as well as:
- **Ex vivo,** via sampling patches,
- **In vivo**, directly on the image.

The quantification of dander is a particularly relevant indicator in studies on:
- Dry skin,
- Nourishing care,
- Skin barrier repair products.

The evolution of desquamation can thus be correlated with **the improvement in skin comfort** observed by the volunteers.



Desquamation on a sampling patch



In-vivo desquamation

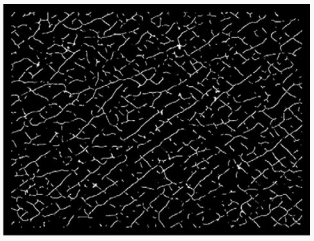
Microrelief sharpness: a visual marker of skin dryness

The skin's hydration status strongly influences the appearance of the skin's **microrelief**. On well-hydrated skin, the furrows generally appear less marked and more homogeneous.

Conversely, dry skin often has **more visible reliefs**, linked to the accumulation of scales in and around the skin folds.
To objectify this phenomenon, the C-Cube uses a line detection algorithm to identify the **grooves visible** in the image.The analysis is based on two complementary criteria:
• The sharpness and visibility of the detected grooves,
• The colorimetric difference between the furrows and the surrounding skin.
The greater the contrast, the more pronounced the microrelief appears.The combination of these two estimates thus makes it possible to generate an index of **the sharpness of the microrelief**.
This parameter provides a particularly relevant reading of the effects of moisturizing or repairing treatments, in addition to the classic roughness or flaking measurements.

Microrelief Detection

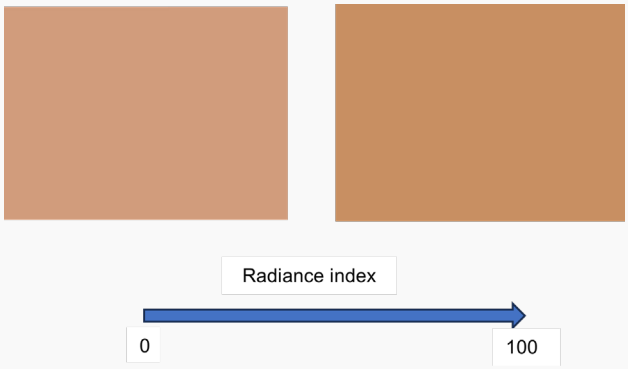
Image source



Processed image

Hydration and radiance: objectify the skin's luminosity

The skin's hydration status directly influences its ability to reflect light. Dehydrated skin often appears duller, less homogeneous and less luminous.
To objectify this effect, the C-Cube allows you to calculate a radiance index based on the L* color component, corresponding to the brightness in the CIE L*a*b* color space.
Thanks to its **calibrated** and **homogeneous** imaging, the system analyzes the variations in luminosity on the skin surface in order to evaluate the evolution of the skin's radiance during a protocol.
This approach supports claims such as:
• «restores radiance»,
• «brighter skin»,
• «fresher and even complexion».
In addition to traditional biophysical measurements, this analysis provides a visual and quantitative reading that is particularly relevant in studies dedicated to hydration and overall skin quality.



Actionable visuals for proof of effectiveness

Beyond numerical values, imaging also plays an important role in the valorization of results.
3D mapping, texture renderings, visualization of scales or before/after comparisons allows to generate visual evidence that can be directly used in:
• Clinical reports,
• Scientific presentations,
• Marketing materials.

This approach responds to a growing market expectation: **to combine objective data with clear visual demonstration.**

Towards a new generation of skin hydration assessment

The evaluation of hydration can no longer be limited to a single biophysical measurement.The expectations of brands and consumers are evolving towards a **more comprehensive understanding of the visible effects** of skincare on skin quality.

Beyond the barrier function, the challenge now is now to also objectify the texture, radiance, homogeneity and visible manifestations of skin dryness.

By providing a morphological, quantitative and visual reading of these phenomena, the C-Cube Clinical Research complements traditional instrumental approaches and paves the way for a more intuitive, **more** illustrated **demonstration of effectiveness** that is closer to the **real perception of consumers**.

Clinical imaging thus becomes a central tool in modern dermocosmetic evaluation protocols, **at the crossroads of scientific measurement and visual evidence**.

PIXIENCE
HEALTHCARE TECHNOLOGY SOLUTIONS

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Understanding skin hydration: advanced measurement solutions

COURAGE + KHAZAKA - MONADERM

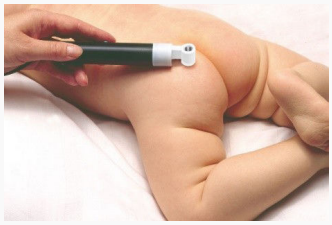
Diana Khazaka - General Manager

Evaluation of skin hydration is a fundamental measurement in dermatological and cosmetic research, particularly for substantiating efficacy claims and investigating skin physiology. Hydration directly influences biomechanical properties, desquamation, barrier integrity, and the formation of fine lines and wrinkles. Objective and reproducible measurement methods are therefore essential for skin research.

