2009

Effect of bilateral or single leg landing on knee kinematics

Randall L. Jensen
Northern Michigan University

EFFECT OF BILATERAL OR SINGLE LEG LANDING ON KNEE KINEMATICS

S. Abe, M.K.D. Lewis, K. Malliah, P.L. Malin, and R.L. Jensen

Department of Health Physical Education and Recreation, Northern Michigan University, Marquette, Michigan, USA

KEY WORDS: range of motion, knee angular acceleration, knee angles, gender differences

INTRODUCTION: Non-contact anterior cruciate ligament (ACL) injury has been shown to be more common in women than men, occurring at a rate of 6-8 times that of men (Hughes *et al*. (2008). Causes for this discrepancy are unknown, but differences in knee landing angle have been suggested as a possibility. Kinematic variables have been shown to be a major predictor in peak anterior tibial shear force (Schultz *et al*., 2009). Hughes *et al*. (2008) found that women display greater valgus angles and range of motion than men in a two legged landing. While Elvin *et al.* (2007) reported that knee contact angle was correlated to ground reaction forces and segment axial accelerations. Thus while it appears that knee kinematics are an important factor determining the stress on the knee in bilateral drop landings, in many cases, individuals cannot land on both legs and instead are forced to landing on a single leg. However, there is information lacking comparing knee joint angle and acceleration when landing on one versus two legs and these variables affect soft tissue forces on the knee. The purpose of this study was to compare knee joint range of motion and angular acceleration of the right and left leg during bilateral and single leg landings for males and females.

METHODS: Five male and six female recreationally active college students were recruited for this study. Subjects were excluded if they reported previous history of lower extremity injury or less than 60 minutes of physical activity per week. The study was approved by the Institutional Review Board and informed consent forms were signed by each subject.
Video of the landings was obtained at 60 Hz from six cameras using 1 cm reflective markers placed bilaterally on the iliac crest, greater trochanter, lateral knee joint line, lateral malleolus, second metatarsal and posterior heel. Markers were digitized using Motus 8.5 (Peak Performance Technologies, Englewood, CO) and knee joint angle and acceleration data were determined after smoothing with a fourth order Butterworth filter (Winter, 1990).
Subjects performed three drop landing trials each onto the right, left and both legs (bilateral) from a height that maintained their feet 33 cm above the landing surface. When instructed, they released their hands from a horizontal bar and dropped to the landing surface. Order of landing condition (right, left, and bilateral) was randomly assigned for each subject.
The dependent variables were knee angular acceleration, peak knee angle, and relative knee angle of the right and left legs. Means and standard deviations were calculated for the dependent variables. A 4×2 (legs × gender) mixed design ANOVA was used to evaluate the dependent variables, where the individual leg was the repeated measure.

RESULTS & DISCUSSION: Preliminary findings indicate that knee joint angles differ when landing with one leg compared to two legs, but angular acceleration of the knee does not differ across the landings. There was no difference between genders. Further study should focus on whether different knee angles alter forces on the knee during two and one leg landings and if these strategies can be learned.

REFERENCES:

Elvin, N.G., Elvin, A.A., Arnoczky, S.P., and Torry, M.R. (2007) The correlation of segment accelerations and impact forces with knee angle in jump landing. *J Appl Biomech 23:* 203-212.

Hughes, G., Watkins, J., Owen, N. (2008) Gender differences in lower limb frontal plane kinematics during landing. *Sports Biomech 7:* 333-341.

Schultz, S.J., Nguyen, A-D., Leonard, M.D., and Schmitz, R.J. (2009) Thigh strength and activation as predictors of knee biomechanics during a drop jump task. *Med Sci Sports Exerc 41*: 857-866.