

Evaluation of the efficacy of skin surface parameters by image analysis with the SELS - method

U. Heinrich, M. Herling, S. Binder, N. Gerlach, H. Tronnier
DERMATRONNIER, Institute for Experimental Dermatology at University of Witten/Herdecke, 58455 Witten, Germany

Introduction

The skin is influenced by many different extrinsic and intrinsic factors. These factors cause visible changes of the skin surface. For the assessment of the efficacy of anti-aging and skin care products, it is necessary to evaluate the skin surface quantitatively. Corresponding to subjective sensations, SELS (surface evaluation of living skin) analyses the skin surface by calculating four skin specific parameters.

Methods



Figure 1

Principle

The measuring principle of the SELS method is based on the graphic representation of living skin under special illumination as well as electronic processing and analysis of the picture. The measuring head of the Visioscan® camera (Courage + Khazaka, Cologne) contains two special metal halide bulbs, arranged on opposite sides, illuminating the 15 x 17 mm measuring area of the skin uniformly (Fig 1 and Fig 2). The spectrum of the lamps, the intensity as well as their location has been chosen in a way that only the skin surface, without reflections of deeper layers, is monitored. Furthermore, unlike with formerly applied procedures with diagonal illumination with SELS a distinct representation of the wrinkling is avoided.

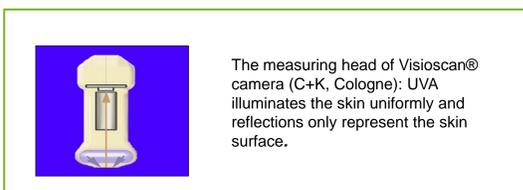


Figure 2

SELS Parameters

The SELS parameters represent the physiological condition of the skin surface, quantitatively and qualitatively. The calculation of all parameters is based on the histogram function of the original image, which represents the distribution of the grey values.

SE_r = roughness

SE_r is made up of the ratio of all pixels smaller than the color threshold value from the setup of the program and the sum of the zero-runs.

SE_{sc} = scaliness

All pixels larger than the threshold value from the setup of the program are recorded and put in proportion to the total number of pixels.

SE_v = volume

SE_v shows single deeper wrinkles of the skin. The depth of the wrinkle is determined by the volume.

SE_w = wrinkling

SE_w is made up of the total number and the ratio of horizontal and vertical "wrinkles" as well as wrinkle depth. The parameter increases in proportion to the width and the number of wrinkles.

Figure 3

Positive effect of nutritional supplements

Study design

The study was carried out as a monocentric, double-blind placebo-controlled efficacy test. 39 healthy volunteers with skin type II and aged between 18 and 65 years were included in the study. They were divided into 3 groups of 13 subjects each (2 verum groups and 1 placebo group). The study lasted for 12 weeks with a dosage regimen of 2 capsules daily.

Table 1

Treatment allocation	
Group 1	13 test subjects consumed 4 fruit and vegetable concentrate capsules of <u>formula A</u> per day
Group 2	13 test subjects consumed 4 fruit and vegetable concentrate capsules of <u>formula B</u> per day
Group 3	13 test subjects consumed 4 placebo capsules per day

12 weeks supplementation. Measurements at day 0, wk 6 and wk 12.

Measuring time points were before supplementation and after 6 and 12 weeks. Anti-aging parameters were evaluated by skin surface analysis by means of SELS (Visioscan® camera, C+K, Cologne). Ultrasound measurements were carried out with a frequency of 20 MHz by means of DermaScan® B device (Cortex Technology, Denmark) to determine the thickness and density of dermis.

Results

In addition to external skin care products, the application of nutritional supplementation is becoming more and more common in anti-aging concepts. As shown in figure 4 and table 3, the intake of fruit and vegetable capsules significantly decreased skin scaliness and skin roughness.

Table 2

SELS parameter (Roughness)			
Formula A (OE 02 08)	decrease	- 37.78 %	n.s.
Formula B (OE 02 05 S)	decrease	- 32.71 %	*p=0.005
Placebo	decrease	- 15.68 %	n.s.

Table 3

SELS parameter (Scaliness)			
Formula A (OE 02 08)	Decrease	- 57.99 %	*p=0.007
Formula B (OE 02 05 S)	Decrease	- 44.22 %	*p=0.014
Placebo	Decrease	- 30.14 %	n.s.

