GLUTEUS MEDIUS ACTIVATION AND KNEE ABDUCTION MOMENT DURING A SINGLE LEG MINI SQUAT

Daehan Kim, Joel L. Lanovaz, Alison R. Oates
College of Kinesiology, University of Saskatchewan, Saskatoon, Canada, daehan.kim@usask.ca

INTRODUCTION
Excessive knee abduction moment (KAM) in a weight bearing leg is a well-known biomechanical risk factor of chronic knee pain such as patellofemoral pain (PFP) [1]. In previous studies, delayed gluteus medius (GMED) onset has been associated with PFP [2]. The authors speculated that delayed onset of GMED activation possibly contributed to an increased KAM in patients with knee pain; however, the influence of GMED activation on KAM has not yet been investigated. This study aims to investigate the relationship between GMED onset and KAM.

METHODS
To date, two healthy females (25 ± 2.1 yrs; 161 ± 0.7 cm; 56.4 ± 1.3 kg) performed 10 Single Leg Mini Squats (SLMS) on each leg. Participants started each SLMS trial from a double leg standing position. Lower limb kinematics and ground reaction forces were recorded with an 8-camera three dimensional motion capture system (F20, VICON Motion Systems, CO) and a force platform (OR6-7, AMTI Inc., MA). GMED activation was recorded using a telemetered surface electromyography (EMG) system (Telemyo, Noraxon Inc., AZ). Kinematic data were recorded at a sampling rate of 100 Hz while force and EMG data were sampled at 2000 Hz. All data were recorded simultaneously. The KAM was calculated using standard inverse dynamics techniques and was normalized to body weight.

GMED was considered to be activated when its activity level exceeded the mean plus two times the standard deviation of the baseline EMG level for at least 30 msec. Mean EMG activity during one minute of quiet standing was used as the baseline EMG. Anticipatory GMED activation for preventing excessive frontal plane knee moment is critical at the time when the non-supporting leg leaves the ground [3]; therefore, supporting limb GMED onset was measured relative to toe-off (TO) of the non-supporting limb. In this study, negative timing represents GMED onset before TO.

The KAM of the supporting limb was calculated by taking the average value of the frontal plane knee moment occurring between TO of the non-supporting limb and when the supporting limb knee reached first 10° of flexion during the downward phase of the SLMS.

RESULTS
Participant A activated her GMED after TO, while participant B activated her GMED before TO. GMED onset (±SD) in sec was 0.187 ± 0.043 for participant A, and -0.250 ± 0.051 for participant B. The KAM in Nm / kg (±SD) was 0.015 ± 0.002 for participant A and 0.011 ± 0.003 for participant B. The participant who activated her GMED after TO showed a 32% increase in supporting limb KAM compared to the participant who activated her GMED before TO. The slower the GMED onset was, the greater the KAM was (Figure 1).

DISCUSSION & CONCLUSIONS
To our knowledge, this is the first study to directly examine the relationship between GMED onset timing and KAM. The results suggest a potential relationship between slower GMED activation and higher KAM during the SLMS. This preliminary study provides evidence for further investigation into the influence of GMED activation on KAM. A study with a larger sample size is ongoing.

REFERENCES