Synopsis of Original Research Paper

Development of photoacoustic skin diagnostics

Shunichi Sato

Division of Biomedical Information Sciences, National Defense Medical College Research Institute

Chromophores in skin tissue, such as melanin and hemoglobin, can be excited by irradiation with short pulsed light, by which adiabatic expansion occurs in the chromophores and as a result, photoacoustic waves are emitted in the tissue. By detecting the photoacoustic waves on the skin surface, we can obtain information on the distributions of chromophores in the skin, which is an important factor for determining cosmetic characteristics of the skin. The objective of this study was to develop a new modality for skin diagnosis, based on the photoacoustic technique. To investigate the validity of this technique, we performed multiwavelength measurements of photoacoustic signals induced in rat skins and human skins under the various experimental conditions. We used a transducer which consisted of an annular P(VdF/TrFE) (vinylydene fluoride trifluoroethylene copolymer) film and a quartz fiber; the film and fiber were coaxially arranged. Output pulses from an OPO (optical parametric oscillator) were coupled to the fiber and transmitted pulses irradiated skins. Photoacoustic signals induced were recorded in a high-speed digital oscilloscope. For human forearm skins, photoacoustic signal peaks appeared in the depth range of 0.1 - 0.2 mm, which were thought to be originated from melanin in the epidermis. The signal amplitude for the forearm outside skin was higher than that for the inside skin, indicating the higher melanin content in the outside skin due to exposure to larger amount of sunlight. For human palm skin, no clear signal originating from melanin was observed, while signal peaks which were thought to be originated from hemoglobin were observed in the three depth ranges: 0.3 - 0.4 mm, 0.75 - 0.8 mm, and 1.1 - 1.2 mm. Theses results suggest the validity of this method for depth-resolved skin diagnosis.