M. HOSONO, K. NODA, K. MATSUMOTO, I. SHIMOYAMA. Flexible force sensor sheet for preventing pressure ulcers. Gerontechnology 2010;9(2):217; doi:10.4017/gt.2010.09.02.268.00 **Purpose** We propose a wearable force sensor sheet to develop a pressure ulcer prevention system (*Figure1a*). The sensor is embedded in biocompatible silicone rubber so that the sensor sheet can disperse forces applied to a body. Also, the sensor sheet is flexible and capable of measuring pressure and biaxial shear forces. Conventional sensors can measure tri-axial forces but they are not designed to disperse forces. By attaching the sensor sheet to the common sites of pressure ulcers, force dispersion and monitoring can be done simultaneously. A pressure ulcer is mainly caused by pressure in combination with shear force and/or friction[1]. For its prevention, polyurethane or silicone gel film dressing is applied. However, the method is not sufficient to prevent pressure ulcers since the amplitude of forces depend on positioning, and conditions and build of a person at the time[2]. Thus, monitoring external forces over time plays an important role in prevention of pressure ulcers. In the work described in this paper, we fabricated the flexible sensor sheet and the forces applied to a human body were measured to confirm the sensor characteristics. **Method** The sensor sheet consists of two standing piezo-resistive cantilevers and a beam (*Figure 1b*), and is embedded in a polydimethylsiloxane (PDMS) sheet. PDMS is a silicone rubber and known as a biocompatible material. Piezoresister is formed on hinge parts of cantilevers and a beam. As PDMS deforms, stress is caused on the hinge parts of them and their resistances change. Since cantilevers and a beam are oriented orthogonal to each other, the sensor can detect tri-axial forces independently. The sensor was fabricated by applying microelectromechanical system (MEMS) process. The details of the fabrication steps of the sensor were reported previously[3]. The size of the sensor sheet was 30×30mm and 0.6mm in thickness. It was designed to measure up to 5.5N which is almost the same value as the shear force applied to scapula, one of the common sites of pressure ulcers in a supine position[4]. **Results & Discussion** Shear forces applied to a human body from a chair were measured with the sensor sheet. The sensor sheet was attached to the subject's scapula position. The subject sat and repeatedly leaned against the back of a chair. Shear forces in both x and y direction were applied to the sensor as the subject leaned against the chair (*Figure 1c*, sections marked with diagonal lines).The sensor detected shear forces generated by motion when the subject sank into a back support. The obtained real-time data indicated that the shear forces were applied up to 2 N in x-direction and 5 N in y-direction during the experiment. The results show that the fabricated sensor is capable of measuring the shear forces applied to a body.

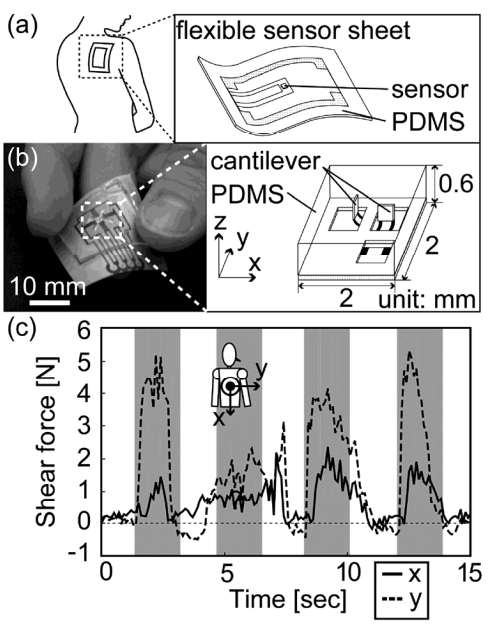

Figure 1 (a) Concept of a flexible sensor sheet, (b) Fabricated sensor sheet, and (c) Response of the sensor sheet attached to a human body

References

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