Courage + Khazaka electronic GmbH
Mathias-Brüggen-Str. 91 * 50829 Köln, Germany
Phone: +49-221-956499-0 * Fax: +49-221-956499-1

Literature List
Meibometer®

Use on scalp – see further down

B. Aral, **Testing Tactics: Approaches to Measure Scalp Comfort and Care**, Cosmetics & Toiletries, May 2024

The global hair and scalp care market is expected to generate a revenue of about $94 billion in 2024, with an anticipated CAGR of 2.8% in the next four years. Anti-dandruff, hair loss, dry and itchy scalp, dry and dull hair, and white/gray hair product categories dominate, while products targeting scalp comfort and care have emerged as their own sub-category thanks to a few combined factors.

J. Garcia-Queiruga, H. Pena-Verdeal, M.J. Giráldez, C. García-Resúa, E. Yebra-Pimentel, **Inter-week variation of meibometry and tear break-up time in healthy subjects**, Clin Exp Optom, 2021 Aug; 104(6): p. 691-697

Clinical relevance: Variation with time in the tear film parameters should be considered by the clinician since the time when measurements are made can influence proper diagnosis. Background: A hallmark of dry eye is an unstable tear film associated with variability in objective daily measures. The purpose of the present study was to evaluate the inter-week repeatability of meibometry, break-up time (BUT) and maximum blink interval (MBI) in healthy subjects. Methods: Forty healthy subjects were recruited for the study. Meibometry, BUT and MBI were performed twice in two sessions, one-week apart. Meibum from the lower eyelid was collected and quantified with the Meibometer MB550. Five meibomian curves were generated by tape and each peak value was averaged as a mean value per session. BUT and MBI were determined three times after fluorescein instillation and recorded by a DV-3 camera attached to the slit lamp. BUT and MBI videos were analysed by a second masked observer. Both BUT and MBI values were calculated by averaging the two most similar measurements of the three evaluated. Results: No statistical difference between inter-week sessions was obtained for the meibometry ($p > 0.340$; Wilcoxon test), BUT ($p > 0.326$; Wilcoxon test) and MBI values ($p \geq 0.248$; Wilcoxon test). Inter-week differences were low for BUT and MBI when time intervals were no longer than 15 seconds (both $p \geq 0.586$; Wilcoxon test). A correlation between BUT and MBI was found ($r \geq 0.668$, $p < 0.001$; Spearman Rho), while a no statistical correlation was obtained between meibometry results and BUT or MBI (all $p \geq 0.194$; Spearman Rho). Conclusion: Meibum secretion and the tear film stability present good intersession repeatability, and are stable along with sessions in healthy patients.

I. Petriček, S. Vidas Pauk, M. Tomić, T. Bulum, **Dry eye and dry skin - is there a connection?,** Ophthalmic Epidemiol, 2021, December, 29; p. 1-10

Aim: To enquire whether patients with dry eye symptoms also report dry skin, whether their perception could be corroborated with objective measurement, and whether dry eye disease might be suspected based on patients' complaints. Methods: This cross-sectional study included 50 subjects, 25 with and 25 without dry eye symptoms. Schein questionnaire was used to determine the severity of dry eye symptoms. Ocular signs were assessed by monitoring conjunctival hyperemia, ocular surface staining, meibomian gland expression, tear film lipid layer thickness, tear break-up time, lid parallel conjunctival folds, Schirmer test, and meibometry. Skin dryness was assessed by noting patients' self-perception of their facial skin dryness and measured by sebumeter. Results: Subjects without dry eye symptoms had self-reported oilier facial skin than those with dry eye symptoms ($p < .001$). Sebumetry scores measured on the forehead and cheek were significantly higher in subjects without dry eye symptoms than dry eye subjects ($p = .003$). After adjustment for age and gender in a logistic regression analysis, dry eye was independently and significantly associated with dry skin (AOR 0.69, $p = .040$), higher LIPCOF score of both eyes (AOR 2.28, $p = .028$), lower sebumetry score of the forehead (AOR 0.98, $p = .041$) and cheek (AOR 0.98, $p = .041$), and shorter TBUT score after gland expression (AOR

0.90, p = .018). Conclusion: This study showed that ocular dryness was subjectively and objectively positively correlated to facial skin dryness. Patients reliably described their skin condition. People with dry facial skin also had drier eyes.