Corneometer® – Quantitative Measurement of Stratum Corneum Hydration

The **Corneometer®** is internationally established as **the reference instrument** for non-invasive measurement of stratum corneum hydration. The device is based on capacitance measurement, utilizing the high dielectric constant of water to quantify hydration levels within the superficial skin layers. Hardly any cosmetic company worldwide is unfamiliar with the Corneometer® or does not already work with it. Thousands of scientific publications using the device underline its position as the **gold standard in skin hydration assessment.**

The latest development extending the classic laboratory application of the Corneometer® is the **"Cliniscale"** project. In this innovative concept, product performance can additionally be monitored directly in the subject's home environment. Using a smartphone app that is highly customizable by the laboratory for the respective study, study volunteers can answer questionnaires and perform skin hydration measurements with a Bluetooth-enabled Corneometer®. Answers to questions in the app and measurement results are transmitted to the laboratory in real time, enabling researchers to collect information on product performance under real-life conditions. At the same time, subjects feel more involved in the study process, increasing motivation and compliance with product application protocols.



Tewameter® – Skin Barrier Quality and Beyond

Skin hydration is inseparably linked to skin barrier quality. The standard parameter for assessing skin barrier integrity is **transepidermal water loss (TEWL).** State-of-the-art measurement of this parameter is provided by the **Tewameter® TM Hex**, which utilizes 30 pairs of sensors in an open chamber configuration to achieve highly stable TEWL measurements within only twenty seconds. Due to the high density of measured data points, in addition to TEWL, the system enables assessment of advanced parameters such as the **local skin energy balance**, differentiated into **evaporative cooling** and **heat diffusion**. First promising studies investigating the relevance and applications of these novel parameters have already been published.
The versatile Tewameter® family further includes specialized probes for measurements on very small skin areas (scalp, lips, nails), as well as probes for in vitro TEWL measurements on Franz diffusion cells and simultaneously in 24-well cell culture plates.

MoistureMap® – Capacitance Imaging of Hydration Distribution

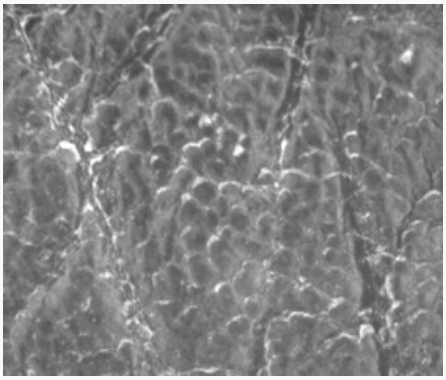
While single-point hydration measurements provide quantitative data, spatial visualization of skin moisture distribution offers additional insight into moisture heterogeneity. The **MoistureMap** enables analysis of hydration patterns across larger skin areas using capacitance imaging technology.

Fine lines and wrinkles appear as bright structures because they have no direct contact with the sensor surface. This allows detailed analysis of parameters such as anisotropy, polygon formation, and other aging-related skin characteristics. In addition, video sequences can be recorded and analyzed, which is particularly useful for in vitro applications and occlusion studies.

The MoistureMap® is also partly used for assessing moisture of hair. Together with the Corneometer® and the Tewameter®, both of which can be connected to the device, the MoistureMap becomes a **versatile all-round solution for hydration-related measurement applications**.

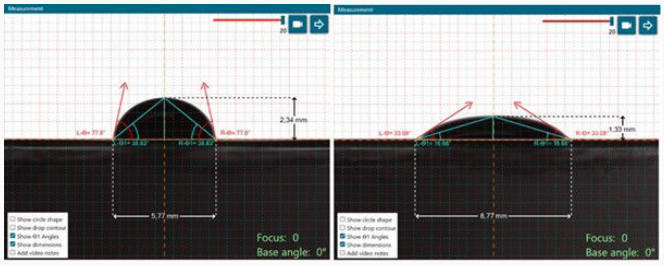
Visioscan® and Corneofix® – An unbeatable duo for dryness studies

The widely used **Visioscan®** skin camera makes dry skin conditions impressively visible using specialized UVA illumination and has been employed for decades in dryness



studies. Combined with the adhesive sampling method **Corneofix®**, desquamation of the uppermost skin layers or even the nails can be evaluated both quantitatively and qualitatively.
The classical rectangular Corneofix® tape has now been complemented **by three new disk-shaped formats of tapes.** Used together with a dedicated pressure-control instrument standardizing the force applied to the skin, they are ideally suited for the gentle removal of intact keratinocytes along with barrier components. This consistency makes the method exceptionally versatile: such as studying changes in keratin morphology or assessing the degree of protein carbonylation, a marker of oxidative damage. The new tape formats are also ideally suited for a wide variety of protein analyses and bioassays.

Drop Angle Meter – Surface Wettability and Skin Interaction Analysis



The **Drop Angle Meter** measures the contact angle of a liquid droplet on the skin surface, providing information on wettability and surface energy, offering an additional perspective on skin hydration. Influenced by hydration state, lipid composition, and topical formulations, the method is particularly useful for assessing skin surface properties, formulation spreadability, as well as water resistance and water repellence in skin, hair, and nail care applications. Together with the other hydration-related instruments from Courage + Khazaka, it completes a comprehensive portfolio for skin hydration analysis.

