Measurement Method for Lumbar Motion and Development of Lumbar Assistive Device

Physical burdens caused by work in kinds of jobs including nurses, and diseases such as low back pain caused thereby are significant social problems. Among them, it has been pointed out that accumulation of burden on the low back by performing work in an unnatural posture such as a half-sitting posture for a long time is one of the causes of low back pain. In this research, we are conducting two studies with the aim of developing an assisting device that supports the lumbar.

One of them is the accurate measurement of lumbar spine motion. For a better lumbar support device, it is necessary to understand the kind of motion the lumbar spine makes during daily activities. In this study, regarding each lumbar vertebra as a rigid body, we propose a method to estimate the motion of these rigid bodies from the change of the contact point of overlapped two belts attached to the back. Based on the model shown in Fig. 1, we estimate the motion of the original rigid body by developing the sensor system that measures the change in the contact position as the rigid body transitions and rotations. We verified the effectiveness of this method by several experiments (Figure 2).

Together with the above development of measurement method, we also developed a device that supports the low back with a belt attached along the back when taking half-sitting posture or forward tilting posture for work such as nursing care. To realize such a device, we have proposed a mechanism for supporting the low back by mechanically locking the belt attached to the back in an arbitrary posture, and releasing this lock when the half-sitting work is over. The proposed mechanism is possible to support a theoretically infinite force with a small force because of the friction generated between the belt and the friction body by disposing of two overlapped belts. Besides, we proposed a method to change the friction coefficient by the ultrasonic vibration and change the locked state of the belt and confirmed the effectiveness of this system by experiment (Fig. 3).

Keywords: Estimation of lumbar motion, Assistive device for low back, Mechanism using blts

Reference

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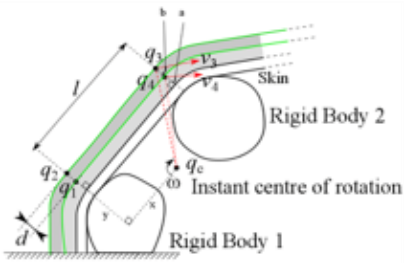

Fig 1. Model of the lumbar motion.

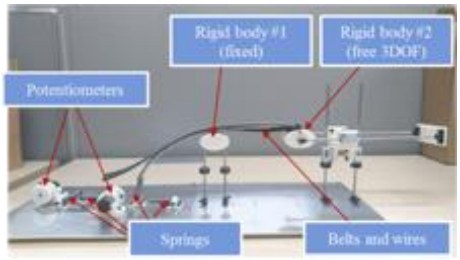

Fig 2. Experimental setup for evaluation of proposed method.

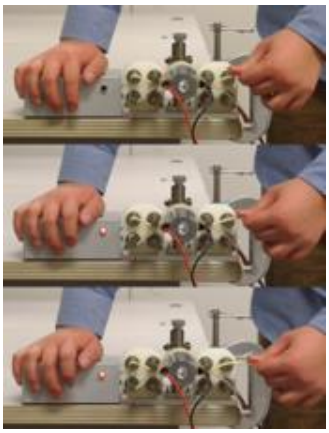

Fig 3. Proposed mechanism to lock the motion of a belt.