C. Uhl, D. Khazaka, **Skin sensitization in pandemic times,** PERSONAL CARE MAGAZINE, June 2021

For almost a year and a half, an unprecedented pandemic has had us in its grip worldwide, forcing us to abandon many cherished activities and realign our entire daily lives. It is particularly important in these times to prevent the spread of the pandemic through protective measures, distance and significantly increased requirements for hygiene measures such as the wearing of protective mouth-nose masks and the frequent use of sanitisers on all kinds of surfaces and naturally also on the skin.

C. García-Resúa, H. Pena-Verdeal, M.J. Giráldez, E. Yebra-Pimentel, **Clinical relationship of meibometry with ocular symptoms and tear film stability**, Cont Eye Anterior Eye, 2017 Dec;40(6): p. 408-416

Purpose: To evaluate the relationship between meibometry with both ocular symptoms and tear film stability by: (1) to find out whether meibometry is able to differentiate between dry eye symptomatic and asymptomatic subjects classified by standardized dry eye questionnaires (OSDI and McMonnies), and (2) to assess the clinical relationship between meibometry with both tear break-up time (BUT) and maximum blink interval (MBI). Methods: 140 Patients were recruited for the study. Using Meibometer MB550, five curves were generated for each patient. Subjects performed OSDI and McMonnies questionnaires and were stratified following a two- and a three-subgroup stratification for each questionnaire. BUT/MBI were repeated three times (by video recordings), and they were determined by counting their frames. Results: Subjects grouped by OSDI showed a trend to present lower meibometry values as the OSDI score were higher (ANOVA, p≤0.044). For McMonnies questionnaire this was only true for the two-subgroup stratification (ANOVA, p=0.04), but not for three-subgroup stratification (one-way ANOVA, p=0.30). On the other hand, meibometry values showed a statistical correlation with both BUT (r=0.305, p<0.001) and MBI (r=0.265, p<0.001). When the sample was divided in three groups regarding BUT value (≤5s, between 5 and 10s and≥10s), significant differences of meibometry values were found between BUT subgroups (p=0.008). **Conclusion:** Meibometer MB550 can discriminate asymptomatic from dry eye symptomatic patients. Furthermore, there is a relationship between meibometry and the tear film stability.

N. Nakavama, M. Kawashima, M. Kaido, R. Arita, K. Tsubota, **Analysis of Meibum Before and After Intraductal Meibomian Gland Probing in Eyes With Obstructive Meibomian Gland Dysfunction,** Cornea, 2015 Oct;34(10): p. 1206-8

Purpose: To evaluate whether the amount of meibum and its viscosity change after intraductal Meibomian gland probing in patients with refractory obstructive meibomian gland dysfunction (o-MGD). Method: Six lid margins of 3 patients with refractory o-MGD underwent intraductal meibomian gland probing. Meibum and the clinical outcome were evaluated before the procedure and at a 1-month postoperative visit. Meibum was quantified with a Meibometer, and its viscosity (Shimazaki grade) was assessed simultaneously. The tear film condition was evaluated by lipid layer interferometry (DR1, Kowa, Nagoya, Japan), and meibomian gland loss was analyzed by noncontact infrared meibography. Lid margin findings, tear break-up time, fluorescein score, and ocular symptoms were also assessed. Results: At the postoperative visits, all cases showed improvements in meibum lipid levels (446-1376, 757- 802, and 396-571 meibometer units) and meibum viscosity (grade 3-0, 3-1, and 3-2). Two cases showed an improvement in tear break-up time (2-5 and 0-6 seconds). No morphological changes in the meibomian gland were observed in any cases. Conclusions: Intraductal meibomian gland probing seems to improve meibomian gland lipid levels, and it may be a good treatment option for cases of o-MGD that are resistant to conventional treatment.