Courage + Khazaka – 40 Years of Skin Measurement Expertise

With 40 years of experience in bioengineering and skin physiology, Courage + Khazaka continues to set international standards in objective skin measurement.
Ask us for guidance in selecting the optimal device configuration for your next hydration study.

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Skin hydration, barrier function and epidermal homeostasis: advanced scientific approaches in cosmetic evaluation

GOYA INNOVA
Iván Parra - Commercial Director

Skin hydration is one of the fundamental physiological pillars required to maintain epidermal homeostasis and overall skin integrity. However, the modern concept of "hydration" has evolved significantly in recent years. Cosmetic efficacy is no longer understood solely as the external supply of water, but rather as the ability to optimize **barrier function, improve lipid organization** within the stratum corneum, and reduce transepidermal water loss (TEWL).

From a biophysical perspective, skin hydration refers to the water content present mainly within the stratum corneum, which is essential for maintaining elasticity, flexibility, corneocyte cohesion, enzymatic activity, and barrier performance. The epidermis contains **approximately 70–75% water,** while a physiologically balanced stratum corneum maintains a hydration level of around 10–20%.

Disruption of this equilibrium leads to progressive functional impairment characterized by:
- Increased TEWL
- Altered corneocyte cohesion
- Disruption of the intercellular lipid matrix
- Reduced elasticity and biomechanical flexibility
- Increased subclinical microinflammation
- Environmental stressors such as UV radiation, pollution, temperature fluctuations, oxidative stress, and aggressive surfactants can induce structural changes within the epidermis, altering lipid organization and compromising the skin's water-retention capacity.

Lipid barrier and regulation of skin homeostasis

Skin barrier function relies primarily on the highly organized extracellular lipid matrix of the stratum corneum, composed mainly of:
- Ceramides (~50%)
- Cholesterol (~25%)
- Free fatty acids (~10–15%)

These lipids are arranged in compact orthorhombic lamellar structures generated by epidermal lamellar bodies.

The integrity of this lipid architecture is essential to:
- Regulate selective permeability
- Minimize transepidermal water loss
- Protect against irritants and microorganisms
- Maintain epidermal osmotic homeostasis

Skin hydration and barrier function are now considered physiologically inseparable processes. Any quantitative or qualitative alteration of epidermal lipids immediately increases TEWL and reduces water-retention capacity.

The role of Natural Moisturizing Factor (NMF)

In addition to the lipid matrix, epidermal hydration depends on the Natural Moisturizing Factor (NMF), composed of free amino acids, PCA, lactic acid, urea, lactates, and hygroscopic electrolytes mainly derived from filaggrin degradation.
NMF regulates:
- Environmental water binding
- Stratum corneum plasticity
- Biomechanical flexibility
- Epidermal enzymatic activity
- Reduced NMF levels are associated with xerosis, impaired barrier function, and increased skin sensitivity.

Corneometry: biophysical assessment of epidermal hydration

Corneometry remains one of the gold-standard instrumental methods for quantitative evaluation of superficial skin hydration.

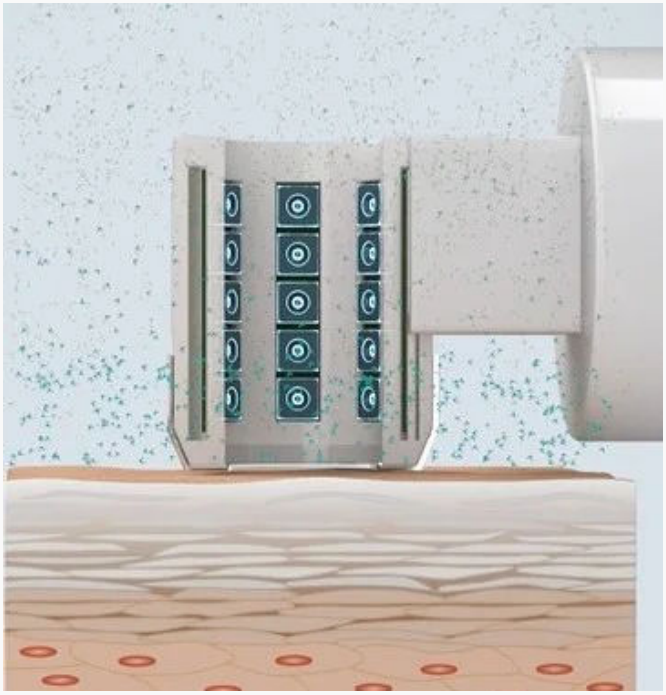
The Corneometer® measures the dielectric constant of the stratum corneum through electrical capacitance. Because water has a high dielectric constant, capacitance variations directly reflect changes in epidermal water content.
This technique enables:
• Immediate and long-term kinetic assessment
• Comparative formulation studies
• Evaluation of humectant efficacy
• Validation of "long-lasting hydration" claims
Advanced Moisture Mapping technologies additionally allow visualization of hydration distribution and stratum corneum microtopography.

TEWL as a functional biomarker of barrier integrity

Transepidermal water loss (TEWL) is currently considered the most robust functional biomarker for evaluating skin barrier integrity.

