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Literature List
Frictiometer

J. Leignadier, A. Zibi Elbaz, J. Attia, **Empowering natural skin barrier function**, PERSONAL CARE MAGAZINE, Volume 25, Issue 4, April 2024, p. 89-93

The skin is its own best ally. It acts permanently as a protective barrier against external aggressors. However, these repeated attacks can damage it, resulting in a loss of efficacy in its barrier function, leading to skin water loss (dehydration), and an increase in skin permeability. Over time, this damage contributes to premature skin ageing with visible signs such as the appearance of wrinkles, skin roughness and a decrease in skin tonicity. Lucas Meyer Cosmetics, in collaboration with the Infinity Institute in France, discovered a new protein: LCE6A. LCE6A, part of the 'Late Cornified Envelope' protein family, is known to be essential for the mechanical resistance of the corneocytes in the stratum corneum. By mimicking the LCE6A protein activity, Corneopeptyl™ strengthens the corneocyte envelope resulting in a more resilient epidermal barrier with improved skin barrier function demonstrating a reduction of skin permeability and water loss. Substantiated with AI, rebuilding skin barrier consequently future-proofs the skin by reducing the appearance of ageing signs like wrinkles, decreasing skin roughness, and increasing skin tonicity.

N.G. Ha, S. L. Kim, S.H Lee, W.J. Lee, **A novel hydrogel-based moisturizing cream composed of hyaluronic acid for patients with xerosis: An intraindividual comparative analysis**, Poster Presentation at the 1st Congress of Investigative Dermatology, Tokyo, May 2023 & Skin Research & Technology, Volume 29, Issue 11, November 2023

Background: Hyaluronic acid (HA) is mainly used to treat xerosis. It also exerts woundhealing, moisturizing, and antiaging effects. Although HA is considered an effective and safe ingredient in cosmetics, there is a constant demand for a more money-saving and effective formulation. This study aimed to evaluate the safety and efficacy of a novel hydrogel-based moisturizer containing HA cross-linked with silicone polymers, produced solely through irradiation without the use of cross-linking agents. Materials and Methods: A safety study enrolled 30 participants with healthy skin to perform patch and photopatch tests while recording adverse events. For the efficacy study, 30 participants with xerosis were compared before and after using the novel hydrogel, evaluating the cutaneous barrier function, xerosis severity scale (XSS) score, participant's satisfaction, and Investigator's Global Assessment (IGA). Furthermore, the efficacy of the novel hydrogel-based moisturizer was evaluated by comparing it with a conventional moisturizer, Physiogel, in another 30 participants with xerosis. Results: In the safety study, no serious adverse events were observed. In the efficacy study before and after use, skin hydration and skin surface lipid increased ($p < 0.05$) whereas the XSS scores decreased ($p < 0.05$) with time. In the comparative efficacy study with Physiogel, skin hydration increased whereas the XSS scores decreased ($p < 0.05$) over time in both groups. Furthermore, IGA improved in 100% of participants in both groups. Also, 100% and 93% of participants were satisfied with the novel hydrogel-based moisturizer and Physiogel, respectively.

E. Willeit, **Natürliches Astaxanthin aus Österreich - ein einzigartiger Wirkstoff für biologischen Zellschutz**, sofw journal, 149 Jahrgang, 9/23

Mit steigender Lebenserwartung und zunehmendem Stress im Alltag rückt gesundes Altern in den Mittelpunkt des Interesses. Durch einen gesunden Lebensstil und die Förderung der Funktionsfähigkeit unserer Haut versuchen wir, sichtbaren Alterserscheinungen und altersbedingten Erkrankungen vorzubeugen. Eine Sisyphusarbeit, denn wir können den Alterungsprozess unseres Körpers und insbesondere unserer Haut nicht aufhalten - aber durch vorbeugende Maßnahmen positiv beeinflussen und verzögern. Der Einsatz von Antioxidantien spielt vor allem im Bereich der Hautgesundheit eine wichtige Rolle. Astaxanthin ist ein hochwirksames natürliches Antioxidans, das

durch seine biologische Wirkung einen effektiven Zellschutz bietet. Als natürliches Schutzschild gegen umweltbedingten Stress und degenerative Oxidationsprozesse ist es die perfekte Wahl fur AntiAging-Produkte. Zahlreiche klinische Studien belegen die positive Wirkung seiner einzigartigen Molekulstruktur auf den Hautalterungsprozess. BDI-BioLife Science konnte die positive Wirkung von Astaxanthin anhand eigener Studien im Kosmetikbereich mit seinem markengeschützten Wirkstoff, einem Oleoresin mit 5% Astaxanthingehalt, bestätigen.

