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Literature List

CutiScan

*C. Rosado, R. Barbosa, R. Fernando, F. Antunes, L. Monteiro Rodrigues, **New Approaches to Quantify Cutaneous Anisotropy and Viscoelasticity**, Physiology 2014 London*

Introduction: Skin is a complex biomaterial. One of its characteristics is anisotropy due to preferred fiber alignment in the skin, resulting from prolonged exposure to a surrounding stress state. Skin anisotropy is an important issue for plastic surgeons, as well as cosmetics science. In the last decades, several devices have emerged as indispensable tools in the study of the cutaneous physiology, as well as in the assessment of the efficacy and safety of topical formulations. The CutiScan CS 100[®] (Courage and Khazaka, Koln, Germany) is designed to provide information not only about the elastic and viscoelastic properties but also on anisotropy and directionality of the skin. This device contains a probe that combines mechanical force with imaging in a unique way. It consists of a suction ring (14 mm diameter) that draws the skin uniformly in all directions with a constant negative pressure. During the suction and recovery time a high resolution CCD camera inside the probe monitors the displacement of each pixel by an optical flow algorithm in a video. From that video an overall graph is generated, as well as interesting measurement parameters.

*C. Rosado, R. Barbosa, R. Fernando, F. Antunes, L. Monteiro Rodrigues; **Use of the Cutiscan CS100 to quantify cutaneous cutaneous anisotropy and viscoelasticity**, Skin Forum Prag September 2014*

Introduction: Skin is a complex biomaterial with anisotropy, due to preferred fiber alignment resulting from prolonged exposure to a surrounding stress state. Several devices were developed to quantitatively assess skin biomechanics. The CutiScan CS 100[®] aims to provide information not only about the elastic and viscoelastic properties but also on anisotropy and directionality of the skin. This device contains a probe that combines mechanical force (suction) with imaging (Fig. 1). During the suction and recovery time a high resolution CCD camera inside the probe monitors the displacement of each pixel by an optical flow algorithm in a video. From that video an overall graph (Fig.2) is generated, as well as measurement parameters.

*M. Higuchi, K. Kitahara, K. Shimizu, K. Hirai, T. Matsumoto, M. Takahashi, **Analysis of the Facial Skin Pores with a Video Microscope with Concerning the Relationship between the Pore direction and the Cutaneous Mechanical-Anisotropy**, J. Soc. Cosm. Chem. Jpn. (Article in Japanese)*

Recently a number of studies on the facial skin pores are reported. The shape of pores is ellipsoidal but non-circular, and its elliptic distortion increases with age. Many factors such as menstrual cycle, ultraviolet irradiation, sebum secretion, and dry skin affect the size of pores. However, few studies focus on the relationship between the direction of pores (the angle of the long axis of ellipse) and the cutaneous mechanical-anisotropy. This study examined the pore size and its direction at six different sites on the face by image analysis with a video microscope and software (Integral, Tokyo, Japan). The directions of pores in the forehead, jaw, and upper and lower cheeks of the both sides of the face run along the Langer's lines. The size of pores in the upper cheek was larger than those of other sites. This study also measured the cutaneous mechanical-anisotropy with CutiScan (C+K, Cologne, Germany). The low extensible direction of the skin was found to

correspond to those of the pores and the Langer's lines. Finally, this study investigated the effect of a 4- week treatment with skincare products on the shape of pores. The total area of pores significantly decreased with improving the skin condition, which was confirmed by increase in water content in the stratum comeum and decrease in the transepidermal water loss. However, the direction of pores was unable to be changed.

H. Silva, F.F.C Rego, C. Rosado, L. Monteiro Rodrigues, Novel 3D “active” representations of skin biomechanics, Biomed Biopharm Res.,2016; (13) 2: p. 219-227

Skin exhibits unique biomechanical properties that enable unrestricted body movements without tearing. Several devices have been used to quantify skin mechanical properties, but techniques, in general, do not concern this multidirectional capacity, only allowing measurements in a few angles. CutiScan[®] is a new device that quantifies skin elasticity over 360°. It uses a suction method to induce skin deformation and a video camera to quantify its displacement. This work aims to assess these properties through the analysis of 3D time-angle-height of displacement representations. 20 female subjects (37.0 ± 18.7 years old) were enrolled in this study after informed consent, grouped by age in group 1 (22.0 ± 1.3 years old), and group 2 (52.0 ± 13.7 years old). The *in vivo* mechanical profile of each volunteer was assessed in the forehead, forearm and in the leg. Significantly higher surface area and volume under the curve values were found in the forehead of the subjects of group 2. Significant differences were also found between the forehead and forearm and between the forehead and leg among each group. These results suggest that these 3D representations are useful in distinguishing the viscoelastic profile of differently aged subjects and of different skin sites.