The Tewameter® quantifies water vapor flux from the epidermis to the environment by measuring the evaporation gradient according to Fick's diffusion laws.

Although TEWL does not directly measure lipid composition, it functionally reflects barrier organization.



Elevated TEWL indicates:
• Disruption of the lipid matrix
• Altered corneocyte cohesion
• Impaired barrier function
• Increased inflammatory susceptibility

Conversely, significant TEWL reduction following cosmetic application demonstrates:
• Functional barrier improvement
• Enhanced water retention
• Optimization of lipid organization
• Increased skin resilience

Today, TEWL is considered an essential endpoint not only in dermatology, but also in cosmetic studies focused on:
• Long-lasting hydration
• Barrier repair
• Sensitive skin
• Anti-pollution protection
• Recovery cosmetics
• Post-procedure skincare

Emerging approaches: epidermal lipidomics and molecular evaluation

The most advanced trends in cosmetic research now integrate classical skin biometrics with omics and spectroscopic technologies.

Techniques such as:
• Tape stripping + LC-MS/MS
• In vivo confocal Raman spectroscopy
• ATR-FTIR
• Epidermal lipidomics
Allow direct evaluation of:
• Ceramide composition
• Lamellar organization
• Cholesterol/free fatty acid balance
• Structural barrier integrity
This multimodal approach enables correlation between:
• Barrier function (TEWL)
• Hydration status (Corneometry)
• Lipid organization (Lipidomics)
Providing significantly stronger mechanistic substantiation for advanced cosmetic claims.

Modern scientific cosmetics are therefore no longer focused solely on hydrating the skin, but on restoring epidermal physiology through simultaneous optimization of hydration, lipid organization, and functional skin resilience.

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Beyond water content: a multi-dimensional approach to skin hydration evaluation

MÉRIEUX NUTRISCIENCES

Chiara Chiaratti - Cosmetics and Personal Care Project Manager

Hydration is one of the most established, yet still one of the most strategically important, performance territories in skincare. Consumers immediately understand the promise of hydrated skin, but for brands, formulators and claim specialists, substantiating this benefit requires much more than showing a temporary increase in water content. Today, **hydration evaluation has to connect several dimensions**: the biological mechanism of action, the measurable effect on skin, the barrier function, the visible skin appearance, the sensory perception and, ultimately, the consumer experience.
This is why a robust hydration protocol should be designed as a multi-tool strategy rather than as a single instrumental measurement.The first question is not only"*does the product increase hydration?*", but also "*how does it contribute to skin hydration and how can this effect be demonstrated in a relevant, reproducible and claim-oriented way?*".

At Mérieux NutriSciences | Pharma & HealthCare, **CosmeticLAB approaches hydration and nourishing claims by combining complementary methods**,selected according to the product positioning, the expected mechanism of action and the final communication objective.

***In vitro* testing** can help investigate the mechanism behind the performance. For example, the evaluation of Aquaporin 3, a membrane channel involved in water and glycerol transport, may be used to explore how an ingredient or finished formula supports the biological pathways associated with skin hydration. This mechanistic layer is particularly valuable when brands want to go beyond a generic moisturising claim and build a more science-based narrative around the product.

In parallel, ***in vivo* measurements on volunteers** remain essential to provide direct evidence of product performance under real conditions of use. The evaluation of stratum corneum water content, using instruments such as Corneometer or Moistumeter, is a key parameter to quantify the hydration effect at the skin surface. However, water content alone does not fully describe the quality of skin hydration. A formula may increase the water level temporarily without improving the skin's ability to retain it. For this reason, trans-epidermal water loss, measured through TEWL, is an important complementary endpoint to assess the skin barrier and water loss. When hydration is interpreted together with barrier function, the result is a more complete picture of product efficacy.

Hydration is also closely linked to the **physical properties of the skin**. Well-hydrated skin is often perceived as more comfortable, smoother and more supple. Instrumental evaluation of skin viscoelasticity, using devices such as Cutometer or Elastimeter, can therefore complement hydration measurements by assessing parameters related to firmness, elasticity and laxity. This is particularly relevant for products positioned at the intersection between hydration, nourishing, well-ageing and skin comfort.

A further layer of evidence can be provided by **3D imaging and skin profilometry**, which help document how hydration may translate into visible and measurable changes in skin appearance. Parameters such as micro-roughness, desquamation, skin texture and smoothness are highly relevant because they connect the biological and instrumental assessment with what consumers can actually see and feel. In this perspective, imaging is not only a visual support for communication, but also a technical tool to monitor the evolution of the skin surface before and after treatment.

Clinical evidence also plays a central role. Dermatological scoring, performed at defined time points, can support the interpretation of instrumental data by assessing the skin condition from a clinical perspective. This is especially valuable when hydration claims are associated with sensitive skin, dryness, tightness, roughness, flaking or discomfort. By combining instrumental measurements with clinical observation, the study can better capture both objective performance and the visible improvement of the skin.

Depending on the claim territory, hydration protocols may also be enriched with additional endpoints.