B. Yeni, A. Dermietzel, C. Varnava, P. Wiebringhaus, M. Aitzetmueller, M.-L. Klietz, T. Hirsch, M. Kueckelhaus, **Biomechanische Eigenschaften transgener Haut nach lebensrettender Regeneration der Epidermis durch kombinierte Gen- und Stammzelltherapie**, Journal der Deutschen Dermatologischen Gesellschaft. 2023;21: p. 245–254

Hintergrund: Im Jahr 2017 beschrieben wir die erste lebensrettende Regeneration einer nahezu vollständigen Epidermis durch kombinierte Gen- und Stammzelltherapie. Kürzlich berichteten wir über eine ausgezeichnete Langzeitstabilität dieser transgenen Epidermis. Zur Charakterisierung der aus diesem experimentellen Ansatz resultierenden Hautqualität und ihrer potenziellen Anwendung bei anderen Erkrankungen berichten wir hier über die Langzeitergebnisse hinsichtlich der biomechanischen Eigenschaften der Haut. Patienten und Methodik: Eine detaillierte Analyse der biomechanischen Eigenschaften, einschließlich Hautelastizität, Anisotropie und Friktion, wurde an mehreren Körperstellen 24, 36 und 60 Monate nach der ersten Transplantation durchgeführt. Zunächst wurden die Körperstellen mit den stabilen nicht-transgenen Bereichen verglichen. Im Weiteren erfolgte ein Vergleich mit einer Kontrollgruppe aus 13 hautgesunden Probanden. Die Messung von Hautelastizität, Anisotropie und Friktion erfolgte mit nichtinvasiven Messungen. Ergebnisse: Die biomechanischen Hauteigenschaften der transgenen Epidermis zeigten ähnliche Ergebnisse im Vergleich zur verbleibenden nicht-transgenenHaut und zur gesunden Kontrollgruppe. Die Hautelastizität zeigte vergleichbareErgebnisse wie bei der Kontrollgruppe. Die Friktion der Haut nahm sowohl in den transgenen als auch in den nicht-transgenen Bereichen im Vergleich zurKontrollgruppe ab. Schlussfolgerungen: Die neuartige kombinierte Gen- und Stammzelltherapie zeigt hervorragende funktionelle Langzeitergebnisse der vollständig regenerierten transgenen Epidermis. Wegen dieser Ergebnisse sollten weitere Anwendungen dieser Technologie, wie die Behandlung von Verbrennungen, Gegenstand zukünftiger Forschung sein.

N.G. Ha, S.H. Lee, W.J. Lee, **A novel hydrogel-based moisturizing cream composed of hyaluronic acid for patients with xerosis: an intra-individual comparative analysis**, Poster Presentation at the 1st Congress of Investigative Dermatology, Tokyo, May 2023

Xerosis is a condition caused by decreased hydration of the stratum corneum and is characterized by clinical signs such as microscopic cracks, scaling and inflammation in the skin and it significantly impairs patients' quality of life, especially when associated with itching. Hyaluronic acid (HA) is mainly used to treat xerosis and plays an important role in wound regeneration, moisturizing, and anti-aging. Although HA is considered as an effective and safe ingredient of cosmetics, there is a constant demand for a more economical and efficient formulation.

