

Measures of Center of Pressure and Lower Leg Muscle Electromyography during Landing before and after Plantar flexor Stretch

CONNOR HILL, BRITTANY COLTRAIN, & MICHAEL W. OLSON

Biomechanics Lab; Department of Athletic Training & Exercise Physiology; Midwestern State University; Wichita Fall, TX

Category: Undergraduate

Advisor / Mentor: Olson, Michael (michael.olson@msutexas.edu)

ABSTRACT

Static stretching of the plantar flexor muscles is reported to modify neuromuscular responses to external stimuli. However, it is not known how these muscles respond to external loading in an applied task, such as single-leg drops. Further, if mechanical laxity in the plantar flexor muscles is present after stretching of it is unclear how this laxity will influence the muscle activation and movement patterns of the lower extremities. **PURPOSE:** This study is intended to further explore the response of the lower extremities to plantar flexor muscle stretch in an effort to understand its impact on potential injury. **METHODS:** Five participants (20.6 ± 1.1 yrs; 1.78 ± 0.1 m.; 80.6 ± 9.9 kg) performed drop landings from a 30 cm box onto a force platform before and immediately after 10 min of passive plantar flexor stretch. Surface electromyography (EMG) was collected from tibialis anterior (TA), medial gastrocnemius (MG), lateral gastrocnemius (LG), peroneus longus (PL), and soleus (SOL) muscles. Maximal isometric plantar and dorsi flexion efforts were performed before and after 10 minutes on passive plantar flexor stretch. EMG were normalized (NEMG) to maximum values during the maximal isometric efforts. Variables of interest were NEMG at landing and center of pressure (COP) measures. NEMG were assessed 300 ms prior to and after landing onto the force platform. An inertia measurement unit (IMU) was fixed to the tibia to record landing. Comparisons were performed at landing for NEMG and COP/COP velocity up to 5 sec after landing to measure COP/COP velocity variability. Alpha was set at 0.05. **RESULTS:** NEMG signals differed over time for all muscle from -300 to 300 ms (all $p < 0.01$). Significant differences in NEMG amplitude were present in MG (0.44 ± 0.5 vs 0.36 ± 0.4), LG (0.28 ± 0.3 vs 0.24 ± 0.3), and SOL (0.40 ± 0.5 vs 0.32 ± 0.3) muscles (all $p < 0.05$) before and after stretch. COPx (pre: $-\Delta 29.8\%$ post: $-\Delta 56.4\%$) and COPy (pre: $-\Delta 58.8\%$, post: $-\Delta 53.5\%$) variability measures were significant reduced over time ($p < 0.001$). A significant time x condition interaction was present for COPx velocity variability ($F_{6,308} = 2.135$, $p < 0.049$). **CONCLUSION:** Passive prolonged stretching of the plantarflexor muscles can modify a functional dynamic activity, such as single-leg drop landings. Although COP was not different between the landing before and after static stretch, the control of the balance at landing was different.