

# Skin diagnosis – based on measuring results

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The precise diagnosis of the skin condition is essential for a successful cosmetic treatment as even the best product will be useless if it is not matched with the skin type of the customer.

Customers of beauty institutes expect visible effects after their treatment sessions and also of the products recommended for their skin care at home. The ability to select and advise the appropriate products, however, takes many years of experience in skin diagnosis and also excellent product knowledge. As additional support the instrument-based skin analysis may be considered which provides detailed objective data. However, which instruments or measuring results can we trust in?

## Appropriate parameters

An essential factor for a well-functioning skin barrier is the moisture content of the stratum corneum. Only the intact NMF (Natural Moisturizing Factor) guarantees that penetrating radicals like e.g. nitrogen oxides are neutralized and that the skin will be protected against premature skin aging. Hence, the moisture content is the most important parameter in skin diagnosis and it is measured with the corneometer. This capacity reading can easily be performed and responds to the dielectric constant of water which is recorded in the surface layers of the stratum corneum in a diameter of about 10 to 20  $\mu\text{m}$  from the surface. This specific area makes sure that the reading will not be influenced by the capillary blood vessels. Superficial skin lipids have no influence on the moisture reading - in contrast to a dense make-up layer or camouflage. It is also recommended to measure the lipid concentration on the skin surface (sebum) in order to facilitate the selection of skin care products with regard to their lipid content. The sebumeter should be used on non-treated skin. In case that the data are collected after a skin treatment it is possible to evaluate the products which were used. This avoids an overdose of skin care which otherwise would reduce the natural regenerative activity of the skin.

As a rule, the reading is carried out with a parchment-like foil which increases its transparency after contact with lipid substances. This foil is pressed on the skin surface for a certain period of time. The change in the transparency is then measured with a specific

source of light. Sebum and skin moisture values are generally taken with portable devices which are battery-powered due to their low energy consumption and which are also appropriate instruments for smaller institutes.

## Transepidermal water loss (TEWL)

With some experience it is also possible to estimate the transepidermal water loss (TEWL) from readings of skin moisture and sebum. The TEWL informs on the permeability of the skin barrier for evaporating water and, vice versa, also for substances which may penetrate into the skin from outside. Dry skin generally shows a low skin hydration and disproportionately high evaporation intensity.

The TEWL may be instantaneously measured on the skin by applying a tewameter or evaporimeter probe consisting of two sensor pairs to measure humidity and temperature in two different spots. Based on the resulting humidity and temperature gradients the TEWL is then automatically calculated and displayed. A disadvantage of the TEWL reading is that it may be influenced by factors like surrounding temperature and humidity with the result that it is hardly possible during summer time.

## Skin elasticity

An important element of product advertising is preserving or increasing the elasticity of the skin which can be checked with the cutometer and is based on a simple measuring principle: sub-pressure is shortly built up on the skin with the help of a probe and then the skin is lifted, stretched and released. After that, the deflections are optically measured and evaluated.

In addition to that, the properties of the collagen and elastin fibers can be measured with a reviscometer and then evaluated in relation to the respective age of the person. The principle consists of emitting an acoustic shock wave which is recorded by a specific receiver. The time the wave needs from sender to receiver is measured.

This specific reading is particularly interesting for the application of anti-aging products influ-

encing the collagen metabolism through substances like vitamin A and C, phytohormones or peptides. A further parameter showing the condition of the hydrolipid film is the pH value on the skin surface. It gives details on the protective pH layer and can be measured with a probe on the skin surface.

A more specific technique is involved when measuring the wrinkle depth and skin roughness (micro relief) by using 3 D image recognition together with silicon replica (visiometry, profilometry), a method which is based on the transmitted-light technique. The replica consists of a two-component blend which hardens on the skin and is then removed for analyzing purposes.

An important element to diagnose the skin condition is the visual examination which can already be carried out with a magnifying glass with integrated light source. If however a detailed skin analysis is required, it is recommended to use a digital camera in combination with the respective image recognition software. The advantage of this combined analyzing equipment is that the skin condition before and after the treatment as well as possible anomalies can be easily recognized and that the wrinkle depth during the treatment with anti wrinkle products can be clearly observed. Comparisons based on imaging techniques usually are powerful arguments to convince any customer.

Parameters like skin hydration and sebum may also be measured with inexpensive test strips. Probes, however, offer the advantage of electronic data processing. The effects of treatment and skin care can be precisely documented and then evaluated with the appropriate software. This way the customers may also benefit from the product recommendations supplied.

### **Micro circulation and skin tanning**

If the skin is well supplied with blood, also the amount of the hemoglobin will increase. Accordingly, measuring the hemoglobin value before and after the treatment also gives information on the stimulation of blood circulation. The very same probe can also be used to determine the intensity of skin redness (erythema) and the degree of skin tanning (melanin).

This way circulation stimulating effects e.g. by caffeine may be found out. Besides the degree of skin tanning also a decrease of hyper pigmentation due to bleaching products can be determined. Also irritations caused by cosmetic products as well as soothing effects of active agents like vitamin K, echinacea, D-panthenol, evening primrose oil and linseed oil

may be documented.

The measuring principle consists of a light source with three specific wave lengths, with the radiation being absorbed by the skin and then diffusely reflected. A photo detector analyzes the diffused radiation on the skin. In terms of micro circulation, also the surface temperature of the skin may be taken as an additional step.

### **Measuring the skin thickness**

A very interesting aspect are measurements of the skin thickness which usually are taken with specific ultrasound devices. This technique is used to determine an increase in skin thickness as e.g. in cases of atrophic skin. This way, skin structures as thick as about 1 cm become visible. It should however be considered that the imaging may be influenced by certain factors like e.g. menstruation cycles. Hence, it is very important to ensure standardized measuring conditions.

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