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Conference Abstract

## Dynamic posture correcting device used for rehabilitation exercises

*Tinus Benjamin Byrgesen*, student, Mads Clausen Institute, Alision 2, 6400 Soenderborg, Denmark

*Mille Lizzi Skov*, student, Mads Clausen Institute, Alision 2, 6400 Soenderborg, Denmark

*Mark James Skov Yeoman*, student, Mads Clausen Institute, Alision 2, 6400 Soenderborg, Denmark

*Fei Yu*, PhD, Assistant Professor, Mads Clausen Institute, Alision 2, 6400 Soenderborg, Denmark

Correspondence to: *Fei Yu*, E-mail: [fei@mci.sdu.dk](mailto:fei@mci.sdu.dk)

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## Abstract

**Purpose:** Elaborate studies show that lower back problems cost the Danish society 16.8 billion Danish krone a year. Among all the musculoskeletal disorders, lower back problems is reported as the leading cause to medical attention, and the estimated lifetime prevalence is up to 84% [1]. Exercise is a key element of the treatment plan, but there is a lack of technology to support the training. The objective of this study is to develop a sensor and actuator system that could help the users during rehabilitative training.

**Methods:** Dielectric Electro-Active Polymers can be used as stretch sensors [2]. The capacitance of the material is changing while it is being stretched. By attaching the sensors on the user's lower back, we are able to measure bending and twisting. The sensor material has the distinct advantage of mechanical flexibility and stiffness parameters comparable to those of human skin, constituting a key ingredient for wearing comfort. An indicator will show the results in real time, and a vibrator will function to inform the user when a posture is wrong according to the exercise or a posture is potentially harmful to the back. The system is designed with several modes for different exercises, which could help the user to keep a beneficial posture, e.g. a straight back while training a certain exercise.

**Results and discussion:** A prototype has been developed, in which the sensor is placed in a LM555 timer circuit. The output frequency of the timer is defined according to the value of the capacitance, which is further determined by the stretch level of the sensor. A serial of LEDs are used as indicator to show the level of bending and welding. Arduino Nano is employed to read the frequency from the timer and to control the indicator and the vibrator. The sensor will be attached on the outside of the lumbar section of the spinal cord. By measuring the degree of elongation of sensor, we could register flexion and extension on the back of the user. Lower back problems are very complicated, involving several diagnoses for each individual. A recent study categorizes lower back problems to different sub-groups [3], which may need different measuring position. A preliminary test with a focused lower back problem subgroup will be implemented in the near future.

## **Keywords**

**lower back pain; Dielectric Electro-Active Polymers; monitoring**

## **References**

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