J. Leignadier, M. Pancarte, G. Serre, N. Jonca, J. Attia, **Reinforcing the Skin Barrier with a Biomimetic Green Peptide LCE6A to Reduce the Signs of Aging,** Poster Presentation at the 1st Congress of Investigative Dermatology, Tokyo, May 2023

A youthful and beautiful appearance can have a positive influence on the social behavior and reproductive status of individuals. Skin aging is characterized by the appearance of wrinkles, loss of elasticity, laxity and roughness of the skin 1. This aging process is also accompanied by an increase in the inflammatory reaction of the skin which leads to a disruption of the skin barrier function (BF). This alteration of BF leads to a phenotypic change of the skin cells as well as structural and functional modifcations of the extracellular matrix components 2. Thus, the strengthen of the BF is important to protect from the skin aging 3. The objective here was to develop a biomimetic green peptide encoding for a specifc sequence of the LCE6A (Late Cornifed Envelop 6A) protein, a constitutive component of the cornifed envelope (CE), covalently cross-linked by CE transglutaminase activity, in order to lead the stratum corneum (SC) and BF reinforcement. Through *in-vitro* and *ex-vivo* studies, we previously demonstrated that LCE6A peptide was able to increase the BF by reinforcing the CE. Here, by a second double blinded clinical study, we will focus on how the BF strengthening is able to prevent the skin aging.

A. Samadi, M. Movaffaghi, F. Kazemi, T. Yazdanparast, S.A. Nasrollahi, A. Firooz, **Tolerability and efficacy assessment of an oral collagen supplement for the improvement of biophysical and ultrasonographic parameters of skin in middle eastern consumers**, J Cosmet Dermatol. 2023;22: p. 2252–2258

Background: Topical skin care products often do not reach the deeper layers of the skin, and oral hydrolyzed collagen is one of the newest and most popular systemic supplementations for skin rejuvenation. However, there are limited information in case of Middle Eastern consumers. Objective: The purpose of this study was to evaluate the tolerability and efficacy of an oral collagen supplement for improvement of skin elasticity, hydration, and roughness in Middle Eastern consumers. Methods and Materials: It was a 12-week, before-after clinical study, conducted on 20 participants (18 women and 2 men) aged 44.15 ± 5.36 years with skin type III–IV. Skin elasticity parameters (R0, R2, R5, and R7), skin hydration and friction, as well as the thickness and echo density of the dermis, were measured after six and 12 weeks daily intake of the study product, as well as 4 weeks after stopping its use (week 16). Participants' satisfaction was assessed on the basis of their answers to the standard questionnaire, and tolerability of the product was assessed by monitoring the adverse effects. Results: A significant improvement was detected in R2, R5, and skin friction at week 12 (p-values 0.041, 0.012 and <0.01, respectively). At week 16, the values remained at an increased level, which indicates the persistence of the results. The increase of dermis density in week 16 was also significant (p-value = 0.03). Moderate overall satisfaction was reported with the treatment, and a few gastrointestinal complications were reported. Conclusion: The study demonstrated that oral collagen peptides could significantly improve the skin elasticity, roughness, and dermis echo density, and they also proved to be safe and well-tolerated.

B. Yeni, A. Dermietzel, C. Varnava, P. Wiebringhaus, M. Aitzetmueller, M.-L. Klietz, T.Hirsch, M. Kueckelhaus, **Transgenic skin biomechanical properties following frst lifesaving epidermal regeneration using combined gene and cell therapy**, JDDG: Journal der Deutschen Dermatologischen Gesellschaft. 2023;21: p 245–252

Background: In 2017, we reported the first life-saving regeneration of virtually an entire epidermis by combined gene and stem cell therapy. Recently, we demonstrated excellent long-term stability of this transgenic epidermis. Skin quality in this experimental approach and its potential application in other conditions were elucidated here regarding long-term outcomes of biomechanical properties. Patients and methods: Analysis of biomechanical properties including skin elasticity, anisotropy and friction was performed on multiple body sites 24, 36 and 60 months following transplantation. Firstly, the sites were matched against and compared to remaining stable non-transgenic areas as well as to a control group of 13 healthy subjects. Parameters for skin elasticity, deformation and friction were assessed non-invasively. Results: Biomechanical properties of the transgenic epidermis showed encouraging results in comparison to both the remaining stable non-transgenic skin as well as healthy controls. Skin elasticity was comparable to the controls. Skin friction showed some decrease in both transgenic and non-transgenic areas as compared to the controls. Conclusions: The excellent functional outcomes of the transgenic epidermis demonstrate stable long-term results of this novel combined gene and stem cell therapy for epidermal regeneration. Thus, other applications for this technology, such as treatment of specific burns, should be explored.

