TACSM Abstract

Landing Styles Influence Reactive Strength Index without Increasing Risk for Injury

DANA CHERRY, JORDAN CLAYBORNE, LAUREN MILLER, PT, DPT, DARRIN STALOCH, PT, DPT and ALEXIS ORTIZ, PT, PhD, SCS, CSCS, FACSM

Balance and Motion Laboratory; Department of Physical Therapy; Texas Woman's University; Houston, TX

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Advisor / Mentor: Ortiz, Alexis (aortiz10@twu.edu)

ABSTRACT

PURPOSE**:** Current knee injury prevention and rehabilitation interventions focus on "soft landings" to prevent lower extremity landing misalignments that could predispose the knee to injury when landing "stiff". However, from a performance perspective, a "soft" landing is not the self-selected (SS) technique chosen during sports performance. The goal of sports performance is often repeated jumps for maximal height while minimizing ground contact time. The purpose of this study was to determine which of three different landing styles; stiff (ST), self-selected (SS), or soft (SF), exhibit safer landing mechanics and greater jumping performance. Subjects**:** 30 participants (men: 16; women: 14; BMI: 23.75 ± 2.35kg/m^2) METHODS**:** Subjects performed five trials of three randomized drop jump landing styles including SF (approx. 60° knee flexion), ST (knees as straight as possible), and SS. Upon landing, subjects were asked to perform a countermovement jump; jumping as high and fast as possible trying to touch the laboratory ceiling. Knee flexion and valgus were measured using a ten-camera, three-dimensional motion capture system (120 Hz). Kinetics were measured by four force plates (960 Hz) and an FScan In-shoe system (100 Hz) synchronized to the motion system. A wireless electromyography (EMG) system was used to measure muscle activity of the glutes, quadriceps, hamstrings, tibialis anterior, and gastrocnemius. Reactive strength index (RSI) was estimated by dividing the height of the vertical jump (as measured by the displacement of the sacrum) during each trial divided by the contact time with the force plates previous to performing the countermovement jump. Multivariate analyses of variance (MANOVA) with post-hoc if appropriate, were used to compare landing mechanics, kinetics, EMG, and reactive strength among landing styles. RESULTS**:** All landing styles differed in flexion ($p < 0.001$) but not in valgus. For flexion, SF (116°) > SS (89°) > ST (60°). MANOVAs for RSI showed significant differences for all jumps ($p < 0.001$) with SS (0.96) showing the highest value, followed by ST (0.93), and SF (0.64). Kinetics showed significant differences between jumps ($p < 0.001$) with SF (1.34/bw) showing lower forces followed by SS (1.50/bw), and ST (1.81/bw). No differences between jumps were observed for EMG variables. CONCLUSIONS**:** The difference in flexion between landing styles showed all jumps were performed with different landing depths. No particular landing style demonstrated dangerous valgus landing mechanics. SS landing styles seemed to be the appropriate landing style to enhance jumping/landing performance as they exhibited the highest RSI. Clinical Relevance**:** Sports physical therapists should allow and reinforce each athlete's landing style and ensure it is performed with no valgus as this would allow the athletes to maximize their reactive forces and subsequent performance.