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Literature List
Frictiometer

H. Tronnier, M. Wiebusch, U. Heinrich, **Frictiometry on human skin,** Skin Research and Technology, Vol. 9, No. 2, May 2003 and poster presentation at DermaDays Universität Witten-Herdecke, April 2005.

The state and function of human skin can be quantified by numerous non-invasive test methods. There are, however, still no valid methods to measure the tactile properties of the skin surface and thus to quantify the state of the skin on the one hand, and to determine the negative and positive effects of tactile influences on the other hand. The measuring device (Frictiometer) consists of a sensor, a steering unit and a monitor. The torque, the circular friction on the skin surface, is measured via the motor load current and is shown as a voltage drop.

H. Tronnier, **Stoffe aus dem Prüfstand**, Spiegel 37/2003

Wer den ganzen Tag in strapazierfähiger Berufskleidung steckt, hat darunter oft wunde Stellen: Straßenarbeiter, Feuerwehrleute, Großküchenköche. „Durch die ständige Bewegung bei der Arbeit entzündet sich empfindliche Haut besonders dort, wo sie sich an Nahtstellen oder rauem Gewebe reibt.“, sagt Hagen Tronnier, Dermatologe an der Universität Witten/Herdecke.

H. Tronnier, M. Wiebusch, U. Heinrich, **Frictiometrie an der menschlichen Haut,** Poster

Zustand und Funktion der menschlichen Haut können mit zahlreichen nicht-invasiven Testmethoden quantifiziert werden. Zur Messung taktiler Eigenschaften der Hautoberfläche fehlt aber bisher eine valide Methode, mit der einerseits ein Hautzustand zu quantifizieren, andererseits negative oder positive Wirkungen taktiler Einflüsse zu bestimmen ist.

A. Sirvent, L. Roussel, T. Thu Hang Ngo, P. Buche, S. Fontaine, M. Renner, F. Girard, **Skin Softness Evaluation – Description of skin suface state thanks to an innovative tribological device,** IFSCC 2010 Buenos Aires, Argentina

We describe a new measurement device that has been designed in order to approach skin softness thanks to the evaluation of skin surface state. This device uses an innovative approach: the analysis of the vibrating effect measured by extensometric gauges fixed on a vibrating slide that rubs on the skin. The energy of two specific peaks (mode 1 at 30Hz and mode 3 at 230Hz) was analyzed afterwards. The aim of this study was to check the repeatability of measurements and to correlate the results obtained on cosmetic products with both sensorial analysis and biometrological measurements (hydration, roughness and friction) to those obtained with this new device. In view of the results obtained, we can conclude that our measuring method seems to quantify: - on one hand, the smoothness and softness of the skin. A smooth surface, as observed on normal hydrated skin or after application of a cream penetrating rapidly, increases mode 1 whereas the presence of a sticky film on skin surface limits or decreases mode 1.

Y.H. Zhu, S.P. Song, W. Luo, P.M. Elias, M.Q. Man, **Characterization of Skin Friction Coefficient, and Relationship to Stratum Corneum Hydration in a Normal Chinese Population**, Skin Pharmacol Physiol 2011;2 4: p. 81–86

Background and Objectives: Studies have demonstrated that some cutaneous biophysical properties vary with age, gender and body sites. However, the characteristics of the skin friction coefficient in different genders and age groups have not yet been well established. In the present study, we assess the skin friction coefficient in a larger Chinese population. Methods: A total of 633 subjects (300 males and 333 females) aged 0.15–79 years were enrolled. A Frictiometer FR 770 and Corneometer CM 825 (C&K MPA 5) were used to measure the skin friction coefficient and stratum corneum hydration, respectively, on the dorsal surface of the hand, the forehead and the canthus. Results: In the females, the maximum skin friction coefficients on both the canthus and the dorsal hand skin were observed around the age of 40 years. In the males, the skin friction coefficient on the dorsal hand skin gradually increased from 0 to 40 years of age, and changed little afterward. Skin friction coefficients on some body sites were higher in females than in age-matched males in some age groups. On the canthus and the dorsal hand skin of females, a positive correlation was found between skin friction coefficient and stratum corneum hydration ($p < 0.001$ and $p < 0.0001$, respectively). In contrast, in males, the skin friction coefficient was positively correlated with stratum corneum hydration on the forehead and the dorsal hand skin ($p < 0.05$ and $p < 0.0001$, respectively). Conclusion: The skin friction coefficient varies with age, gender and body site, and positively correlates with stratum corneum hydration on some body sites.

