

Non-specific low back pain (NSLBP) is the leading cause of disability. People with NSLBP exhibit alterations in their lumbar muscle characteristics and proprioceptive postural control (PPC). Defining shared underlying mechanisms and guiding treatment based on them may improve the limited effects of current treatments. This study will define the most distinctive lumbar muscle characteristics among people with NSLBP and healthy controls, and examine their interrelatedness and correlation with PPC to delineate NSLBP phenotypes. The effects of a proprioceptive intervention on these phenotypes will be investigated.

In 53 people with recurrent NSLBP and 47 healthy controls, the characteristics of the lumbar multifidus and erector spinae muscles will be investigated and compared. To evaluate PPC, ankle and back muscle vibration are applied during standing on stable and unstable ground with vision occluded. The vibration-induced Center of Pressure (COP) displacements are measured with a force plate and used to calculate relative proprioceptive reliance. Muscle activation and oxygenation are measured with electromyography and near-infrared spectroscopy, respectively, and muscle volume with 3D freehand ultrasound. The 53 people with NSLBP participate in a 16-week proprioceptive intervention, integrated into their daily lives and comprising a high-load lifting exercise. Its effects are evaluated midway, at the end and 16 weeks after the end of-intervention.

Recruitment is in progress and preliminary descriptive results of the five enrolled participants with NSLBP on PPC comprise an increase in back vibration induced COP displacement (Pre:  $0.018 \pm 0.011$ ; Post:  $0.020 \pm 0.012$  stable and Pre:  $0.015 \pm 0.013$ ; Post:  $0.021 \pm 0.009$  unstable) at the end of intervention and an increased lumbar proprioceptive reliance at midway (Pre:  $0.69 \pm 0.04$ ; Post:  $0.46 \pm 0.30$  stable and Pre:  $0.58 \pm 0.13$ ; Post:  $0.44 \pm 0.31$  unstable) and end (Post:  $0.40 \pm 0.30$  stable and Post:  $0.34 \pm 0.16$  unstable) of intervention.

This proprioceptive intervention improved PPC, based on preliminary results. It increased the use of lumbar proprioception, leading to a shift from dominance in ankle proprioception to lumbar. The lumbar muscle characteristics and their correlation with PPC will be examined and the effects of this intervention on the delineated NSLBP phenotypes will be assessed. Patient-tailored exercise therapy for NSLBP may benefit from these results.