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ABSTRACT BOOK

STINTS7

PORTABLE PROBE TO RAPIDLY ASSESS MECHANICAL AND SENSORIAL PROPERTIES OF SKIN

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Introduction: Early diagnosis of pressures ulcers (PUs) has received increased interest. Multiple studies have been performed to discover reliable indicators for skin at risk of PUs [1]–[4]. In this paper, we propose a portable probe to rapidly assess mechanical properties of skin in situ, adapted from ideas in [4].

Methods: To perform in vivo measurements, we designed a portable probe. Two piezoelectric bender actuators were employed to stretch the skin tangentially. A set of strain gauges were glued to collect feedback signals that allow skin force and displacement derivation. Figure 1 illustrates the interaction of the probe with the inner forearm. To make repeatable measurements, a control on bender displacement was implemented. In experiments, the two benders worked symmetrically and loaded the skin cyclically at 1 Hz.

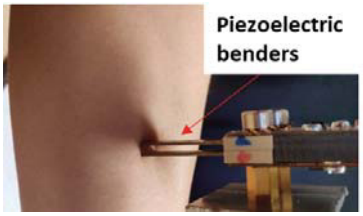

Figure 1 In vivo tests with the proposed probe.

Results: Skin responses under three displacement levels are displayed in Figure 2. The nonlinearity of skin was captured by the proposed probe, seen in the nonlinear stiffening at higher strains. Skin behaved similarly under displacement amplitudes of 100 µm and 200 µm, where the skin strain was less than 10%. For the latter, a stronger hysteresis was observed, as it corresponds to a higher rate condition. For the curve obtained under the largest vibration amplitude (400 µm), it was different from others. This maybe because of the nonlinearities of the skin and those of the contact between the bender tips and the skin.

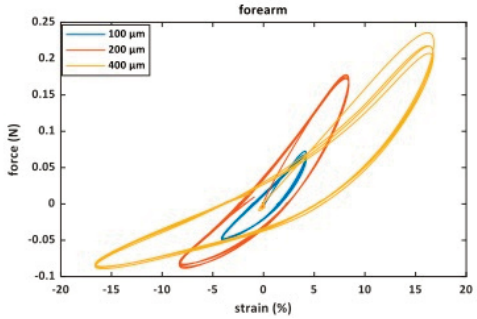

Figure 2 Skin response under cyclic loading at 1 Hz with displacement controlled. Here, strain is calculated from displacement with an initial skin length of 2.4 mm (initial distance between two bender tips).

Conclusions: Here, a portable probe is presented to characterise biomechanics of skin in situ. Skin force and displacement can be measured simultaneously through the probe. Further research will be dedicated to skin parameters extraction (stiffness, viscosity, modulus, etc), including body sites vulnerable to PUs. The highly integrated probe is beneficial to the early diagnosis of pressure ulcers.

References:

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