Klinische Studie bezüglich der Wirksamkeit und Verträglichkeit (Auszug), Institut Dermatologie an der Universität Hamburg (2013), Ästhetische Dermatologie 8, 2015

Fragestellungen: Eruiert werden sollten der Vitalisierungseffekt für die Wimpern, die Patientenzufriedenheit sowie biophysikalische Messergebnisse. Untersuchungskriterien und Methoden: Ausschlusskriterien waren gefärbte Wimpern und künstliche Wimpernverlängerungen. Entsprechend einer 5-Punkte-Skala wurden die Effekte untersucht. Die Bewertung geschah sowohl durch die Probanden als auch durch neutral externe Auswertung basierend auf standardisierten klinischen Photographien (Fotofinder Systems/Deutschland). Zusätzlich wurde die Patientenzufriedenheit ausgewertet. Zur Bestimmung der Hauttoleranz wurden eingesetzt: pH-Wert-Messung, Corneometrie

und die Messung des Lipidgehaltes in der Tränenflüssigkeit (alles durchgeführt mit Geräten von Courage & Khazaka, Köln).

A.M. Ewert, **Interferometrie, Meibometrie und biochemische Analyse der Lipidschicht des Tränenfilms beim Hund**, Dissertation an der Klinik und Poliklinik für kleine Haustiere des Fachbereichs Veterinärmedizin der Freien Universität Berlin, 2011

Ein gesunder und stabiler Tränenfilm (TF) stellt einen entscheidenden Faktor für die Aufrechterhaltung der Augengesundheit dar. Er ernährt die avaskuläre Hornhaut, schützt sie mechanisch und immunologisch vor diversen Umwelteinflüssen und optimiert die Lichtbrechung an der Augenoberfläche [1]. In der Humanmedizin ist schon lange bekannt, dass ein Defizit der wässrigen Anteile des dreischichtigen präkornealen TF nicht ausschließlich für eine unzureichende Befeuchtung des Auges und das daraus resultierende Krankheitsbild des „trockenen Auges" verantwortlich gemacht werden kann. Unumstritten ist in diesem Zusammenhang die Relevanz einer intakten Lipidschicht (LS) für den funktionsfähigen TF und somit für die Augengesundheit. Ein „trockenes Auge", welches trotz ausreichender Produktion der wässrigen Phase auftritt, wird als evaporatives „trockenes Auge" bezeichnet (syn. Evaporative dry eye; EDE). Das EDE ist durch eine erhöhte Verdunstung und Instabilität des TF u.a. aufgrund einer mangelnden bzw. unzureichenden LS charakterisiert und kann sich klinisch ähnlich einer Keratokonjunktivitis sicca (KCS) präsentieren. Von den Meibom Drüsen (MD) am Lidrand gebildet und sezerniert (hier Meibom Sekret, MS), gewährleistet eine physiologische LS die Stabilität des gesamten TF und somit eine ausreichende Befeuchtung der Augenoberfläche. Die LS ist nur wenige Mikrometer dünn und eine komplexe Komposition verschiedener polarer und nicht polarer Fette. Die logische Schlussfolgerung ist, dass kleinste Veränderungen in der Zusammensetzung oder ein quantitatives Defizit der LS großen Einfluss auf die Funktionalität des TF haben können.

M. Streker, L. Kleine-Börger, M. Kerscher, **Efficacy of a novel formulation for eyelashes revitalization – results of a pilot study,** University of Hamburg

Background: Long lashes are associated with attractiveness. Lash grow has been reported following an accumulation of prostaglandin after application of eye drops. The aim of this single-center, randomized trial was to determine the revitalizing effect of a new lash serum by using a clinical score, a patients' satisfaction questionnaire and biophysical measurements over a study period of 12 weeks (figure 1). Material and methods: 30 adult healthy volunteers (26 woman, 4 men) wishing longer and fuller lashes were enrolled. Study specific exclusion criteria were lash extensions and colored lashes. Primary endpoint was to evaluate the effects of the lashes serum by using a five-point rating scale (figure 2). Both patients and blinded evaluator were asked to rate the effect according to standardized clinical photographs (Fotofinder Systems, Teachscreen Software GmbH, Bad Birnbach, Germany).To evaluate skin tolerance, pH-value, corneometry and lacrimal fluid's lipid content were measured (all Courage+Khazaka, Cologne, Germany).

