

## **Selected topic: Anatomy, biomechanics and motor control**

### **Using surface electromyography to quantify diaphragm muscle activation during postural control in chronic nonspecific low back pain: Protocol for a validation study**

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**Introduction:** Impaired postural control and diaphragm dysfunction have been shown in chronic nonspecific low back pain (CNSLBP). Transesophageal diaphragmatic electromyography (EMG<sub>di,es</sub>) is considered as the golden standard for measuring diaphragm activation during postural control tasks. However, this method is expensive and relatively invasive. Surface diaphragmatic electromyography (EMG<sub>di,sur</sub>) can possibly serve as an alternative.

**Purpose/Aim:** To evaluate the criterion validity of EMG<sub>di,sur</sub> to EMG<sub>di,es</sub> during postural control tasks in persons with and without CNSLBP.

**Materials and Methods:** EMG<sub>di,es</sub> (with esophageal catheter), EMG<sub>di,sur</sub> (seventh intercostal space) and center of pressure (CoP) will be measured simultaneously during six postural control tasks in 15 adults (18-65 years) with CNSLBP and 15 age-, sex-, and BMI-matched controls. Participants will be asked to perform ballistic arm movements in upright standing without vision during different combinations of support surface (stable/foam), arm movement frequency (single/repetitive), and breathing mode (normal/breath holding at end-expiration). Outcomes will be the change in EMG<sub>di,es</sub>, EMG<sub>di,sur</sub> and CoP between baseline upright standing compared to during ballistic arm movements. Criterion validity will be assessed using Intraclass Correlation Coefficients.

**Results:** When adding ballistic arm movements to upright standing, we hypothesize that changes in EMG<sub>di,sur</sub> are positively correlated with changes in EMG<sub>di,es</sub> and changes in CoP in persons with CNSLBP and healthy persons. Ethical approval is currently being requested and preliminary results are expected in September 2023.

**Conclusion(s):** This study will reveal whether EMG<sub>di,sur</sub> is a valid method to measure diaphragm activation during postural control tasks in persons with and without CNSLBP. This could support future research as EMG<sub>di,sur</sub> is cheaper, less invasive, and therefore less likely to lead to drop-outs in longitudinal studies compared to EMG<sub>di,es</sub>.

**Keywords:** chronic nonspecific low back pain, surface diaphragmatic electromyography, postural control