

KNEE PROPRIOCEPTION AND STRENGTH CORRELATE TO KNEE FLEXION ANGLE DURING A LANDING TASK

Nagai T, House TJ, Deluzio JB, Lawrence DM, Lovalekar MT, Sell TC, Abt JP, McGrail M, Lephart SM: Human Performance Research Center, Fort Campbell, KY; Neuromuscular Research Laboratory, Department of Sports Medicine and Nutrition, School of Health and Rehabilitation Sciences, University of Pittsburgh, Pittsburgh, PA

Context: Tactical performance and prevention of knee injuries during dynamic landing tasks requires afferent information from joint mechanoreceptors about joint position, kinesthesia, and sense of heaviness, as well as adequate muscular strength to attenuate large impact forces. In order to design better physical fitness training for the Soldiers and to minimize unintentional musculoskeletal injuries, understanding the relationship between those variables would be beneficial. **Objective:** To investigate the relationship between knee proprioception, strength, and knee flexion angle during a landing task. **Design:** Descriptive Laboratory Study. **Settings:** Human Performance Research Laboratory. **Patients or Other Participants:** Convenient sample of 50 healthy male Soldiers of the 101st Airborne Division (Age: 26.4±5.8 yrs; Height: 176.5±8.0 cm; Mass: 79.8±16.6 kg). **Interventions:** Knee flexion and extension conscious proprioception measured as threshold to detect passive motion (TTDPM) was performed on an isokinetic dynamometer at 45° flexion and 0.25°/s. Subjects wore a compression boot, were blindfold, and listened to static noise in order to eliminate extraneous cues. Subjects were instructed to press a stop-button when they first felt limb movement and were then able to detect the direction of movement. The arc between the initial and final positions was reported as TTDPM. Subjects performed a total of five trials for each direction (order of direction was randomized). Isometric knee extension and flexion strength was evaluated at 45° flexion with the isokinetic dynamometer. Landing kinematics were evaluated using a 3D motion analysis system while subjects performed three single-leg stop-jumps at a distance 40% of their height from the force plate. Knee flexion angles at initial contact and maximum knee flexion angle were calculated. **Main Outcome Measurements:** TTDPM toward flexion and extension direction, isometric knee extension and flexion strength, knee flexion angles at initial contact and maximum knee flexion angles during a single-leg stop-jump task. Due to the nature of TTDPM data (positively skewed), a nonparametric correlation, Spearman's rho, was used to evaluate the relationship. P-value was set at 0.05. **Results:** The following pairs were significant: TTDPM and initial knee flexion (TTDPM Flexion: rho = -0.318, p=0.024; TTDPM Extension: rho = -0.349, p=0.013), knee strength and knee flexion angle at initial contact

(Flexion Strength: $\rho=0.392$, $p=0.005$; Extension Strength: $\rho=0.335$, $p=0.018$), and knee strength and peak knee flexion angle (Flexion Strength: $\rho=0.447$, $p=0.001$; Extension Strength: $\rho=0.465$, $p=0.001$). **Conclusions:** Enhanced knee proprioception and increased knee strength was associated with greater knee flexion angle at initial contact. Greater knee extensor strength was also associated with peak knee flexion. Greater initial and peak flexion can attenuate the landing impact far greater than the extended knee. Collectively, enhanced proprioception, greater knee strength, and greater initial and peak knee flexion are inter-related and may play a vital role in unintentional musculoskeletal injury prevention for the Army Soldiers. **Word Count:** 449