P. Versura, V. Profazio, M. Ortolani, C. Coslovi, A. Bron, E.C. Campos, **Performance of Meibometry Analysis in Meibomian Gland Dysfunction (MGD) Evaluation,** tfos Florence 2010, Poster 36

Meibometry is a non-invsive method to assess meibomian lipid reservoir We aimed to evaluate the diagnostic performance of lipid casual distribution at the central lower lid margin, as measured by Meibometry, in classifying and quantifying MGD. 96 patients: 62 women, 43 men, medium ae, 49,5 and 52,7 yrs. Respectively. Direct Meibometry (DM) was performed by Meibometer MB550 (Courage-Khazaka electronic GmbH, Germany) readings in AU (Arbitrary Units).

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P. Benz , A. Tichy , B. Nell, **Review of the measuring precision of the new Meibometer MB 550 through repeated measurements in dogs,** Vet Ophthalmol. 2008 Nov-Dec;11(6): p. 368-74

A meibometer is a device to measure the delivery rate of lipids on the eyelid margin. The aim of this study is to determine the measuring precision of the new Meibometer MB550 (Courage-Khazaka electronic GmbH, 50829, Cologne, Germany), linked to a computer, by means of repeated measurements in dogs by different examiners. PROCEDURE: Two investigators measured the lipid rate on the eyelid margin in 10 healthy dogs for 10 days. One examiner measured the right eye (OD)

and the other measured the left eye (OS) for 5 days. After 5 days, the eyes to be measured were switched between the examiners. The new device was able to record all measurement values as charts and curves in comparison to the previous Meibometer, which displayed only one value.

A. Wenzel, J.K. Mueller, C. Eule, **Meibometry: a reliable tool for feline ophthalmology?,** International Veterinary Ophthalmology Meeting 14. - 18. May 2008, Versailles France

Purpose: Meibomian lipid secretions are forming the outermost tear filmlayer and are essential in preventing tear overflow and evaporation. In human and canine ophthalmology meibometry is described as a simple, minimally invasive method to quantify the amount of lipid at the lid margin and to detect meibomian gland (dys)function. The aim of this project, performed during a student's elective course, was to evaluate feasibility of meibometry in healthy cats.

*R. Ofri, K. Orgad, P.H. Kass, S. Dikstein***, Canine meibometry: Establishing baseline values for meibomian gland secretions in dogs**, The Veterinary Journal (2006)

Meibomian lipid secretions are essential in preventing tear evaporation. Disorders of the meibomian glands may therefore play an important role in the pathogenesis of some forms of keratoconjunctivitis sicca (KCS). Until now, meibomian lipid secretions have never been quantitatively evaluated in dogs.

N. Yokoi, F. Mossa, J.M. Tiffany, A.J. Bron, **Assessment of Meibomian Gland function in Dry Using Meibometry,** Arch. Ophtalmolol., Vol 117; June 1999

Meibomian gland disease is a common condition that is often symptomatic. Meibomian gland dysfunction (MGD) is a term adopted by Jester et al chiefly to describe obstructive meibomian gland disease. The primary disease is common, but there is a strong association between MGD and certain forms of skin disease such as a topic and seborrheic dermatitis and acne rosacea. It also may be caused by systemic retinoid therapy or less commonly by polychlorinated biphenyl. Obstructive MGD may be focal, with patchy involvement of gland, or diffuse, when oil expression is impaired in all glands. Cicatricaland non-cicatricial forms of MGD exist.

J.M. Tiffany, A.J. Bron, F. Mossa, S. Dikstein, **Delivery of meibomian oil using the clinical Meibometer®,** Lacrimal Gland, Tear Film, and Dry Eye Syndromes 2, Plenum Press, New York, 1998

Tear film studies in recent years have emphasized the importance of the oily secretion of the meibomian glands in reducing evaporation from the open eye and in promoting stability of the precorneal film. The thickness of the spread oil film is readily measured, but little information exists on the amount of oil available for the film, or on its quantity or manner of delivery from the glands.

