ALTERED NEUROMUSCULAR CONTROL IN PEOPLE WITH LOW BACK PAIN DURING THE ACTIVE HIP ABDUCTION TEST: A CASE-CONTROL STUDY

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INTRODUCTION
The Active Hip Abduction (AHAbd) test is an observation-based, clinical assessment of frontal plane lumbopelvic control during dynamic hip abduction performed in sidelying [1,2]. The test is scored from 0-3 based on presence of aberrant movement; 0/1 is considered (-) and 2/3 considered (+). The test has been shown to predict low back pain (LBP) in asymptomatic individuals, however this is the first study conducted in people with LBP. The purpose of this study was to investigate muscle activation strategies in individuals with LBP and healthy controls during the AHAbd test. It was hypothesized that LBP cases would have delayed relative activation of trunk stabilizing musculature compared to healthy controls.

METHODS
22 participants (13 with current LBP) participated in this study. Surface electromyography (EMG) data (Biopac Systems Inc., Goleta CA, USA) were recorded from 4 bilateral trunk and hip muscles (lumbar erector spinae, internal and external oblique, and gluteus medius) during execution of the AHAbd test performed bilaterally. A physical therapist, blinded to participant’s LBP status, concurrently scored performance on the AHAbd test. Kinematics (Northern Digital Instruments, Inc., Waterloo, ON, Canada) were recorded simultaneously for calculation of relative trunk (thorax-pelvis) and hip (pelvis-thigh) angles. EMG data during AHAbd trials were normalized to peak values obtained during standardized sub-maximal reference voluntary contractions (RVC) [3].

Signal post processing and analyses were performed using custom software written in Matlab (MathWorks, Natick, MA, USA). EMG data were linear enveloped (f = 2.5 Hz) and normalized to %RVC. Concentric phases of movement were windowed out using kinematic data, and cross correlations were performed between all possible combinations of muscle pairs. Phase lags at maximum spatial correlation were extracted to determine relative timing and sequencing between muscle pairs. Phase lag data were entered into one-way ANOVA with between factor of LBP group and a significance criterion of .05 using SPSS software (IBM, Chicago, IL, USA).

RESULTS
11/13 cases and 4/9 controls had (+) scores on AHAbd Test, yielding a sensitivity of 0.85, specificity of 0.56, and diagnostic odds ratio of 6.9 for this sample. Controls demonstrated a consistent pattern of agonist gluteus medius muscle activation prior to stabilizing trunk musculature where cases demonstrated the opposite activation strategy. An example plot for relative timing between ipsilateral (side of moving limb) gluteus medius and contralateral erector spinae is shown in Figure 1.

DISCUSSION AND CONCLUSIONS
The AHAbd test performed well in discriminating between LBP cases and controls. Clear neuromuscular control differences were shown between LBP cases and controls during AHAbd, however the directionality was opposite to the initial hypothesis. The AHAbd test may be a relatively easy movement to control for people without LBP, decreasing the necessity for a strong anticipatory postural response. LBP cases had a delayed anticipatory trunk muscle activation in an attempt to provide lumbopelvic control during hip abduction, yet they were unsuccessful as documented by their (+) test scores (aberrant lumbopelvic movement). Delayed anticipatory postural responses of the trunk have been reported with active upper extremity movement (rapid arm elevation) [4]. The AHAbd test may require a higher level of effort than upper extremity elevation, and is also performed in an inherently unstable position, which may explain these disparate findings.

REFERENCES