C. Uhl, D, Khazaka, **Techniques for globally approved skin testing,** Personal Care April 2013

In efficacy testing and claim support for cosmetic products, objective measurement systems became indispensable long ago, especially since subjective clinical assessments are often prone to bias and inter-observer variation. Without suitable instrumentation it is close to impossible to determine what a product is really doing for the skin. Those objective measurement methods and subjective evaluations are mutually dependent. No measurement can be performed without the subjective evaluation of the results by the user of such instrumentation. However, a pure subjective evaluation of the skin without appropriate measurement techniques is not able to achieve accurate results either. This relationship becomes clearer when looking for example at skin colour measurements. Subjectively, the human brain cannot process slight changes in colour, especially when the colours are not viewed side by side, but at different points in time. Instrumental measurement however will clearly detect such slight changes. The achieved result must then be interpreted in context with the expected outcome or the hypothesis. For this, you will always need a knowledgeable and experienced person because ‘a fool with a tool is still a fool’, as the late Albert Kligman used to say. This relationship between objective measurement and subjective evaluation is not only true for the determination of differences in skin colour, but also for all other skin measurement parameters important for the cosmetic industry.

P. Neto, M. Ferreira, F. Bahia, P. Costa, **Improvement of the methods for skin mechanical properties evaluation through correlation between different techniques and factor analysis,** Skin Research and Technology 2013;19;405-416

Background: In the past decades, many instruments have been developed to measure skin elasticity and firmness. The offer is extensive and is constantly increasing, becoming difficult to decide which equipment and mechanical property measurement are better to portrait the desired characteristics. The aim of this study was to compare and correlate parameters assessed with different probes, based on different methodologies, to understand which probe characterizes each skin elasticity property. Methods: Measurements were performed in the abdomen region of 34 female volunteers, with three different probes: Cutometer SEM 575, Reviscometer RVM 600 and Frictiometer FR 700. Statistical data analysis was performed by Factor Analysis on IBM SPSS Statistics 17.0.

A.C. da Silva Marques, **Biometrologic Evaluation of Cosmetic Products**, Dissertation in pharmaceutical sciences at the University of Coimbra, 2016

Given the growing importance that cosmetic products have on human's health and in our daily life, it is important to increase the control of these products, both in terms of safety and effectiveness. Taking into account that conducting animal tests for the production and validation of cosmetic products is prohibited by law, producers of these products have to resort to alternative methods. Biophysical methods have gained an important highlight in the scientific community, in particular the non-invasive methods. They allow a safe and faster evaluation of cosmetics. The purpose of this work is to describe some methods and equipments used at national and European level to test the effectiveness of cosmetic products and correlate the parameters evaluated with the alleged properties in the products. The methods include evaluation tests of the following skin properties: hydration, elasticity, coloring, sebum production and perspiration.

Y. Inoue, R. Shiozawa, D. Niiyama, I. Shinohara, S. Narumi, A. Mitsumori, N. Komiya, T. Sakurai, S. Miki, R. Suzuki, I. Kanamoto, **Characterization of prescription and OTC formulations of vidarabine cream,** World Journal of Pharmaceutical Sciences, January 2017

The aim of this study, to assess the uniformity of content, viscosity, spreadability, near-infrared absorption spectroscopy and water content of vidarabine cream (Ara-A: bland name, Ara-B: generic and Ara-C: Over the Counter). Moreover, this study assessed the physicochemical properties of the creams. The Uniformity test indicated that the VDN content was uniform and equivalence was observed. As results of viscosity, Ara-B differed from those in Ara-A and Ara-C. The yield value was calculated based on measured flattening and was 1109.8 dynes/cm2 for Ara-A, 527.7 dynes/cm2 for Ara-B, 1200.1 dynes/cm2 for Ara-C. Measurement of water content revealed that Ara-A, and -C had water content of around 56.3%, Ara-B had water content of 59.9%. NIR absorption spectroscopy revealed that Ara-B had the highest absorption peak due to hydroxyl groups, followed by Ara-A, then -C. In order to evaluate the feel on the skin, friction generated by Ara-A and-C was around 90 N, Ara-B was 54.4 N. The drug spread is good about the skin friction, spreadability might be affecting the human sensory.

