

## Biomechanical Response of the Leg to Single leg drop Landings Before and After Prolonged Plantar flexor Stretch.

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### ABSTRACT

The plantar flexor muscles have become important in activities such as gait analysis in healthy and patient populations. The duration of stretch is reported to influence their ability to generate force and if mechanical laxity is present after stretching, it is unclear how this laxity will influence the movement patterns of the lower extremities. **PURPOSE:** The study aimed to investigate influence of prolonged stretch to plantar flexor muscles on landing biomechanics during a single-leg drop landings. **METHODS:** Sixteen active participants ( $24.6 \pm 3.1$  yrs,  $75.4 \pm 15.6$  kg mass,  $1.75 \pm 0.9$ m height) were recruited and randomly assigned to either the experimental group (n=8) or control group (n=8). The experimental group (EG) performed six single leg drop-landings from a 65 cm height onto a force platform before and after a 10 minute continuous stretch to the ankle plantar flexor muscles of their dominant leg. Once landed they maintained their position for 5 s. An isokinetic dynamometer was used to provide a continuous stretch to the ankle plantar flexor muscles by fixing the ankle in a maximal tolerated dorsiflexed position. Simultaneously muscle torque was recorded during 10min stretch. Additionally, participants performed maximal voluntary contractions (MVIC) in plantar flexed ( $+15^\circ$ ) and dorsiflexed ( $-15^\circ$ ) position before and after the stretch ( $-30^\circ$ ). The control group (CG) performed all landing and MVIC measures and did not perform the stretching procedure. Force platform measurements included peak value of vertical ground reaction force (vGRF), rate of force development (RFD), and center of pressure (COP) and COP velocity. The Statistical Package for Social Sciences was used to assess differences present between groups and the pre and post stretch landing conditions with an analysis of variance (ANOVA). Alpha level was set at  $p < 0.05$ . **RESULTS:** There was a significant reduction in the torque output during the 10 min stretch ( $p < 0.01$ ,  $T_0$  to  $T_{10}$ :  $-5.26 \pm 4.1$  Nm) There was no significant difference in vGRF, RFD, range COPx and MVIC pre and post stretch. However, there were group (EG  $0.115 \pm 0.02$  vs CG  $0.123 \pm 0.02$  m,  $p=0.021$ ) and pre/post (Pre  $0.123 \pm 0.02$  vs Post  $0.115 \pm 0.02$  m,  $p=0.0017$ ) in COPy range as well as COPy velocity (EG  $-0.01 \pm 0.01$  vs  $-0.014 \pm 0.004$  m/s,  $p=0.001$ ). **CONCLUSION:** This study concludes that there is a significant effect of stretching on landing biomechanics and balance in the anteroposterior direction. A stress-relaxation of the passive tissues during prolonged stretch of the plantar flexor muscles was observed.