

# Benchmark skin measurements - a solid evidence

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Measuring the skin before and after the treatment is a popular method to awaken consumer desire for skin care products. Also cosmeticians can convince their customers with facts and figures.

**T**here are different reasons for skin measurements: cosmetic industry makes use of it to prove the efficacy of products with human test persons and to compare products with competitors' brands. Beauty institutes utilize skin measurements as significant tools for customer acquisition and retention, particularly during the establishment phase of the institute. It certainly helps building up customer confidence more quickly and the treatment result can be recorded over an extended period of time.

Today's probes and devices offer various options. At the same time, it should be kept in view that the results coincide with the customers' perceptions. If this is not the case there is need for convincing rationales. Thus far, the majority of customers relate the smoothing effect of skin care products with an improved skin hydration. Yet, this perception of smoothness also applies if an impermeable lipid film covers the skin. Physiologically formulated non-filming products with the same hydrating features however cannot feel that smooth - to the benefit of increased regenerative properties of the skin.

Measuring the efficacy right after the treatment seems preferable although it is almost useless. The same applies for skin analyses right after skin cleansing. In both cases it is recommended to wait for 2 hours at least. In addition, the results depend on various factors such as:

- Atmospheric temperature (outdoors and indoors)
- Atmospheric humidity (outdoors and indoors)
- Day time (morning or evening)
- Date and kind of fluid intake (i.e. water, coffee or tea)
- Season (skin condition, light stimulated callus growth or pollination)
- Frequency and type of skin cleansing (water, surface-active agents, refattners)
- Current individual hormone status

- Medical drug consumption
- Diets

As a matter of fact, the beauty institute is not able to consider all the variants listed. It is however essential to know the factors in order to identify potential "odd results". For skin analyses in the context of product studies, the cosmetic industry adapts the test persons to standard conditions for several hours.

## Measuring parameters

Both subjective awareness and measurement after applying cosmetic products do not allow any statements on long-term effects. They can only be established after a long-term treatment - in comparison with reliable standards. It is essential to continue the measurements even after the treatment has been finished. Measurements one or two days after the treatment for instance inform on how good/bad the skin care substances remain in the skin (washout effect).

Now, which parameters can be determined in detail? Routine measurements for instance are the degree of skin hydration and the lipid content of the skin surface. The following list of measuring procedures gives a survey although it is not intended to be exhaustive.

**Allergy test:** As a basic orientation it is recommended to apply a small amount of the product on the forearm and observe the reaction after the first or repeated application. The test is particularly indicated for natural extracts as their components may vary.

**Skin thickness:** There are specific ultrasound devices to measure the increase of skin thickness after a treatment of atrophic skin. Skin structures as deep as 1 cm can thus be made visible.

**Skin elasticity:** There are different measuring procedures. The cutometer generates a short-term vacuum on the skin which is raised, stretched and then released again. The movements are evaluated visually. The re-

viscometer emits shock waves and determines the properties of the collagen and elastin fibers. Skin elasticity measurements are mainly taken after treatments with anti-aging and cellulite products.

**Skin hydration:** The most popular probe in this context is the corneometer that immediately supplies a measuring result after pressing it onto the skin. It registers the moisture content in the surface layers of the skin as deep as 10-20 µm. Capillary blood vessels do not influence the measurement. Neither does superficial skin fat affect the measurement - in contrast to a thick layer of make-up or camouflage. An alternative to the corneometer is the adhesive film to collect superficial skin cells which then are optically analyzed in terms of quantity, size and covered surface area. This allows assessing the hydration of the horny layer.

**Skin surface lipids:** The parchment-like foil of the sebumeter is pressed on the skin over a defined period and absorbs the lipids which then are photometrically analyzed after the probe has been removed. There are also simple test strips for an immediate result. This specific measurement of course records the natural lipids of the skin as well as the lipids released from skin care products. The procedure however has no negative impact as it also allows diagnosing and adequately adjusting excessive skin care. Too much skin care is supposed to be the second leading cause for skin reactions, behind the barrier disturbed and dry skin. Excess care also reduces the regenerative activity of the skin.

