S. ISHIHARA, K. ISHIHARA, M. NAGAMACHI. ***Computer simulation of interaction between pressures inside the body with a mattress.*** *Gerontechnology 2014;13(2):218;* doi:10.4017/gt.2014.13.02.177.00 **Purpose** Bedsore prevention is a key aspect of the treatment of paralysis. We developed two devices, a bedsore preventative mattress and a wheel chair cushion[1]. Throughout the process of development, numerous body pressure measurements were calculated using different mattresses and cushions. Obtaining such measurements is labor intensive. Thus, numerical simulation of body pressure can be useful in estimating the distribution of pressure that is caused by physical parameters of different mattresses. In this paper, we provide examples of methods used to model the pressures created by a body in a transverse plane. **Method** This analysis was based on the mean sizes of Japanese people found in the AIST database[2]. In this simulation, we used the width of iliac crest, abdominal depth, shoulder breadth and the diameter at the base of the arm. The average size of a Japanese male's shoulder was assigned for the use in the shoulder model; a shoulder breadth and arm joint diameter of 45.62cm and 12.63cm, respectively, were used for this study. FEM modeling and computations were done with ANSYS 12 (ANSYS Inc.). We referred anatomical and MRI images from The Visible Human Project[3], for making the shapes of cross-sections of the body. Parameters of human tissues are referenced from Linder-Ganz & Gefen[4]. We used Ogden's formulation for hyperelastic materials stress and strain model. **Results & Discussion** Measurements from a simulated 60kg male body were used for the simulation. A commercially produced high-density urethane mattress was used (YM: Young's Modulus 25kPa, Poisson's ratio 0.0, density 48kg/m^3). Estimated maximum pressure on the skin touching the mattress was 2.53kPa and 3.83kPa for subcutaneous fat. The mean value of measured pressure at the corresponding region was 1.32kPa with 63kg 158cm male. The corresponding simulation result was 1.12kPa. The difference was as small as 0.2kPa. The softer mattress (YM 3.81kPa) simulation shows a larger deformation and pressure diffusion; the computation with this mattress was based on a non-linear finite element method of hyperelastic materials such as muscle, skin and fat. Because it simulates different tissues, we could estimate the pressure not only on the surface, but also the pressure inside the trunk. The simulated results reflected the actual results of pressure measurements very well.

References

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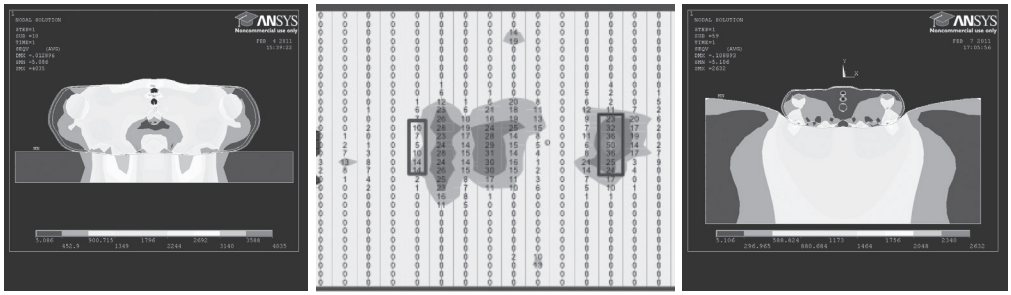

Figure 1. Computational result showing an upper shoulder model on a YM 25kPa mattress (left); actual measurement results with a 63kg male (center) and a softer YM 3.81kPa mattress model (right)