*C. Rosado, F. Antunes, R. Barbosa, R. Fernando, L. Monteiro Rodrigues, Cutiscan[®] - A new system of biomechanical evaluation of the skin *in vivo* - comparative study of use depending on the anatomical site*, Biomed Biopharm Res., 2015; (12) 1: p. 49-57

Skin is a complex biomaterial. One of its characteristics is anisotropy due to fiber alignment, resulting from prolonged exposure to a surrounding stress state. This property is important in experimental studies of skin biomechanics and in experimental dermatology. During the last decades, several devices have been developed to study the cutaneous physiology. The CutiScan[®], one of the latest, provides information not only about the elastic and viscoelastic properties, but also on anisotropy and directionality of the skin. The aim of this study is to investigate the changes in the biomechanical properties of human skin due to the anatomical site, combined with a study on the benefits and limitations of the CutiScan[®], and also comparing it with other more studied devices - the Cutometer[®] and the Reviscometer[®]. 20 volunteers were engaged in this investigation after an informed consent. Measurements were conducted in three different anatomical sites (forehead, forearm and leg) with each device. Results showed that devices were able to identify significant differences among anatomical sites. The CutiScan[®] enabled a more complete assessment of skin's biomechanical properties, since it provides real-time images and 360° elasticity curves that allowed the simultaneous study of viscoelasticity and anisotropy.

J. Comas, C. Davi, E. Canadas, M. Vincendet, R. Delgado, Firmed Face, Neck and Decolletage, COSSMA 5 | 2017, p. 24-27

Actifcol*, Lipotec's new botanical active ingredient, is based on shiitake mushroom - considered to be an elixir of life. Designed to offer complete care for the collagen lifecycle, the ingredient's new approach helps provide high levels of quality protein while decreasing the deterioration of collagen for visible firming effects on the face, neck and decollétage

*C. Rosado, F. Antunes, R. Barbosa, R. Fernando, M. Estudante, H.N. Silva, L.M. Rodrigues, About the *in vivo* quantitation of skin anisotropy*, Skin Research and Technology 2017; 23: 429-436

Background/purpose: Human skin anisotropy is difficult to quantify. The Cutiscan[®], is allegedly, the first biometrical system to provide information on the elastic and viscoelastic properties, as well as on anisotropy and directionality of the human skin *in vivo*. Thus, this study aims to contribute to characterize this new device and its applicability, and to compare its behavior with two

other well-known devices— the Cutometer® and the Reviscometer®. Methods: Measurements were conducted with each device in three different anatomical sites (forehead, forearm and leg) of 20 female volunteers engaged after informed consent. The participants in the study were aged 19-73 years (mean age 37 ± 18.7 years old), and were divided in two groups (n = 10), based on their age - Group I, mean age 22 ± 1.3 years; Group II, mean age 52 ± 13.7 years. Results: All devices were useful tools to explore the anatomical and the age dependant changes in biomechanical terms, showing different discriminative capacities. Interesting correlations were established between the variables provided by the equipment. Conclusion: The Cutiscan® descriptors delivered excellent relationships with those from Cutometer® and Reviscometer®, while providing more detailed information about skin anisotropy through a full 360° analysis.

*J. Comas, O. Laporta, M. Ollagnier, S. Venkataraman, R. Delgado, **A firmer skin from the elixir of life mushroom**, PERSONAL CARE EUROPE, November 2017, p. 85-87*

Shiitake mushroom has been recognised throughout history for its youth-promoting benefits, even being acknowledged as an elixir of life. In terms of its application in skin care, a shiitake mushroom-based extract has been recently selected to provide rejuvenating and firming effects to the skin of the face, neck and décolleté. More specifically, Actifcol advanced botanical ingredient has shown to offer a holistic care of the collagen protein, by helping increase its synthesis, improve its quality, through the PLOD1 gene, and reduce its deterioration process caused by carbamylation. When evaluated on mature skin, it showed to enhance firmness and to achieve a more isotropic skin behaviour, typical of a younger skin.

*H. Silva, F.F.C Rego, C. Rosado, L. Monteiro Rodrigues, **Exploring Human Skin Anisotropy by 3D Plotting**, Poster Presentation at ISBS Conference San Diego, May 2018*

Introduction: The CutiScan® is a recent device apparently capable of quantifying skin viscoelastic behavior in a 360° topography. Here we propose a new 3D representation of CutiScan's data and parameters obtained from 13 healthy female foreheads (n=7 20.0 ± 1.2 y.o., an n=6 50.2 ± 2.4 y.o.). Methodology: The CutiScan® quantified the height of displacement, after suction, for each of the 360 angles. From a 3D polar data representation (time-displacement-angle), several 2D plots were constructed, from which other parameters - stretchability, stretching speed, stretching time and rise time were calculated and graphically represented. Results and Conclusions: These representations shown that older subjects display larger displacement heights, as well as larger height max slopes, higher rise and stretching times, irrespective of orientation. Results suggest that these new parameters are sensible and useful for the characterization of in vivo skin biomechanics.

*P. Barlier, V. Couturaud, **Évaluation de l'effet antirides et des propriétés biomécaniques**, in: A.-M. Pénse-Lhéritier (Editor): Évaluation des produits cosmétiques, Lavoisier Paris, Tec & Doc, chapter 4, p. 58-81, 2016*

En vieillissant, les organes du corps humain, dont la peau fait partie, se mettent à fonctionner de façon moins efficace. Ce processus, programmé par notre profil génétique, peut être amplifié par l'environnement et par nos habitudes de vie.