D. Martinovic, D. Tokic, M. Usljebrka, S. Lupi-Ferandin, L. Cigic, L.V. Rogosic, S. Ercegovic, M. Kontic, M. Kumric, D. Rusic, M. Vilovic, M. Leskur, J. Bozic, **The Association between the Level of Advanced Glycation End Products and Objective Skin Quality Parameters**, Life 2023, 13

Advanced glycation end products (AGEs) represent an endogenously produced or exogenously derived group of compounds derived from nonenzymatic glycation. Recent experimentalstudies are suggesting that AGEs could play an important role in the skin’s quality and its aging process. Hence, the aim of this study was to clinically evaluate the AGEs and skin quality parameters across different age groups in the general population. The study included 237 participants. Melanin, erythema, hydration, friction and transepidermal water loss (TEWL) were evaluated using noninvasive probes, while AGEs were evaluated using a skin autofluorescence reader. There was a significant positive correlation between AGEs and the amount of melanin ($p < 0.001$), erythema ($p < 0.001$) and TEWL ($p < 0.001$), while there was a significant negative correlation between AGEs and hydration ($p < 0.001$) and friction ($p < 0.001$). After dividing the sample into three groups depending on their age, in all three groups, there was a significant positive correlation between AGEs and the melanin count ($p < 0.001$) and TEWL ($p <$

0.001), while there was a significant negative correlation between AGEs and skin hydration ($p < 0.001$). Multiple linear regression analysis showed that the level of AGEs as a dependent variable retained a significant association with age ($p < 0.001$), melanin ($p < 0.001$), erythema ($p = 0.005$) and TEWL ($p < 0.001$) as positive predictors. Moreover, AGEs retained a significant association with skin hydration ($p < 0.001$) and friction ($p = 0.017$) as negative predictors. These outcomes imply that AGEs could be linked with the complex physiology of the skin and its aging process.

D. Martinovic, S. Lupi-Ferandin, D. Tokic, M. Usljebrka, A. Rados, A. Pojatina, S. Kadic, E. Puizina, A. Mihovilovic, M. Kumric, M. Vilovic, D. Leskur, J. Bozic, **Objective Skin Quality Assessment after Reconstructive Procedures for Facial Skin Defects**, J. Clin. Med. 2022, 11

Abstract: Local random skin flaps and skin grafts are everyday surgical techniques used to reconstruct skin defects. Although their clinical advantages and disadvantages are well known, there are still uncertainties with respect to their long-term results. Hence, the aim of this study was to evaluate outcomes more than one-year post operatively using objective measurement devices. The study included 31 facial defects reconstructed with local random flap, 30 facial defects reconstructed with split-thickness skin grafts (STSGs) and 30 facial defects reconstructed with full-thickness skin grafts (FTSGs). Skin quality was objectively evaluated using MP6 noninvasive probes (Courage + Khazaka GmbH, Cologne, Germany), which measure melanin count, erythema, hydration, sebum, friction and transepidermal water loss. The results showed that there were no significant differences in melanin count, erythema, hydration, sebum level, friction value and transepidermal water loss (TEWL) between the site reconstructed with random local flaps and the same site on the healthy contralateral side of the face. However, both FTSGs and STSGs showed significantly higher levels in terms of TEWL and erythema, whereas the levels of hydration, sebum and friction were significantly lower compared to the healthy contralateral side. Moreover, STSGs resulted in a significant difference in melanin count. These findings imply that the complex pathophysiology of the wound-healing process possibly results in better skin-quality outcomes for random local flaps than skin autografts. Consequently, this suggests that random local flaps should be implemented whenever possible for the reconstruction of facial region defects.

