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Activity: Scientific Abstract

Current Date/Time: 10/31/2012 11:17:34 AM

ACL Loading And Jump Performance Are Decreased With Increased Knee Flexion Landing And Soft Landing

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Abstract:

Anterior cruciate ligament (ACL) injuries usually occur during landing. One strategy to prevent ACL injuries is to adopt landing patterns that decrease ACL loading. Both landing with increased knee flexion and soft landing have been associated with decreased ACL loading. However, the effects of these two landings on performance remain unclear. **PURPOSE:** To determine the effects of landing with increased knee flexion and soft landing on ACL loading and jump performance during a stop-jump task. **METHODS:** Eighteen male and 18 female recreational athletes performed a stop-jump task with three instructed techniques. The three techniques involved 1) jump as high as possible, 2) land with increased initial knee flexion and then jump as high as possible, 3) land softly and then jump as high as possible. Three-dimensional kinematic and ground reaction force data were collected for the dominant limb. Peak ACL force during landing was estimated from a musculoskeletal model. Performance variables included jump height, approach speed, stance time, and lower extremity mechanical work. **RESULTS:** Landing with increased knee flexion landing (0.64 body weight (BW)) and soft landing (0.71 BW) both decreased peak ACL forces compared to regular landing (0.88 BW, $p < 0.001$). Landing with increased knee flexion (0.45 m) and soft landing (0.45 m) both decreased jump height compared to regular landing (0.48 m, $p < 0.001$). Soft landing (2.1 m/s) decreased approaching speed compared to regular landing (2.3 m/s, $p < 0.001$). Landing with increased knee flexion (0.45 s) and soft landing (0.39 s) both increased stance time compared to regular landing (0.32 s, $p < 0.001$). Landing with increased knee flexion (0.37 J/BW/body height (BH)) and soft landing (0.31 J/BW/ BH) both increased mechanical work compared to regular landing (0.28 J/BW/ BH, $p < 0.001$). **CONCLUSION:** Landing with increased knee flexion landing and soft landing both decreased ACL loading, but also decreased movement speed and jump height while increasing mechanical work indicating a decrease in performance. Simply instructing individuals to land with increased knee flexion or land softly might have limited application in athletic competition because of the decrease in performance. Long-term training may be necessary to modify movements without compromising performance.

Author Disclosure Information: B. Dai: None.

Category (Complete): 403. Biomechanics and Neural Control of Movement - musculoskeletal mechanics/modeling

Keyword (Complete): ACL ; Landing ; Performance

Unlabeled/ Investigational Products (Complete):

: No

Presentation Preference (Complete): Slide Preferred

Area of Interest (Complete):

Area of Interest: Applied Science

Additional Info (Complete):

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