When the formula targets sensitive or stressed skin, the **evaluation of barrier response** after mechanical insult and the dosage of inflammatory mediators such as IL-1α can help document a soothing or protective effect.

When the product is intended for face, body, neck or décolleté, the protocol can be adapted to the specific application area, taking into account skin physiology, consumer expectations and usage conditions.

The strength of an integrated testing strategy lies in the ability to correlate different types of evidence. Instrumental measurements provide objective data; dermatological scoring and expert evaluation add clinical relevance; imaging can generate visual and quantitative support; clinical scoring and expert evaluation add dermatological observation; imaging can generate visual support; sensory and consumer science help understand how the product is perceived during and after application. This is particularly important because hydration is not only a biological parameter. It is also a sensorial experience: freshness, comfort, softness, reduced tightness, smoother skin and a pleasant after-feel all contribute to the way consumers recognise and value a moisturising product.

For brands, the challenge is therefore to transform technical data into meaningful, responsible and substantiated claims. A **well-designed hydration study should start from the desired claim architecture and then translate it into a coherent protocol**: mechanism of action, short-term and/or long-term performance, barrier support, skin appearance, clinical evidence, skin feel and consumer perception. The most relevant studies are those built around the product's real promise, not around a standard list of tests.

As skincare continues to evolve toward more sophisticated, evidence-based and experience-driven products, hydration evaluation must evolve as well. The future of moisturising claims will not be based only on measuring water in the stratum corneum, but on **demonstrating how a product supports the skin as a living, responsive and sensorial organ.** In this context, combining *in vitro*, *in vivo*, instrumental, imaging and sensory approaches is not an additional complexity: it is the key to building credible, differentiated and consumer-relevant evidence.

Mérieux NutriSciences

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Demonstrating the moisturizing efficacy of a cosmetic product: beyond consumer perception

ZURKO RESEARCH

Lorena Bellas - In Vivo Efficacy Test Manager

Moisturization remains one of the most important claims in the cosmetics industry. From facial creams to body lotions, a product's ability to improve and maintain skin hydration is a key selling point. However, scientifically substantiating this efficacy requires a rigorous approach that combines instrumental methodologies, clinical assessments, and appropriate study designs.

The stratum corneum, the outermost layer of the epidermis, plays a crucial role in water retention and is responsible for approximately **90% of the skin's barrier function.** Skin hydration depends on the balance between water uptake, retention, and loss, a complex process influenced by both biological and environmental factors. As a result, evaluating moisturizing efficacy cannot rely on a single measurement or solely on consumer perception.

From a formulation perspective, moisturizers act through different mechanisms. Humectants attract water to the upper layers of the skin, increasing its moisture content. Emollients improve skin softness and flexibility, while occlusive agents reduce water evaporation by forming a protective film on the skin surface. Each of these mechanisms can generate different responses in instrumental measurements, making it essential to interpret results according to the type of product being evaluated.

In this context, **biophysical instrumental techniques** have become key tools for cosmetic claim substantiation.

Among them, the assessment of the skin's electrical properties is one of the most widely used approaches. Instruments such as the **Corneometer®** estimate superficial skin hydration by measuring skin capacitance. Since water has a significantly **higher dielectric constant** than other skin components, changes in capacitance correlate with variations in the water content of the stratum corneum.

Other technologies, such as the **MoistureMeterD®**, allow the assessment of water content at different skin depths, providing complementary information on skin hydration. This approach is particularly valuable for products targeting deeper hydration and for studies involving nutricosmetics.
One of the key lessons in cosmetic research is that no single method can fully describe the hydration status of the skin. Current best practice recommends a **multiparametric approach** combining different instrumental techniques, including **transepidermal water loss** (TEWL) measurements, skin texture and desquamation analysis, mechanical skin assessments, and imaging techniques. Integrating these parameters provides a more comprehensive and robust evaluation of product efficacy.

Study design also plays a critical role in the quality of the evidence generated. **Single-application studies** are useful for identifying immediate effects and can deliver results quickly and cost-effectively. However, they do not fully reflect real-life usage conditions. For this reason, many companies choose multiple-application studies conducted over several weeks, enabling the evaluation of product performance under conditions that more closely resemble everyday use.
Beyond traditional single-use and repeated-use studies, testing strategies can be tailored to the specific objectives of each product. For example, **long-lasting studies** are designed to demonstrate the duration of the moisturizing effect over several hours after application, while regression studies assess how long the benefits persist once product use has been discontinued. These study designs provide valuable evidence to support differentiated claims such as **"24-hour hydration," "long-lasting moisturization," or "lasting improvement of skin dryness,"** strengthening both product positioning and marketing communications.

Participant selection and study conditions are equally important. Factors such as age, **baseline hydration levels,** anatomical test site, and environmental conditions can significantly influence results.

Maintaining controlled temperature and humidity conditions, standardizing cleansing habits, and implementing appropriate acclimatization procedures are essential to ensure data reliability and reproducibility.

In addition to instrumental measurements, **clinical assessments** provide valuable insight into the practical relevance of the results. Standardized dry skin scoring systems can evaluate visible signs such as scaling, roughness, redness, and cracks. Combining instrumental data with **expert clinical evaluations** generates stronger evidence aligned with the consumer experience.