C.K.S. Chew, P.G. Hykin, C. Jansweijer, S. Dikstein, J.M. Tiffany, A.J. Bron, **The casual level of meibomian lipids in humans,** Current Eye Research, Vol. 12, No. 3, 1993

Using a modified skin surface lipid measuring instrument, the Meibometer, the amounts of meibomian lipid on the lid margins (the casual levels) of 421 subjects aged 1 to 94 years were measured. The lowest levels were found in children younger than 14 years (means ± S.E.: males = 1.48 ± 0.17, females 1.53 ± 0.17 µg lipid/mm^2 lid margin surface) and rose with age, the highest levels being found in males aged 60-69 years (means ± S.E.= 3.26 ± 0.18 µg lipid/mm^2 lid margin surface).

C.K. Chew , C. Jansweijer, J.M. Tiffany , S. Dikstein, A.J. Bron, **An instrument for quantifying meibomian lipid on the lid margin: the Meibometer,** Curr. Eye Res. 1993 Mar;12(3): p. 247-54

Abstract: An instrument, the Meibometer, is described for estimating the casual level of meibomian lipid on the human eyelid margins, adapted from a commercially-available instrument used for measurement of skin surface lipid. A loop of plastic tape is pressed onto the everted lower lid margin to lift off a blot of lipid. The resultant change in light transmission of the tape is read by a photometer. Readings are not affected by side (R or L), time of day or lid surface temperature. After cleaning lipid from the lid margins with hexane, the rate of recovery per 10 blinks, as a percentage of the pre-cleaned level, was measured as 33.7 +/- 5.8 (mean +/- SE). This rate of delivery appears to provide enough lipid for complete resurfacing of the preocular tear film with every blink. Over short periods no detectable lipid was delivered in the absence of blinking.

C. Franck, E. Bach, P. Skov, **Prevalence of objective eye manifestations in people working office buildings with different prevalence of the sick building syndrome compared with genereal population,** Int. Arch. Occup. Environ. Health. 1993; 65: p. 65-69

Summary A**:** cross-sectional clinical epidemiological study was carried out among 169 office workers in four Copenhagen town halls with different prevalences of the sick building syndrome The

results were compared with those in 112 subjects randomly selected from the general population Biomicroscopic eye manifestations, such as premature break-up of the precorneal tear film, absence of foam at the inner eye canthus and epithelial damage of the bulbar conjunctiva, were investigated together with self-reported eye complaints Although intercorrelated, the objective eye manifestations independently were statistically associated with self-reported eye complaints in office workers The prevalence of the objective eye manifestations was significantly elevated in office workers compared with the general population and most pronounced for the buildings with a high prevalence of the sick building syndrome (P< 0 001) In the general population, subjects with a non-industrial occupation, including office workers, had a significantly higher prevalence of objective eye manifestations than those with an industrial occupation *(P* = 0 03), but the prevalence was still significantly lower than that among the office workers in buildings with a high prevalence of the sick building syndrome *(P*< O 001) Since possible confounders were found not to explain the difference in prevalence of objective eye manifestations and complaints among the two populations, it is concluded that the office environment (buildings and/or type of office work) promotes these objective changes accompanied by self-reported complaints.

C.K.S. Chew, J.M. Tiffany, S. Dikstein, A.J, Bron, **Lipid levels on the lid margins of patients with meibomian gland dysfunction,** Invest. Opthalmol. Vis. Sci. 1992; 33:950

Diseases of the Meibomian glands are poorly understood at present. Although originally thought to be caused by bacterial infection, they are now widely accepted to be of non-infectious aetiology. The term Meibomian gland dysfunction (MGD) is used to include all disorders of the Meibomian gland. Although disorders of the Meibomian glands are very common there is as yet no widely accepted way of classifying them.

