Comparison of Knee Kinematics and Kinetics during Different Landing Tasks

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Context: Several tasks have been used to examine lower extremity biomechanics during landing for the purpose of evaluation and rehabilitation, especially in relation to ACL injuries. However, it can be difficult to compare results between studies utilizing different tasks and it is unclear which task may be most appropriate. Additionally, some tasks may have the advantage of simultaneously informing researchers on landing biomechanics and dynamic postural stability, such as the forward jump single-leg landing task. **Objective:** To compare lower extremity biomechanics across five commonly used landing tasks. **Design:** Descriptive laboratory study. **Setting:** University-operated, Special Operations Forces human performance research laboratory. **Patients or Other Participants:** A total of 66 Air Force Special Tactics personnel participated (age = 27.7 ± 5.0 years; weight = 83.1 ± 9.1 kg; height = 176.5 ± 5.7 cm). **Interventions:** Kinematic and kinetic analysis of five different landing tasks including double and single-leg drop-landing (DLDL and SLDL), double and single-leg stop-jump (DLSJ and SLSJ), and forward jump to single-leg landing (FJSL). **Main Outcome Measures:** Hip, knee, and ankle joint kinematics; knee joint forces and moments; and ground reaction forces. Shapiro-Wilk tests were used to assess normality. Repeated measures ANOVA or Friedman’s ANOVA, as appropriate, were used to assess within subject differences across tasks. Significance was set to 0.05 a priori. Appropriate post-hoc pair-wise comparisons used Bonferroni p-value adjustments. **Results:** Peak vertical ground reaction force (GRF) (180.1 – 504.0% body weight, p<0.001) and peak knee flexion angle (58.4 – 101.9 degrees, p<0.001) were significantly different between all tasks. Single-leg landings generated higher vertical GRF (504.0 vs. 342.0% body weight and 271.6 vs. 180.1% body weight, p<0.001) and lower peak knee flexion (68.1° vs. 91.4° and 74.4° vs. 101.9°, p<0.001) with the exception of FJSL which had the lowest peak knee flexion (58.4°) and the second highest peak vertical GRF (435.1% body weight). SLDL generated the highest vertical and posterior GRF (504.0 and 50.2% weight, respectively, p<0.001). Peak valgus moment was significantly higher during DLDL (0.83Nm, p<0.001) but similar for SLDL, DLSJ, SLSJ, and FJSL (0.47, 0.46, 0.44, and 0.43Nm, respectively). **Conclusions:** A distinct within subject pattern of similarity between two tasks was not discernable and it does not appear to be one task that is best for eliciting a wide range of biomechanical risk factors of ACL injuries. Multiple tasks should be considered, as certain tasks may be better suited for evaluating specific strategies as demonstrated by stop-jumps eliciting higher knee valgus angles but drop-landings eliciting higher valgus knee moments and ground reaction forces. Researchers need to be cautious when comparing results between tasks. Athletic trainers and other clinicians need to consider these findings during evaluation of landing mechanics during assessments or rehabilitation. **Word Count:** 443

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