For cosmetic brands, demonstrating moisturizing efficacy goes far beyond obtaining a favorable instrumental result. The **real value** lies in designing studies that generate evidence aligned with the product's positioning strategy and intended marketing messages. Whether supporting claims related to immediate hydration, long-lasting efficacy, or improved barrier function, robust scientific data can transform a marketing promise into a genuine competitive advantage.

At Zurko Research, we develop **customized testing protocols** tailored to the specific needs of each project, combining instrumental methodologies, clinical evaluations, and specialized study designs such as **long-lasting studies, regression studies, and trials involving dry or sensitive skin.** Our goal is to help brands generate reliable, relevant, and commercially meaningful evidence that supports successful product launches and strengthens market positioning.

In an increasingly demanding market, where consumers, retailers, and regulatory bodies expect objective proof of efficacy, well-designed studies can make the difference between an ordinary launch and a product that truly stands out within its category.

If you are developing a new moisturizer or strengthening the evidence behind an existing formulation, the Zurko Research team can help define the most appropriate testing strategy to maximize your product's commercial potential.

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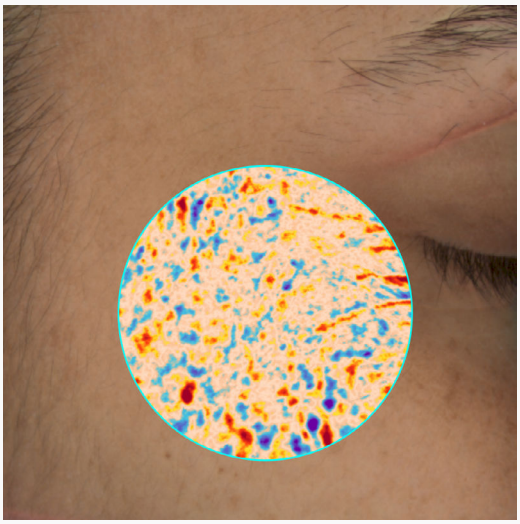
Skin Texture with Antera 3D®

MIRAVEX LIMITED

Guido Mariotto - CEO

Imaging Skin Texture and Roughness

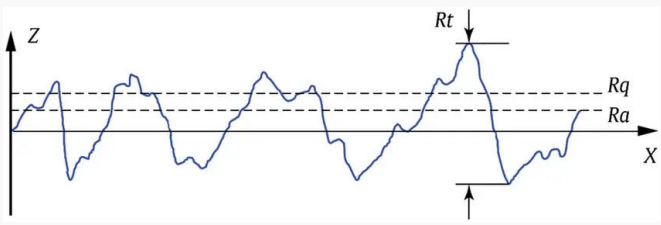
The Antera 3D® provides a sophisticated texture analysis through its advanced multidirectional LED illumination and fast computer algorithms. Unlike traditional 2D photography that suffers from ambient lighting interference, the Antera 3D imaging the skin's microscopic peaks and valleys with great physical accuracy.



Topographic Precision

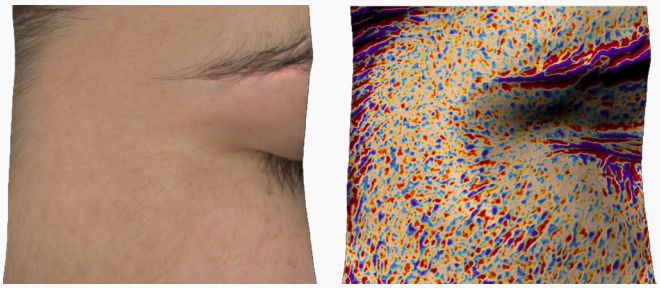
The Antera 3D® translates complex skin texture into three simple, universally accepted metrics:

- **Ra (Average Roughness):** Measures the overall «bumpiness» of the skin, ideal for tracking general smoothing.
- **Rq (Root Mean Square):** Accurately flags scattered, severe imperfections like deep pores or sharp micro-peaks.
- **Rt (Total Height):** The distance from the absolute highest peak to the deepest valley, perfect for monitoring dramatic structural changes.



Proving Product Claims with Texture Imaging

When proving the efficacy of skincare products, side by side visuals do the heavy lifting. Texture images take the guesswork out of clinical proof by showing exactly how a formulation can smoothen the skin's surface. It gives you clear, visual data to back up your big selling points.