C.M. Keck, A. Abdelkader, O. Pelikh, S. Wiemann, V. Kaushik, D. Specht, R.W. Eckert, R.M. Alnemari, H. Dietrich, J. Brüßler, **Assessing the Dermal Penetration Efficacy of Chemical Compounds with the Ex-Vivo Porcine Ear Model**, Pharmaceutics 2022, 14, 678

Background: The ex vivo porcine ear model is often used for the determination of the dermal penetration efficacy of chemical compounds. This study investigated the influence of the post-slaughter storage time of porcine ears on the dermal penetration efficacy of chemical compounds. Methods: Six different formulations (curcumin and different fluorescent dyes in different vehicles and/or nano carriers) were tested on ears that were (i) freshly obtained, (ii) stored for 24 or 48 h at 4 ◦C after slaughter before use and (iii) freshly frozen and defrosted 12 h before use. Results: Results showed that porcine ears undergo post-mortem changes. The changes can be linked to rigor mortis and all other well-described phenomena that occur with carcasses after slaughter. The post-mortem changes modify the skin properties of the ears and affect the penetration efficacy. The onset of rigor mortis causes a decrease in the water-holding capacity of the ears, which leads to reduced penetration of chemical compounds. The water-holding capacity increases once the rigor is released and results in an increased penetration efficacy for chemical compounds. Despite different absolute penetration values, no differences in the ranking of penetration efficacies between the different formulations were observed between the differently aged ears. (4) Conclusions: All different types of ears can be regarded to be suitable for dermal penetration testing of chemical compounds. The transepidermal water loss (TEWL) and/or skin hydration of the ears were not correlated with the ex vivo penetration efficacy because both an impaired skin barrier and rigor mortis cause elevated skin hydration and TEWL values but an opposite penetration efficacy. Other additional values (for example, pH and/or autofluorescence of the skin) should, therefore, be used to select suitable and non-suitable skin areas for ex vivo penetration testing. Finally, data from this study confirmed that smart Films and nanostructured lipid carriers (NLC) represent superior formulation strategies for efficient dermal and transdermal delivery of curcumin.

S. Wiemann, C.M. Keck, **Are lipid nanoparticles really superior? A holistic proof of concept study**, Drug Delivery and Translational Research (2022) 12: p. 1433–1444

Lipid nanoparticles are a successful carrier system for dermal drug delivery. They possess

various beneficial properties, i.e. increased chemical stability for chemically labile compounds, increased dermal penetration of active compounds, or skin carrying properties after dermal application due to the formation of a so-called “invisible patch.” Despite manifold studies showing these properties individually, a study that investigates if one lipid nanoparticle formulation can really combine all the above-mentioned benefits at once is not yet available. In the present study, lipid nanoparticles (NLC) were produced and characterized regarding their physico-chemical properties. The chemical stability of the incorporated active ingredient (AI) was determined, as well as the dermal penetration efficacy of the AI, and the skin carrying properties of the NLC after dermal penetration. The properties of the NLC were compared to classical formulations, i.e., AI dissolved in pure oil, an o/w cream base and a nanoemulsion. All formulations contained similar lipids and emulsifiers, which allowed for a direct comparison of the different properties. NLC were shown to provide most efficient chemical stabilization and most effcient dermal penetration for the AI. The formation of the invisible patch was shown for the NLC but not for the other formulations. Skin hydration and skin carrying properties were also most pronounced for the NLC. Results provide evidence that NLC can combine all beneficial effects that were previously described in one formulation. Thus, providing evidence that NLC are a holistically superior formulation principle when compared to other formulation principles.

Z. Khosrowpour, S.A. Nasrollahi, A. Samadi, A. Ayatollahi, M. Shamsipour, A. Rajabi-Esterabadi, S. Yadangi, A. Firooz, **Skin biophysical assessments of four types of soaps by forearm in-use test**, J Cosmet Dermatol, Nov 2021

Background: While soaps are the most commonly used cleansing agents for human skin, they also damage the epidermal barrier and potentially increase the risk of disorders such as contact dermatitis. Aims: This study set out to compare the potential skin irritancy of four types of soaps and their effects on the skin barrier function and biophysical parameters. Methods: In a nonblinded comparative study, three types of soaps (alkaline, creamy, and glycerin soaps), and a syndet were applied to four different groups of 15 healthy subjects. Subjects washed their left forearm with the respective soap at home at least four times a day for seven days. Biophysical skin parameters, including transepidermal water loss (TEWL), erythema, friction, and pH, were measured at various time points using the Cutometer MPA 580. Results: After the first wash, a significant increase in TEWL was observed for all groups compared to the preintervention period. For the alkaline soap, a substantial increase in pH was observed at all time points compared to the baseline. Syndet, the only acidic soap in this study, showed a significant decrease in pH at the last time compared to all time points. The mean value of erythema was significantly higher in alkaline soap users than glycerin and creamy soap users. Conclusion: Our study showed that alkaline-based soaps could cause erythema and increase TEWL and skin pH due to their strong cleansing action, and the addition of compounds such as glycerin can modify these effects. A newer generation of soap containing a mild surfactant such as syndets causes less skin damage.

