*TACSM Abstract*

# Kinetic and Kinematic Difference Between the First and Second Landing of a Single Leg Drop Vertical Landing Task

CHENYANG LI, TIMOTHY W LOWE, LISA GRIFFIN

Neuromuscular Physiology Research Laboratory; Department of Kinesiology and Health Education; University of Texas at Austin; Austin, TX

*Category: Masters*

*Advisor / Mentor: Griffin, Lisa (l.griffin@austin.utexas.edu)*

ABSTRACT

The drop vertical jump is commonly used to assess the biomechanical performance of athletes, both for screening for injury risk and for assessing return-to-play readiness. These assessments rely only on the performance of the first landing and the implications of the second landing have been largely ignored. The second landing, however, better simulates the mechanics of rebounding tasks which are most often associated with greater ACL injury risk. **PURPOSE**: To analyze the differences in kinetic and kinematic metrics at the knee joint during the first and second landings of the single-leg drop vertical jump. **METHODS**: Seven younger adults (4 females/3 males, age: 25 ± 6 years of age) performed 5 trials of a single-leg drop vertical jump landing task from an initial height of 25 cm, 45 cm in front of the force plate. Participants landed with their tested foot on the force plate and then jumped upward as high as possible. A three-dimensional motion capture system (Vicon, Oxford, UK) recorded positional data at a rate of 100 Hz with a standard full-body plug-in gait and 39 markers set. Kinetic data were recorded with a force plate (Bertec, Ohio, USA) at a rate of 2000 Hz. Center of mass (CoM), peak vertical ground reaction force(vGRF), knee flexion, and abduction angles were recorded. The vertical ground reaction force (vGRF) was normalized with the participant's body mass**. RESULTS**: There was no difference in peak CoM between the first and second landing ($p > 0.05$). Peak vGRF was significantly higher in the second landing (2.4 ± 0.2xBM vs 2.8 ± 0.4xBM, $p = 0.004$). Peak knee flexion was significantly smaller in the second landing than the first landing (44.04° ± 11.43° vs 36.80° ± 7.17°, $p = 0.03$). Knee abduction was significantly greater in the second landing than the first landing (9.11°± 5.4° vs 6.1°± 4.5°, $p = 0.009$) at the time of peak vGRF. **CONCLUSION**: The results of this study have implications for the future assessment of ACL injury risk and return-to-sport readiness. Greater peak vGRF and knee adduction and smaller knee flexion angle indicate that the second landing of the single-leg drop vertical jump may exhibit greater perturbation and better represents the mechanics associated with ACL injury risk. Moreover, the second landing is a more rigorous task and presents a more challenging evaluation scenario and serves as a more reliable evaluation of risk factors in the sagittal and frontal plane, than the first landing.