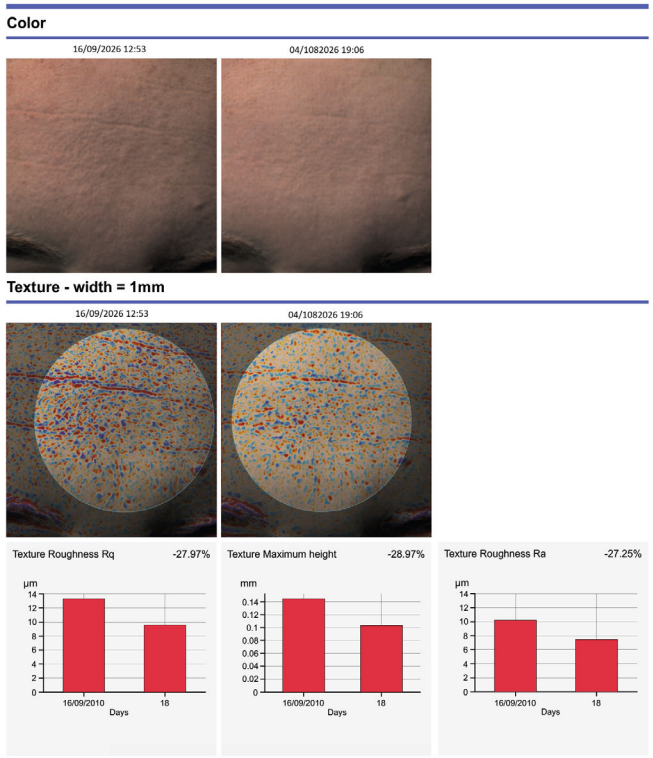
- **Clearer Skin (Anti-Blemishes, Exfoliating, Comedolytic):** texture images show rough patches smoothing out and dead skin buildup disappearing week after week.
- **Youthful Bounce (Anti-Ageing, Firming/Lifting):** The data measures wrinkle depth. When those deep lines flatten out on the map, they provide direct proof of a firmer, lifted look.
- **Deep Hydration (Anti-Dryness, Healthy Skin, Anti-Cracks):** You can easily show how a balsam or cream repairs flaky, cracked skin on the face or lips, leaving behind a smooth, intact barrier.
- **Targeted Body Care (Anti-Cellulite, Anti-Stretch Marks):** For body products, these images track uneven skin irregularities, showing a noticeable smoothing and tightening effect on tough areas.

Bottom line: texture images will help you to support marketing claims and provide visuals that people can easily trust and relate to.

The Power of Data in Skincare Marketing

When marketing skincare products, standard before and after photos are no longer enough to convince a demanding audience. To build real trust, you need objective data. As shown in the image aside, the Antera 3D® system solves this problem by turning visual skin changes into clear, objective measurements.

The **software makes tracking progress** incredibly smooth. The **alignment of follow-up images** is controlled via software, ensuring that the exact same patch of skin is captured every single time.



With one click, you get instant quantitative results. The Antera 3D software generates **clear reports** and easy to read charts. In this specific case, it mathematically proves a massive texture improvement of over 27% in just 18 days across multiple roughness metrics.

Antera 3D® Versatility

Beyond just looking at texture, the Antera 3D® is a complete all-in-one device for measuring many endpoints to support a vast range of cosmetic claims. After a simple and quick image acquisition, you may quantify and substantiate claims related to colour, redness, pigmentation, wrinkles, texture and pores.

The Antera 3D takes all the guesswork out of skincare and gives you an easy, objective and visual proof you need to substantiate claims of your cosmetic products.

Reference to surface roughness image: https://www.researchgate.net/figure/Surface-roughness-parameters-Ra-Rq-and-Rt_fig6_348694133

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Hydration Assessment with the MoistureMap® MM200 and A Novel Algorithmic Approach

SGS - IEC

Valentine Camel - Project Leader - Clinical Efficacy Studies

The assessment of the moisturizing effect, a timeless and still widely sought-after cosmetic claim, is based on the study of the biological mechanisms involved in maintaining and supplying water to the stratum corneum.T

his evaluation relies on instrumental measurements of skin hydration and skin barrier integrity commonly evaluated using validated and widely used methods such as the Corneometer® (C&K), the Tewameter® (C&K), the Epsilon™ (Biox Systems) and the MoistureMap® MM200 (C&K).

This latter instrument generates hydration maps (photos and videos) based on grey-level distribution (0 to 255), derived from measurements of electromagnetic field penetration within the skin.

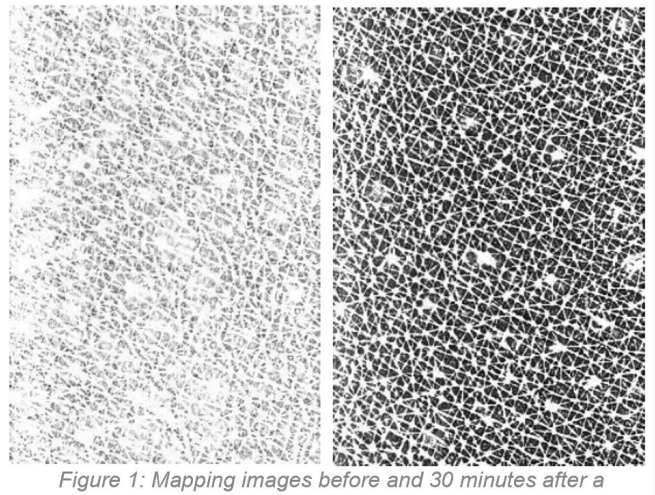

Figure 1: Mapping images before and 30 minutes after a product application on forearms

The most commonly studied parameters are as follows:
✓ **Grey Index** : represents the inverted grey-level index. An increase in this index (darker pixels) indicates an increase in skin hydration
✓ **Mean Grey Level** (MGL) : corresponds to the average grey. Lower values indicate darker pixels, which are associated with higher skin hydration levels
✓ **Homogeneity**: reflects the distribution of hydration to assess its uniformity. Higher homogeneity values indicate a more even distribution
✓ **Permittivity index** (range from 0 to 80): is related to the dielectric constant. The higher it is, the greater the water content.