P. Huber, A. Bongartz, M.-L. Cezanne, N. Julius, **How far can we predict sensorial feelings by instrumental modelling?** Presentation at the IFSCC in Seoul, Korea, October 2017

The extent to which the sensorial attributes of facial and sun protection products can be predicted by instrumental modelling representing tribological data The sensorial benefits of cosmetic products are known to have a considerable influence on consumer product choice. Furthermore, descriptors of sensorial impressions or claims are acknowledged as the new "consumer exciter". The scientific discipline of sensory analysis, which describes the relationship between products and their perception and evaluation by the human senses, and sensory testing methods are powerful tools that can be used to assist in the development of cosmetic product s and enhance the effectiveness of marketing and sales campaigns. The objective of this study is to assess whether there is any correlation between sensorial approaches to product evaluation and predictive models derived from instrumental physicochemical measurements and to assess whether sensory perceptions can be predicted by the models. Having confirmed that rheology and texture analysis are excellent tools to evaluate sensory texture attributes during the "pick up", and some attributes during the "rub out" phase, data from complementary tribological trials are presented and discussed. The objective is to promote a better understanding of how the current limitations in physicochemical techniques corresponding to sensory methods might be overcome, especially in the "rub out" and "afterfeel" phases. It was concluded that there is no acceptable substitute for the human fingertip. Sensory panel testing provides valuable and reliable data that is both accurate and reproducible. This remains the "gold standard". Nevertheless, sensory testing capabilities need to be enhanced in an effort to improve the effectiveness of product formulation development by the cosmetics industry. At an early stage of development, predictive models can provide valuable support as prescreening tools. Combined with classical sensorial methods, predictive data modelling has the potential to create value for both the cosmetics industry and the consumer.

C. Korponya, E. Szél, Z. Behány, E. Varga, G. Mohos, Á. Dura, S. Dikstein, L. Kemény, G. Erös, **Effects of Locally Applied Glycerol and Xylitol on the Hydration, Barrier Function and Morphological Parameters of the Skin**, Acta Derm Venereol. 2017

Glycerol and xylitol hydrate the skin and improve its barrier function over a short period. We studied the effects of glycerol and xylitol on the physiological properties and morphology of the skin after longer-term application. Twelve volunteers with dry skin were examined. Three areas on the arms were determined. Area 1 served as untreated control. The vehicle was applied to area 2, while area 3 was treated twice daily with a formulation containing glycerol (5%) and xylitol (5%) for 14 days. Transepidermal water loss (TEWL), hydration and biomechanical properties of the skin were monitored. Biopsies were taken for routine histology and immunohistochemistry for flaggrin and matrix metalloproteinase-1 (MMP-1). The polyols increased the skin hydration and protein quantity of flaggrin, elevated the interdigitation index, decreased the TEWL and improved the biomechanical properties of the skin, but did not change the protein expression of MMP-1. A combination of glycerol and xylitol can be useful additional therapy for dry skin.

P. Huber, A. Bongartz, M.-L. Cezanne, K. Chatelain, Y. Feusi, **Enhancing sensory driven formulation design through sensory and instrumental modelling,** IFSCC Congress, Munich, September 2018

Sensory benefits are known to materially affect consumers' choice of cosmetics. Formulations of natural cosmetics may need to be optimized or modified if they are prone to initial sensorial issues or if the critical requirements of consumers are not adequately addressed. Any such reformulation may affect both the physical stability of the formulation and the sensorial profile. The sensorial properties can be significantly influenced by the addition of sensory modifiers, the selection of emollients or rheological additives, and structure-providing raw materials. In the case of biopolymers, the recently developed gel formers must be combined and selected in such a way that they are similar to the texture-providing properties of the synthetic agents. However, there is a large range of potential additives and hence product developers are keen to receive rapid, preferably real-time, time-saving and reproducible feedback on new formulations. The objective of this study was to assess whether a correlation between sensorial approaches to product evaluation and predictive models derived from instrumental physicochemical measurements could be established. Measurement protocols, applying rheology and frictiometry, and the concept of predictive modelling were applied in combination with the "gold standard", a trained objective panel. Various raw material groups which influence sensorial attributes were systematically examined in two emulsions types (W/O and O/W) with nonpolar and polar emollients. The potential sensory and physical effects of sensory modifiers and skin feel agents, including various waxes, a biopolymer and very fine particles (silica beads, microcrystalline cellulose particles and starch), were investigated with particular focus on whether properties, such as absorbency or greasy residue, could be optimised. The findings from the initial phase identified which sensorial attributes could be predicted in the model systems with selected instrumental testing methods and enabled the sensorial effect of sensory modifiers in a particular emulsion system to be predicted using physical measuring techniques in a second phase. Frictiometric measurements were used to supplement the rheological data. The linear models complemented the evaluation of behaviour during the "pick up" and "rub out" phases, and even in part in the "afterfeel" phase, for example, through determining greasy or waxy residues. Furthermore, silica beads were found to improve the attributes absorption, oily and waxy residue and increase the silky touch of an O/W emulsion. Although sensory panel testing remains the gold standard, this novel approach has identified a time and resource-saving method that can be applied under certain conditions for prescreening potential additives.