Use on scalp:

E. Martin, A. Zhang, R. Campiche, **Saccharide isomerate ameliorates cosmetic scalp conditions in a Chinese study population**, *J Cosmet Dermatol.* 2023;22: p. 262–266

Background: Scalp conditions such as flaky or oily scalp affect people across ethnicities and age groups. In addition to flaking, increased sebum secretion, itching, and compromised scalp barrier function were described. Scalp conditions are aesthetically disturbing and may cause psychological distress in affected individuals who are looking for mild and effective treatment at the same time. Saccharide isomerate has a long history as a skin moisturizer, and it was found to improve skin barrier function, also suggesting possible beneficial effects on scalp. Aims: To provide relevant claim substantiation to introduce saccharide isomerate as a new scalp care active against scalp flaking condition. Material and Methods: We conducted a placebo-controlled clinical study in an adult Chinese population affected by dandruff scalp as assessed by an adherent scalp flaking score. We monitored transepidermal water loss (TEWL), sebum secretion, and scalp flaking during 28 days. Results: Formulations containing Saccharide isomerate significantly improved all parameters both over time as well as compared to the placebo formulation. Conclusion: We propose Saccharide isomerate for cosmetic formulations directed toward improving scalp conditions such as dandruff or oily scalp.

N.-Y. Kim, B.-R. Kim, M.-G. Jung, S.-H. Park, H.-Y. Jin, H.-J. Jang, S.-J. Kim, **Comparison Analysis of Tests for the Sebum Content on the Scalp Using Meibometer® and Sebumeter®,** Asian J Beauty Cosmetol, 2022; 20(3): p. 315-323 (Article in Korean)

Purpose: The purpose of this study is to show that Meibometer® is a useful analysis technique for the measurement and evaluation of the sebum content on the scalp by comparing the test analysis results of the scalp sebum content using Meibometer® and Sebumeter®. Methods: In this study, Meibometer® and Sebumeter® were used for quantitative measurements of the sebum content on the scalp of the test volunteers, and the measurement results were analyzed using the paired t-test and Pearson's correlation coefficient. Results: The scalp sebum content was analyzed using Meibometer® and Sebumeter®, and according to the results, both measuring devices exhibited a reduction in the scalp sebum content, compared to before the testing product was applied ($p<0.001$). The Meibometer® and Sebumeter® measurements showed a significant positive correlation ($r=0.411$) in the second measurement. Conclusion: These results showed that the measuring results of both Meibometer® and Sebumeter® had a high correlation and they were appropriate for measurement. However, it is suggested that for reducing the interference of the adjacent hair with sebum and quantitatively evaluating the sebum content on the scalp only, Meibometer® can be a relatively useful analysis

technique, and it is expected that further test analysis and studies using Meibometer® will be actively conducted in the future.

C. Uhl, D. Khazaka, A. Pouladi, **"Classic" biophysical methods for hair & scalp**, PERSONAL CARE, March 2021, p. 23-26 and **Métodos biofísicos 'clásicos' de análisis capilar,** Revista técnica de la Industria Cosmética, Perfumería e Higiene Personal, Primavera 2021 No. 018, p. 34-37

Hair is not only strands of horn made mainly of keratin. Hair indicates someone's personal beliefs or social status. The matter of hair care / grooming is not entirely all about women. For men, a well-kept, thick head of hair brings added good looks. However, there is more to it. Nowadays, social media, most of all Instagram, influences different generations. Besides skin, hair is the characteristic attribute for health, youth and attraction. Hair can even be a communication and political instrument. Just take as an example the men who let grow a moustache of their own style every November of a year, the so called Movember, to raise funds for men's health. Plenty of products and treatments are ready to fit the modern hair care market for thin, thick, curly, dry, oily, blonde, coloured, ethnic, young, or old hair. Imagine a claim, the product is already invented. As hair is unique, personalised products flood the hair care market. Respectively, a great number of claims around the various products exists. Hair care rituals can be complemented with food supplements and treatment devices.

Además de la piel, el cabello representa un atributo social característico de la salud, la juventud y la atracción. Multitud de productos y tratamientos están listos para ser adaptados al nuevo mercado de cuidado del cabello, específicamente para tratar cabellos finos, gruesos, rizados, secos, grasos, coloreados, jóvenes, envejecidos... Existe un gran número de afirmaciones en torno a los distintos productos existentes en el ámbito del cuidado capilar.