ABSTRACT
INTRODUCTION: Marine Corps Forces Special Operations Command (MARSOC) Operators are required to perform a multitude of complex tactical movements. Understanding the strategies used to attenuate shock during these movements is critical for injury prevention training. PURPOSE: Examine landing mechanics and the association between knee strength and specific landing strategies. METHOD: Knee strength and sagittal plane knee kinematics were collected on 41 Operators (Age: 28.4 ± 6.1 years, Height: 178.8 ± 6.7 cm, Mass: 85.4 ± 7.9 kg). Knee extension strength (KES) was collected using an isokinetic dynamometer (Biodex Medical Systems, Inc, Shirley, NY). Kinematics and kinetics were collected using an 8-camera 3-dimensional motion analysis system (200 Hz sampling frequency; Nexus Software according to inverse dynamics and the Plug-In Gait model). Participants performed a Double-Leg Drop Landing task (DLDL) and a Forward Jump Single-Leg Landing task (FJSL) (Figure 1) onto two force plates (Kistler 9286A, Amherst, NY) using a sampling frequency of 1000 Hz. Kinematics and kinetics were normalized to body weight (%BW). Pearson correlation coefficients were examined to determine significant relationships. Principal component analysis (PCA) was used to identify relationship patterns between biomechanical variables and injury. RESULTS: Operators demonstrated asymmetrical KES but not asymmetrical K@IC, pkKF, or VGRF during either the DLDL or FJSL. The relationships between strength and VGRF were significant (Table 2), indicating that different landing strategies were associated with knee strength. CONCLUSION: Increased K@IC and VGRF were correlated to decreased VGRF during the DLDL (r=-0.327, p=0.037 and r=-0.643, p<0.001 for the right and left legs, respectively). During the FJSL, KES was correlated to any knee kinematic or kinetic measure for their respective sides (Table 1). Operators demonstrated asymmetric KES, K@IC, and VGRF during the DLDL and FJSL (Figure 3). An increase in VGRF %BW was associated with increased KES %BW, demonstrating that increased knee strength is associated with increased shock absorption during landing. Prevention strategies may provide insight into mechanisms associated with an increased risk of injury. SUMMARIZED CONCLUSIONS: Understanding how landing strategies change with increased complexity will provide insight into specific mechanisms associated with injury allowing for the design of effective injury prevention training strategies. This work was supported by the Office of Naval Research (N00014-15-1-0069) and the United States Marine Corps Special Operations Command, Camp Lejeune, NC. A total of 41 MARSOC Critical Skill Operators (CSOs) participated in this study (Age: 28.4 ± 6.1 years, Height: 178.8 ± 6.7 cm, Mass: 85.4 ± 7.9 kg). CSOs demonstrated asymmetrical KES but not asymmetrical K@IC, pkKF, or VGRF during either the DLDL or FJSL. • Marine Corps Forces Special Operations Command (MARSOC) Critical Skill Operators are required to perform a multitude of complex tactical movements. • Understanding the strategies used to attenuate shock during different dynamic tasks may provide insight into mechanisms associated with an increased risk of injury. • Knee Extension Strength (KES) • Isokinetic Strength (60°/sec) was measured using a Biodex System 4 Pro Isokinetic Dynamometer (Biodex Medical Systems, Inc, Shirley, NY) during a sampling frequency of 1000 Hz. • Knee extension strength was normalized to body weight (%BW). • Subjects: Marine Corps Forces Special Operations Command (MARSOC) Critical Skill Operators (n=41). • Methods: Knee strength and sagittal plane knee kinematics were collected during a Forward Jump Single-Leg Landing task (FJSL) and a Double-Leg Drop Landing task (DLDL) using a 3.0 motion capture system. • RESULTS: Operators demonstrated asymmetrical KES but not asymmetrical K@IC, pkKF, or VGRF during either the DLDL or FJSL. • Pearson correlation coefficients examined the relationships between strength and landing mechanics. • Paired samples t-tests tests were used to examine asymmetries in strength and landing biomechanics. • Examining the association between knee strength and shock absorption strategies during the landing phase of different dynamic tasks may provide insight into mechanisms associated with an increased risk of injury. • IMPLEMENTATION: Prevention strategies may provide insight into mechanisms associated with an increased risk of injury.