**Characterisation of the skin barrier defect in atopic dermatitis using *in vivo* ATR-FTIR molecular spectroscopy**

9th Georg Rajka International Symposium on AD 2016, Sao Paulo, Brazil

**Background:**Attenuated total reflectance (ATR)-Fourier transform infrared (FTIR) spectroscopy is a molecular spectroscopic technique that can be used to investigate the surface properties of human skin *in vivo*.

**Objective:** To compare the molecular structure of the skin of atopic dermatitis (AD) patients to the skin of healthy controls non-invasively using a fibre-based FTIR device.

**Methods:** In a cohort of 56 patients with AD, and a control group of 20 volunteers with healthy skin (no skin conditions or atopy), the clinical and biophysical properties of six different skin sites (cubital fossa, volar forearm, wrist, back of hand, palm, and lower leg) were assessed. The levels of urocanic acid, pyrrolidone carboxylic acid and free amino acids, were determined in tape-strip samples taken from the volar forearm as a measure of natural moisturising factor (NMF) levels. All participants were genotyped for the 5 most common European filaggrin gene mutations.

**Results:** The FTIR spectra of AD patients exhibited prominent changes at several wavelengths associated with the components of natural moisturising factor (1600, 1410, and 1340 wavenumbers). Absorbance at 1340 cm-1 correlated significantly with NMF levels determined at the volar forearm (r=0.7705, p<0.0001) and was further evaluated as an AD biomarker. The highest absorbance at 1340 cm-1 was observed on the cubital fossa, followed by the forearm, wrist, back of hand, palm, and leg in decreasing order. On the forearm FTIR determined NMF levels increased 4-fold with increasing depth into the stratum corneum (SC), achieved by repeated tape-stripping. Throughout the depth of the SC, NMF levels were on average 29% lower in AD patients compared to controls. The difference between AD patients and controls was lowest at the surface (5.574±0.289 AU compared to 7.195±0.677 AU). Similar FTIR measurements at the surface of the cubital fossa revealed highly significant differences (p<0.0001) between patients (7.968±0.554 AU) and controls (12.347±0.831 AU). Moreover measurements on the cubital fossa could predict the presence of filaggrin gene mutations (ROC area under the curve 86±0.03%). FTIR determined NMF levels were significantly correlated with disease severity (SCORAD, *r*=-0.5529, p<0.0001), visual dryness (*r*=-0.7117, p<0.0001), erythema (*r*=-0.6220, p<0.0001), skin hydration (*r*=0.5146, p<0.0001), TEWL (*r*=-0.4509, p<0.0001), skin surface pH (*r*=-0.3687, p<0.0001) and SC lipid structure (determined by FTIR, *r*=0.5678, p<0.0001).

**Conclusions:** ATR-FTIR is a useful technique for the rapid and non-invasive characterisation of the skin barrier defect in AD.