

## SIMULATION OF JOINT CONTACT FORCES IN TOTAL KNEE ARTHROPLASTY PATIENTS USING OPENSIM

Ben Frazier, Jesse Christensen, Joseph A. Zeni, Jennifer Stevens-Lapsley, & Brian A. Knarr

Department of Biomechanics, University of Nebraska at Omaha, Omaha, NE 68182

The occurrence of Total Knee Arthroplasty (TKA) is projected to increase markedly in the coming decade, and a better method of rehabilitating TKA patients is becoming necessary. Rehabilitation of these patients is of utmost importance such that patients are capable of using the limb effectively. Focus towards improving the rehabilitation of patients that have undergone TKA operations requires a metric for comparison of performance between control groups and experimental groups. Joint contact forces (JCF) calculated via simulation in OpenSim using Motion Capture and Force Plate data provide effective means comparing these groups. Subjects are outfitted with a marker set and asked to walk across two force plates, contacting one with the affected limb and the other with the contralateral limb during gait. These data are recorded and processed through Visual3d and exported to c3d format. MATLAB is used in conjunction with OpenSim libraries and a custom script to convert c3d files into OpenSim-readable formats for simulation. A workflow of Scaling and Inverse Kinematics in OpenSim describes the physical dimensions of the subject and their movement. The Residual Reduction Algorithm (RRA) accounts for the over-constrained nature of the system and provides for more accurate JCF data in the end of the process. Static Optimization and Joint Reaction analysis are used to calculate the reaction forces in the joints at every frame of the motion data. The data I am working with are from a 6 month post operation trial. I expect that data from the experimental group will have more symmetrical joint loading as compared to the control group, indicating that the experimental treatment is more effective at rehabilitation.