During landing, the human body is required to absorb impact forces throughout its tissues. Muscle and connective tissue is able to dissipate much of this force, however, a portion of the impact is delivered to the bones. Forces acting on the human skeleton can cause microscopic fractures which may lead to stress fracture. The present study seeks to calculate changes in the magnitude of strain using noninvasive methods. A musculoskeletal model representing a healthy male subject (22 years, 78.6 kg, 1.85 m) was created. A flexible tibia, created from a computed tomography scan of the subject’s right tibia, was included in the model. Motion capture data were collected while the subject performed drop landings from three separate heights (26, 39, and 52 cm) and used to compute simulations in LifeMOD. Surface electromyography and joint angle data were compared to their simulated counterparts using a cross correlation. Maximum magnitudes of principal and maximum shear strain were computed. The model had reasonable agreement between joint angle curves. A large Cohen’s d effect size showed that our subject had increased tibial strain and strain rate as the drop height increased.
This study demonstrates a valid method of simulating tibial strain during landing movements. Future studies should focus on recruiting a larger sample and applying this method.