M. Portugal-Cohen, Z. Ma'or, M. Oron, **Full Scale Customization,** Cosmetics & Toiletries, Vol 133, No. 9, September 2018

The drive for personalized consumer products is no longer a passing fad. Personalization stems from deep motivations. The emotional wish to purchase products created "especially for me" comes across with an understanding of diversity between individuals and the prospects for more effective solutions to meet each individuals special needs. However, efforts to introduce personalized skin care— i.e., for unique skin with distinctive characteristics — on an industrial scale means

products formulated for generalized needs, which could not be as effective.

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T. Yadzanparast, S.A. Nasrollah, L.I. Firouzbadi, A. Firooz, **A Phase II Trial to Assess the Safety and Efficacy of a Topical Repair Cream Containing Skin-identical Ceramide Complex in Patients with Contact Dermatitis**, J Clin Aesthet Dermatol. 2018; 11(11): p. 40–44

Background: Contact dermatitis is a common skin condition observed by dermatologists, presenting a burden on healthcare systems. Recently, there has been a trend in producing skin-identical topical preparations for the repair of skin. However, there is a limited number of experimental studies to assess the safety and efficacy of this products. Objective: This study assessed the clinical efficacy and safety of a skin-identical ceramide complex cream (Dermalex Repair Contact Eczema; Omega Pharma, Nazareth, Belgium) in the treatment of contact dermatitis. Design: This was a Phase II, before-after trial. Setting: This study was conducted at the Center for Research and Training in Skin Diseases and Leprosy (CRTSDL) at Tehran University of Medical Sciences in Tehran, Iran. Participants: Fifteen patients with contact dermatitis (8 men and 7 women) between the ages of 25 and 62 years (median age: 36.4 years) were enrolled in this study. Measurements: Changes were assessed using six skin biophysical parameters (transepidermal water loss [TEWL], stratum corneum [SC] hydration, melanin index, erythema index, skin pH, and skin friction), Physician Global Assessment (PGA) score, and Three-Item Severity (TIS) score at baseline, Week 2, and Week 4 of the study. Results: Skin hydration and TIS showed a statistically significant improvement after treatment with study cream ($p=0.023$ and $p=0.007$, respectively). Although the reduction in TEWL was not significant, a slight decrease was observed at Week 4. Conclusions: The skin-identical ceramide complex cream improved contact dermatitis with a decrease in TIS and an increase in skin hydration, implying a repair of the skin barrier.

T. Yazdanparast, K. Yazdani, P. Humbert, A. Khatami, S.A. Nasrollahi, H. Zartab, L. Izadi Firouzabadi, A. Firooz, **Biophysical and ultrasonographic changes in lichen planus compared with uninvolved skin**, International Journal of Women's Dermatology 5 (2019), p. 100–104

Background: Lichen planus (LP) is a chronic inflammatory disease of the skin. Currently, noninvasive techniques are used to evaluate biophysical properties of the skin in vivo. Objective: In this study, we aimed to evaluate skin biophysical properties in patients with LP and make a comparison between involved and uninvolved skin to provide a better understanding of the pathogenesis of LP. Methods: The stratum corneum hydration, transepidermal water loss, pH, erythema, melanin, sebum, friction, temperature, elasticity parameters (R0, R2, R5), and thickness and echodensity of the epidermis, dermis, and subepidermal low echogenic band were measured on lesions of classic LP in 21 patients and compared with the average of perilesional and symmetrical uninvolved skin (as control) with a paired t test. Results: Stratum corneum hydration ($p = .002$), sebum ($p = .04$), R0 ($p = .005$), and echo-density of the dermis ($p = .005$) were significantly lower, but pH ($p = .007$), melanin content (p b .001), erythema (p b .001), temperature ($p = .01$), thickness of dermis ($p = .02$), and subepidermal low echogenic band (p b .001) were significantly higher in LP lesions. Conclusion: An evaluation of its biophysical, biomechanical, and ultrasonographic characteristics showed that the skin is an objective, noninvasive, and quantitative measuring tool that can be used to provide valuable information about skin changes in classic LP.