**Skin roughness and wrinkle depth:** This "micro relief" is measured with the help of the 3D image recognition with silicon replica (visiometry, profilometry). The recorded skin roughness in combination with a skin hydration analysis allows diagnosing the skin attrition - a parameter that matters in the context of decubitus. With increasing skin hydration also the skin attrition will augment. As an example can be stated that vaseline first reduces the skin attrition like a lubricating agent however due to the following occlusive conditions, the skin hydration will augment and hence also the skin attrition.

**Skin tone analysis:** is a simple and purely visual technique to determine the skin undertone. It is measured by pressing an object slide on the front. The red content of the hemoglobin will disappear and the yellowish skin undertone as well as the degree of tanning will clearly show. If the skin seems whitish the skin undertone is pink.

**pH level:** The pH probe informs on the condition of the acid mantle. It is just applied on the skin surface and the results can immediately be read.

**Microcirculation:** The more intense blood flow in the surface skin layers is measured via hemoglobin content. It is also possible to use this probe to quantify the erythema content and the tanning degree of the skin (melanin). In addition, the surface temperature of the skin can be taken.

**Thigh circumference:** a typical measurement for cellulite treatments which can easily be manipulated via the water balance of the body.

**Photographic image:** This method is most inadequate in terms of comparisons - unless conditions are completely identical. Useful are tube-shaped devices with a lens aperture that captures the fully diode-illuminated face and completely excludes all sources of interference (background, other light sources). The devices mostly are equipped with substantial image recognition software and visualize in detail the various skin structures, similar to the below-mentioned digital cameras

**Transepidermal water loss (TEWL):** By means of an applied cylinder, the tewameter probe measures the humidity and temperature gradients which then serve as basic data to calculate the water vapor escaping from the skin. The TEWL allows assessing the integrity respectively penetrability of the skin barrier.

**Visual skin diagnosis:** Besides magnifying lamp, today frequently digital cameras equipped with integrated light source (UV/VIS) and image recognition software are used and directly applied on the skin. The condition before and after the treatment as well as various micro structures including desquamation, pigment spots, efflorescences and wrinkle depth can be recognized and visually or digitally analyzed. Also the morphology of the hair can be recorded.

## Characteristics

Offered on the market are probes with the same measuring principle but varying precision - depending on the fact whether they are used at universities, hospitals and dermatological practices for purely scientific purposes or in beauty institutes. Frequently, cosmetic probes only allow a broad orientation.

Besides temporary influences that have to be taken into consideration, the measuring results depend on other factors such as age or sex for instance. As an example should be mentioned that TEWL and thickness of the epidermis decrease in older people whereas the thickness of the horny layer will remain. It should however also be considered that these are statistical values which can vary on a case-by-case-basis.

Within the framework of an in-depth and scientific diagnosis of problem skins or disease re-

lated skin alterations, there exists a multitude of further very helpful tests such as:

- **Comprehensive allergen tests**
- **Identification of pathogenic germs**
- **Compilation of natural antimicrobial peptides of the skin such as defensins. They protect both skin and mucous membranes.**
- **Analysis of filaggrins (peptides) which are responsible for the keratin cross-linking in the horny layer. Quantitative and qualitative changes can cause atopic dermatitis or ichthyosis for instance.**
- **Identification of enzyme defects, such as delta-6-desaturase. A dysfunction frequently causes neurodermatitis.**
- **Analysis of the collagen metabolism**
- **Squalene is a marker for the sebum gland activity. The squalene measurement is of interest in the development of acne prevention products targeting on sebum suppression.**
- **The linoleic acid content in the ceramide fraction of the stratum corneum is a criterion for an intact skin barrier. The neurodermitic skin for instance shows a linoleic acid deficiency.**

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