The device can also evaluate the Topography / anisotropy parameters which can also serve as a marker of skin hydration with the assessment of skin surface relief and cellular organization.

This probe can be used in combination with a TEWL and Corneometer probes to provide a more complete assessment of the hydrating efficacy of a cosmetic product.

SGS has developed an innovative algorithm, subject of a patent application, designed to be integrated with the MoistureMap MM200 to extend its functionalities and enhance the analysis of skin hydration parameters.
From videos recordings by the device, this algorithm generates images enabling the mapping of skin hydration (in blue) and the assessment of water loss under probe occlusion (in red).

The algorithm also enables the generation of a dynamic image, illustrating the progressive accumulation of water, under probe occlusion, over time through skin permittivity mapping.

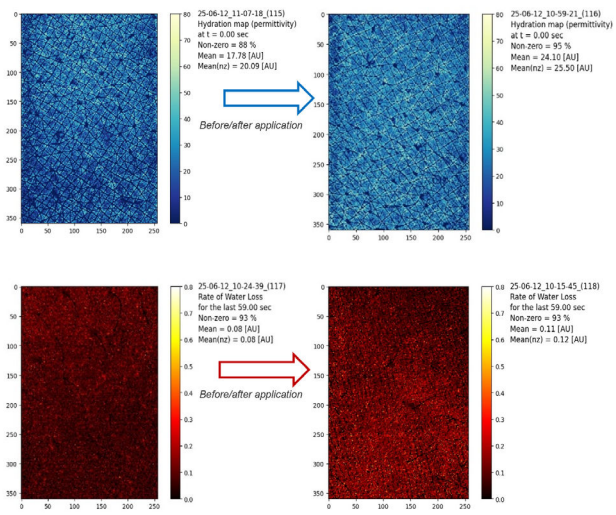

Figure 2: Visuals generated by the SGS algorithm showing the mapping of skin hydration (in blue) and water loss under probe occlusion (in red).

Initially designed for the measurement of skin hydration, this device enhanced by this novel algorithm, extends its capabilities to generate comprehensive high-resolution maps of both skin hydration and water loss, a direct marker of skin barrier integrity.

This integrative approach therefore provides a powerful tool for the objective visualization and assessment of the dual impact of cosmetic products on both moisturization and barrier function.

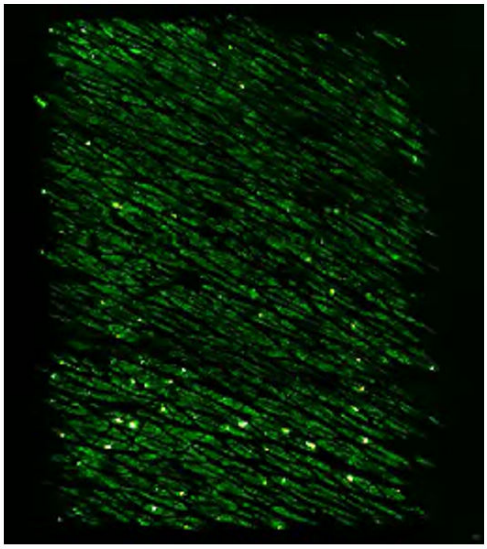

Figure 3: Capture of a dynamic image representing water loss (permittivity/s) under probe occlusion over time

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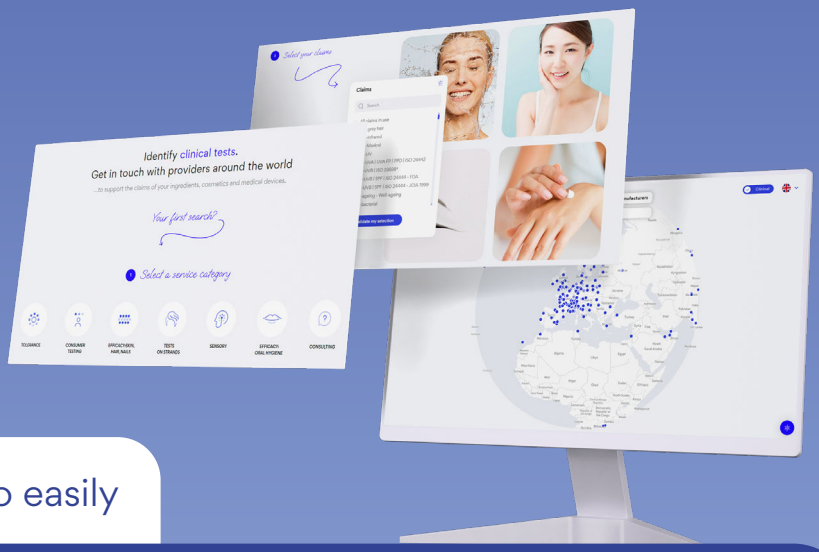

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