Investigate and visualize the skin barrier alterations associated with environmental stresses (UV, ozone) by FTIR Spectroscopy and FTIR imaging analysis.

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**Background:** The skin is composed of two major layers: the epidermis, unvascularized epithelial layer, and the dermis, vascularized layer with a rich supply of capillaries, nerves, hair follicles etc. The epidermis plays a key role as it is our first protective barrier from environmental stresses like UV exposure, Ozone, exogenous contamination (Particulate Matter PM, heavy metals, etc.). Indeed, the superficial layer of the epidermis, the stratum corneum (SC) is permanently exposed to these external aggressions. Typically, the SC consists of ~10 to 20 layers of terminally differentiated corneocytes embedded in intercellular lamellar lipids. The skin barrier function is related to both the unique lipid composition of the SC and their complex and flexible structural organization. Modifications to the SC may result in significant changes of the skin barrier functions and therefore modify the skin permeability with regard to unwanted exogenous components.

**Aim:** The objectives of the present study are to assess and visualize the impacts of UV exposure (10h-100h) and/or Ozone exposure on the skin barrier integrity.

**Methods:** Both FTIR Spectroscopy and ATR-FTIR Spectroscopy Imaging were used to address these questions. FTIR spectrometer equipped with temperature-controlled transmission cell was used for studying SC lipids conformation and packing transition by analyzing the CH$_2$ peak positions between 2800 cm$^{-1}$ and 3000 cm$^{-1}$. The accessory is able to create a gradual heating of the SC samples. In all the experiments the FTIR spectra were acquired as a function of temperature from 5°C to 95°C and recorded every 2 to 3°C. All spectra were collected with a spectral resolution of 4 cm$^{-1}$ and 64 scans accumulation. By studying the frequency variation as a function of the temperature, the phase transitions under which the system goes from an ordered to a disordered conformation were observed.

FTIR images were acquired with a Spectrum Spotlight 400 imaging system (Perkin Elmer Instruments, Shelton, Conn., USA) using a MCT (mercury-cadmium-telluride) detector. FTIR images were collected in the reflective mode at a spectral resolution of 4 cm$^{-1}$ in the mid-infrared (MIR) region from 4000 cm$^{-1}$ to 850 cm$^{-1}$ with a spatial resolution of 6.25 x 6.25 μm.

**Results:** Our data show that progressive UV and Ozone exposure significantly changed the lipid organization inside the SC. These changes could significantly alter the skin barrier proprieties and dramatically change the skin permeability. On the other hand, the FTIR images recorded on the skin surface allow us to visualize the oxidative steps that the epidermal lipids undergo during these environmental stresses.