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Title: Using Principal Components Analysis to Model Muscle Force Contribution in ACL Injury
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Abstract: Researchers have spent decades investigating the mechanism(s) behind anterior cruciate ligament (ACL) injuries and have yet to determine the cause. One athlete from a recent study was selected and a subject-specific simulation of single-leg jump landing was created. A generic musculoskeletal model was developed and scaled to the subject's individual mass properties and segment dimensions obtained from experimental data. Kinematic and kinetic data were derived from experimental motion capture data. The data were used to determine the casual relationship between measured landing biomechanics and estimated muscle forces using principal components analysis (PCA). Using this method, it was possible to simplify the analysis using a smaller number of linear combinations of the original biomechanics variables and muscle force data to develop predictive models to identify individuals at risk for ACL injury. These results are critical to understanding how kinematic, kinetic and computationally derived muscle forces data can identify causal relationships that could be the key to understanding the mechanism behind single-leg jump landing and ACL injury risk.