**SIMTK Project Details**

Studying Anterior Cruciate Ligament Strains in Young Female Athletes

Kar J, Quesada PM. A Musculoskeletal Modeling Approach for Estimating Anterior Cruciate Ligament Strains and Knee Anterior–Posterior Shear Forces in Stop-Jumps Performed by Young Recreational Female Athletes. Annals of Biomedical Engineering 2013;41(2):338-348.

Kar J, Quesada PM. A Numerical Simulation Approach to Studying Anterior Cruciate Ligament Strains and Internal Forces Among Young Recreational Women Performing Valgus Inducing Stop-Jump Activities. Annals of Biomedical Engineering 2012;40(8):1679-1691.

Sprots physiology experts and biomechanics engineers interested in studying anterior cruciate ligament injury in female athletes

The central goal of this study is to contribute toward advancements made in determining the underlying causes of anterior cruciate ligament (ACL) injuries in young female athletes performing high impact activities like stop jumps. ACL injuries are frequently incurred by recreational and professional young female athletes during non-contact impact activities in sports like volleyball and basketball. This musculoskeletal-neuromuscular study investigated stop jumps and factors related to ACL injury like knee valgus and internal–external rotations and moment loads, as well as ACL strains and internal forces. The dynamic simulation steps undertaken for this analysis using OpenSim 3.2 include Model Scaling, Inverse Kinematics, Residual Reduction, Computed Muscle Control and Forward Dynamics.

The files provided can be used for simulating and visualizing musculoskeletal stop jump activities. The model itself was scaled according to the gait2354\_simbody.osim file provided in the OpenSim gait2354\_simbody project. The ACL was then included in each knee joint as a passive tissue with negligible activation. Details of ACl insertion can be found by searching for terms "acl\_l" and "acl\_r" in the file subj01\_ACL\_vv\_ie.osim (xml format).

Guide to files:

subj01\_Setup\_ACL\_vv\_ie\_IK2014.xml: To run inverse kinematics (with file subj01\_ACL\_vv\_ie.osim)

subj01\_Setup\_ACL\_vv\_ie\_RRA2014.xml: To run residual reduction (with file subj01\_ACL\_vv\_ie.osim)

subj01\_Setup\_ACL\_vv\_ie\_CMC2014.xml: To run computed muscle control with RRA output file (with file subj01\_ACL\_vv\_ie-RRA1\_2014.osim)

subj01\_Setup\_ACL\_vv\_ie\_FWD2014.xml: To run forward dynamics with RRA output file (with file subj01\_ACL\_vv\_ie-RRA1\_2014.osim)

The model and data files provide a guide to creating, simulating, and visualizing 3D Anterior Cruciate Ligament and other knee biomechanics while stop jumps are performed.