

**Clinical Multimodal Multiphoton Tomography (MPT)
of Patients with *Atopic Dermatitis* and *Psoriasis Vulgaris***

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Two-photon microscopes have been successfully translated into clinical multiphoton tomographs to obtain high-resolution optical biopsies for *in vivo* histology. Here we report on two-beam multiphoton CARS tomography in a hospital. The high-resolution *in vivo* multiphoton biopsies of diseased skin were obtained non-invasively within a few minutes using the compact tomograph *MPTflex-CARS* equipped with a tunable titanium:sapphire femtosecond laser, a photonic crystal fiber for the generation of a Stokes beam, an optomechanical articulated arm, and a 4-detector-360° measurement head. The tomograph has been employed to patients in a hospital with diseased skin.

Two-photon autofluorescence lifetime (FLIM), SHG of collagen, and two CARS signals of intratissue lipids/proteins have been detected with four PMTs simultaneously during the 6s-scan. Multiphoton sectioning has been performed within 100 µm of skin covering the four epidermal layers and part of the upper dermis. The most important signal was the 777nm-excited autofluorescence from NAD(P)H providing the information on morphology of the intratissue live cells as well as on cellular metabolism. Furthermore, the autofluorescence of keratin, melanin, and elastin was detected. The SHG signal from collagen was mainly used to locate the upper dermis (epidermal-dermal junction) and to calculate the ratio elastin/collagen (skin age parameter SAAID). The CARS/Raman signals provided add-on information such as on cellular membranes. Skin areas affected by *dermatitis* and by *psoriasis* could be clearly identified based on this novel type of non-invasive high-resolution label-free *in vivo* histology.

Novel developments of multimodal MPT are based on the use of an ultracompact 80 MHz femtosecond fiber laser at 780 nm integrated in the measurement head. This new multiphoton tomograph *MPTcompact* is currently tested in two European hospitals.

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