Red colored areas in the 3D image represent those with intense scaling of the skin, a typical appearance of aged skin that is not able to store moisture to the same extent as young skin.

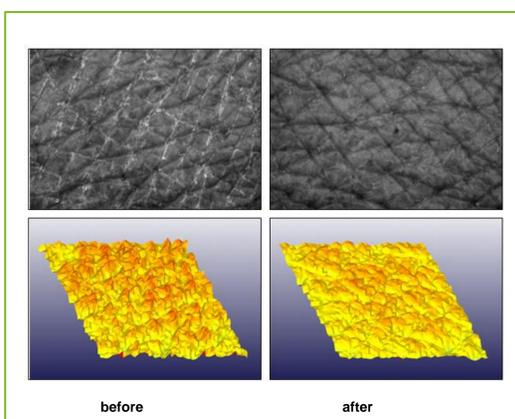


Figure 4: Skin surface before and after the intake of fruit and vegetable capsules as a nutritional supplement. Shown are the original and the pseudo-colored 3D images of skin surface before and after a 12 week supplementation. SELS measurements were carried out before and after the intake of nutritional supplements.

Positive effect of a moisturizing cream

Study Design

15 healthy female test subjects aged between 48 and 65 years participated in this study. Inclusion criteria are healthy and slightly dry skin. The test subjects were instructed to apply the test product to the upper forearm twice daily in the morning and evening over a period of 4 weeks. At the beginning and after 4 weeks of treatment, skin surface is measured by means of the SELS-method. An untreated test field served as control in the test.

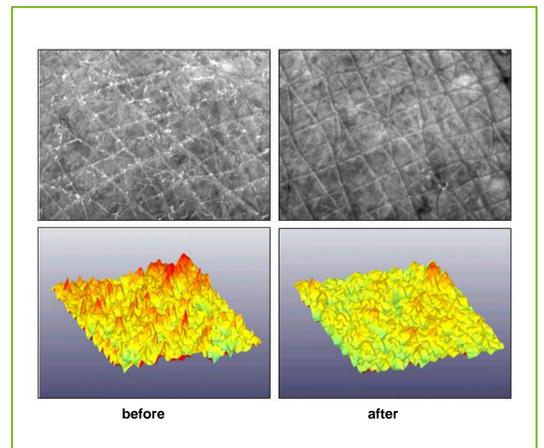


Figure 5: Skin surface before and after application of a moisturizer. Shown are the original and the pseudo-colored 3D images of skin surface before and after a 4 week application of a moisturizer.

Results

The test product significantly improved the skin scaliness of the skin and led to a significantly reduction of the depth of wrinkles compared to baseline.

The parameters skin roughness and number of wrinkles remained unchanged.

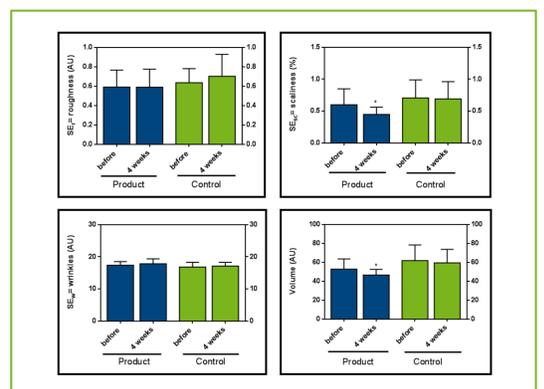


Figure 5: SELS parameters (roughness, scaliness, wrinkles and volume) before and after application of a moisturizing cream.

Conclusions

The measuring principle of the SELS-method is based upon the graphic representation of living skin under special illumination as well as electronic processing and analysis of the picture. In this process, the skin surface is described by 4 different skin parameters - skin roughness, skin scaliness, skin wrinkles and skin volume. Thus, tests which are tailor made for individual products can be designed to evaluate the effects on different parameters related to skin aging and skin care.

References

- Heinrich U, Tronnier H, Stahl W, Béjot M, Maurette JM (2006) Antioxidant supplements improve parameters related to skin structure in humans. *Skin Pharmacology* 19:224-231.
- Tronnier H, Heinrich U, Stute R (1999) Surface evaluation of Living Skin in: *RheumaDerm* edited by Mallia and Uitto, Kluwer Academic, Plenum Publishers, New York, 507-516.