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. Yazdanparast, H. Hassanzadeh, S.A. Nasrollah, S.M. Seyedmehdi, H. Jamaati, A. Naimian, M. Karimi, R. Roozbahani, A. Firooz, **Cigarettes Smoking and Skin: A Comparison Study of the**

Biophysical Properties of Skin in Smokers and Non-Smokers, Tanaffos 2019; 18(2): 163-168

Background: Tobacco smoke is toxic for cells and could be a damaging factor to skin. The purpose of this study was to compare the biophysical properties of skin in smokers and non-smokers. Materials and Methods: The study population consisted of 28 current smokers and 24 non-smokers. The hydration of the stratum corneum, trans epidermal water loss, pH, erythema, melanin content, sebum, friction and elasticity parameters (R0, R2, R5) of skin, epidermis and dermis thickness and echodensity were measured on middle forehead, right cheek and right inner arm of participants. Also volume, surface area and depth of right nasolabial folds were measured. The mean of these values in smokers were compared with nonsmokers by independent sample T- test. Results: Gross elasticity was significantly lower in smokers on forehead (p= 0.048). Thickness of epidermis was higher in smokers in all measured sites but the differences were not statistically significant. Thickness of dermis was higher in smokers in all measured sites too, but only the difference on cheek was statistically significant (p= 0.009). Density of epidermis was lower in smokers in all measured sites, but only the difference on forehead was statistically significant (p= 0.019). Density of dermis was lower in smokers in all measured sites, but only the difference on arm was statistically significant (p= 0.028). Volume and area of nasolabial folds were higher in smokers, but only the difference of area was statistically significant (p = 0.031). Conclusion: Tobacco smoking could affect the biophysical parameters of skin, especially thickness and density of dermis and epidermis and nasolabial folds.

T. Yazdanparast, K. Yazdani, P. Humbert, A. Khatami, S.A. Nasrollah, H. Hassanzadeh, A.H. Ehsani, L. Izadi Firouzabadi, A. Firooz, **Comparison of biophysical, biomechanical and ultra-sonographic properties of skin in chronic dermatitis, psoriasis and lichen planus**, Med J Islam Repub Iran. 2018(5 Nov);32.108

Background: Skin biometrology is a useful method for evaluation of inflammatory skin disorders such as dermatitis, psoriasis, and lichen planus. The current study tries to compare the biophysical features of skin in dermatitis, psoriasis, and lichen planus. Methods: By a convenient sampling method, 22 mild to moderate chronic dermatitis, 26 psoriasis, and 21 lichen planus patients were recruited in the study. Stratum corneum (S.C.) hydration, Transepidermal water loss (TEWL), pH, erythema, melanin, sebum, friction, elasticity parameters (R0, R2, and R5), skin temperature, skin thickness, and echo-density of epidermis and dermis were measured on the lesional (selected active lesion), uninvolved perilesional, and uninvolved symmetrical skin. The average of perilesional and symmetrical uninvolved parameters was used as control, while the percentage change of each parameter [(lesion – control / control) ×100] was calculated, and compared among three diseases by ANOVA test using SPSS software version 18. The significance level was set at α=0.05. Results: Comparison of percentage changes showed that the changes in TEWL, friction index, sebum content, R2 (gross elasticity), R5 (net elasticity), skin temperature, dermal thickness, and epidermal density are not significantly different among three skin diseases. But there were significant differences in three diseases considering the decrease in S.C. hydration ($p<0.001$), R0 (opposed to firmness) ($p<0.001$), and dermal density ($p<0.001$) compared to control skin. Moreover, the increase in skin pH ($p<0.001$), melanin content ($p=0.048$), erythema ($p=0.023$), and epidermal thickness ($p <0.001$) significantly differed among these diseases. Conclusion: Dermatitis, psoriasis and lichen planus lesions had specific biophysical changes. It may be helpful in their differential diagnosis.

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.