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Literature List
Frictiometer

T. Yazdanparast, K. Yazdani, S.A. Nasrollahi, L. Izadi Firouzabadi, P. Humbert, A. Khatami, M. Kassir, A. Firooz, **Biophysical and ultrasonographic changes in early patch/plaque stage of mycosis fungoides, compared with uninvolved skin,** Skin Research & Technology, Volume 26, Issue 6, November 2020, p. 859-866

Background: The goal of this study was evaluation of the skin biophysical properties in early patch/plaque stage of mycosis fungoides (MF) and its comparison with uninvolved skin in order to gain a better understanding of the pathogenesis of diseases. Materials and Methods: The stratum corneum hydration, transepidermal water loss (TEWL), surface friction, pH, sebum, melanin, erythema, temperature, elasticity parameters (R0, R2, R5), thickness, and echo density of epidermis and dermis were measured on lesions of 21 patients and compared with controls (average measures of uninvolved perilesional and symmetrical skins) by paired sample *t* test. Results: Stratum corneum hydration ($P < 0.001$) and echo density of dermis ($P = 0.044$) were significantly lower, whereas pH (*P*-value = 0.007), erythema ($P < 0.001$), and melanin content ($P = 0.007$) were significantly higher in lesions. There was not any significant difference in TEWL, friction index, sebum, temperature, R0, R2, R5, thickness of epidermis and dermis, and echo density of epidermis between lesions and normal skin. Conclusion: Parapsoriasis/MF lesions are specified by a set of certain changes in biophysical properties which are mainly correlated with histological changes. These sets of alterations may help in noninvasive, early diagnosis of parapsoriasis/MF.

L.M. Rodrigues, J.W. Fluhr, **EEMCO Guidance for the in vivo Assessment of Biomechanical Properties of the Human Skin and Its Annexes: Revisiting Instrumentation and Test Modes**, Skin Pharmacol Physiol 2020;33:44–59

Biomechanics of the skin is an important subject in skin research. It has been studied for many decades involving various technologies and methods to characterize and quantify mechanical properties of the skin under different in vivo conditions. The present EEMCO paper reviews the current relevant information, providing practical orientation to researchers dedicated to in vivo assessment of biomechanics of skin and its annexes. We discuss the available noninvasive instruments, including their principles and variables. A correspondence between the descriptors nomenclature proposed by Agache and the designation for the suction-based standard instruments is proposed. The addressed properties include skin softness/stiffness, firmness, elasticity, elastic and viscoelastic properties, extensibility, resilience, anisotropy, acoustical shock wave hardness, friction (in relation to topographic properties), thickness, fiber/stress-mechanics (bending, cyclic, tensile, fatigue, or torsion), and hardness. We provide the relation of these properties to biomechanical descriptors and in some cases to SI units. Practical guidance for the proper use of these instruments, limitations, and possible interpretations are provided, while discussing the meaning of descriptive or “phenomenological” variables. For studies intended to quantify the effect of an intervention with regard to mechanical properties, we recommend a minimum of 30–40 participants, based on normal distribution of the data sets. Some important limitations are recognized, including the lack of standardization of procedures and calibration of instruments, which compromises the relevance and real nature of the descriptors/parameters obtained with these devices. The present work highlights an approach to a better practice and a sciencesupported biomechanical assessment of human skin, hair, and nails.

N. Reichmuth, V. Pedan, R. Ott, P. Huber, **Sensory-driven substitution of acrylate polymers with natural alternatives**, presentation at the 25th IFSCC Conference Milan, October 2019

Natural cosmetics are of increasing interest due to evolving trends in health and environmental care and consumer demand for transparency with regard to all ingredients and adherence to ethical standards. Above all, there is a growing concern about the environmental impact of microplastics and the overall impact of liquid plastics in cosmetics. The industry is therefore under intense pressure to define

acceptable natural alternatives. Since liquid plastic gel formers greatly influence the sensorial characteristics and the stability of a product, it is important that such gels are replaced with appropriate polymers derived from natural products, such as biopolymers or a blend of polymers having similar characteristics. The researchers responsible for developing such products are interested in a time-saving and reproducible "pre-screening tool" to support their product assessment, which can be applied by the formulator before the final formulations are profiled by a trained expert panel. The aim of this study was to apply rheological measurements, frictiometric protocols and sensory profiling, to enable comprehensive characterization of raw ingredients and then to identify appropriate alternatives. Furthermore, the transferability of a predictive model enabling the identification of suitable polymers was evaluated.

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 echo-density 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.

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.

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.

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. Inamoto, W. Nishida, N. Okahata, **Control and Evaluation of Glass Tactile-feeling,** Res. Reports Asahi Glass Co., Ltd., 67 (2017) (article in Japanese)

By imparting visually imperceptible structure to the glass surface, it is possible to control the touch feeling of the glass while keeping its exterior appearance. In addition to sensory methods such as questionnaires, quantitative evaluation methods were examined. In the present study, based on the hypothesis that the main factor of touch feeling is finger slipperiness, we succeeded in quantitative evaluation by measuring the dynamic friction coefficient when actually touching the glass. Furthermore, we found that there is a correlation between surface texture and finger slipperiness.

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, 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.

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.

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.

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.

C. Uhl, D, Khazaka, **Techniques for globally approved skin testing,** PERSONAL CARE GLOBAL 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.

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.