

SKIN AGE DETERMINED BY FEMTOSECOND LASER MULTIPHOTON TOMOGRAPHY

Andreas Schindele, Karsten König
JenLab GmbH, Schillerstr 1, 07745 Jena, Germany
Emails: schindele@jenlab.de, koenig@jenlab.de

KEY WORDS: Multiphoton Tomography, collagen, elastin, skin aging

Multiphoton tomography (MPT) based on a femtosecond laser pulse excitation opens the way for high-resolution non-invasive *in vivo* imaging of intratissue biological structures, co-enzymes and cells. These multiphoton images can be used to derive a skin age parameter SAAID, introduced in [1] for *ex vivo* slices, which is based on the detection of second harmonic generation (SHG) signals of collagen and two-photon autofluorescence (AF) of elastin in the dermis. Multiphoton excitation is the only technique, which provides these nonlinear skin signals. It was shown in [2], that the SAAID can be obtained by a non-invasive *in vivo* MPT system and it correlates with the age of the test person. In [3], a similar measure, based on the same MPT signals is introduced. The skin age parameter is an important measure for the dermatological assessment of the skin as well as for the cosmetic industry to evaluate anti-ageing products [4] and physical procedures such as laser treatment. Furthermore, SAAID provides also information on the effect of UV exposure and other skin damaging processes. It helps NASA and ESA to understand skin-ageing effects and wound healing problems in space. Furthermore, technical details about the SAAID determination and techniques, how to approach wrinkles and hairs, are addressed.

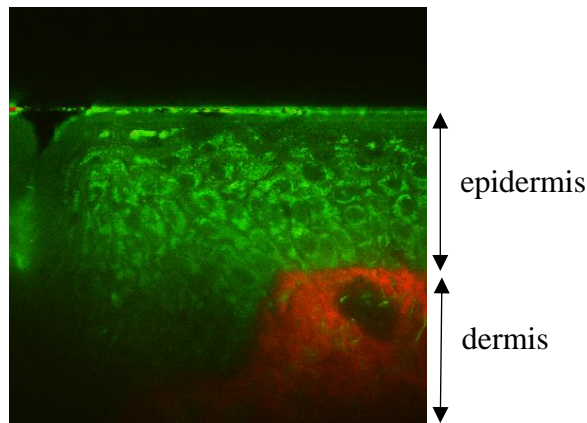


Fig. 1 – Vertical Scan of the human skin up to a skin depth of approx. 150 μm with SHG (red) and AF (green).

- [1] S.-J. Lin, S.-H. Jee, J.-Y. Chan, R.-J. Wu, W. Lo, H.-Y. Tan, W.-C. Lin, J.-S. Chen, T.-H. Young, C.-J. Hsu, and C.-Y. Dong. Monitoring Photoaging by Use of Multiphoton Fluorescence and Second Harmonic Generation Microscopy. Proc. SPIE 6078, Photonic Therapeutics and Diagnostics II, 607803, 2006
- [2] M. J. Koehler, A. Preller, N. Kindler, P. Elsner, K. König, R. Bückle, and M. Kaatz. Intrinsic, solar and sunbed-induced skin aging measured *in vivo* by multiphoton laser tomography and biophysical methods. Skin Research and Technology, 15: 357–363, 2009.
- [3] S. Pushmann, C.-D. Rahn, H. Wenck, S. Gallinat, and F. Fischer. *In vivo* quantification of human dermal skin aging using SHG and autofluorescence. Multimodal Biomedical Imaging VII. Proc. Of SPIE Vol. 8216, 2012.
- [4] R. Bazin, F. Flament, A. Colonna, R. Le Harzic, R. Bückle, B. Piot, F. Laizé, M. Kaatz, K. König, and J. W. Fluhr, Clinical study on the effects of a cosmetic product on dermal extracellular matrix components using a high-resolution multiphoton tomograph. Skin Research and Technology, 16: 305–310, 2010.