Synopsis of Original Research Paper

Development of non-invasive assay system of the skin : Quantitative measurement of a tactile sensation of the palpating finger

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Various attempts have been made to measure mechanical properties of the skin quantitatively and noninvasively. However, no attempt has been made to measure a tactile sense of our finger that palpates the skin; when we palpate the skin to search for any change, we at first rub the skin surface softly with a finger tip to detect a surface change and then press the finger against the skin to perceive any alteration in consistency. The problem here is how to record such tactile sense quantitatively, because the palpating examination for smoothness or softness of the skin totally depends on a subjective perception. Since a new tactile sensor that evolved from robot technology is equipped with a fingertip-like sensing probe oscillating at a resonance frequency of 60 kHz which is capable of clearly sensing small differences in hardness of solid substances from a change in the oscillating frequency and a displacement sensor that detects depressability of the skin, we have tried to introduce this new measuring system to evaluate the hardness and elasticity of the skin.

We constructed a probe with two independent sensors, i. e., a newly developed tactile vibration sensor and displacement sensor. To determine its usefullness we use at first an in vitro skin model and subsequently normal and lesional skin such as neutrophilic erythema, keloid, hypertrophic scar, and scleroderma.

Parameters obtained with our probe consisted of two, i.e., the one that reflected superficial firmness of the skin, which mainly correlated with the hydration state of the stratum corneum, and the other that reflected firmness of deeper tissue.

Our results showed that this probe is useful to evaluate the physical properties of skin lesions accompanying changes in skin firmness.