15th International Symposium on Computer Methods in Biomechanics and Biomedical Engineering
and
3rd Conference on Imaging and Visualization
CMBBE 2018
P. R. Fernandes and J. M. Tavares (Editors)

Abstract ID-183

AN UPDATE ON THE CAMS-KNEE DATASET: A KEY DATASET FOR THE COMPREHENSIVE ASSESSMENT OF THE MUSCULOSKELETAL SYSTEM

William R. Taylor[(1)], Pascal Schütz[(1)], Joern Dymke[(2)], Hamed Hosseini Nasab[(1)], Adam Trepczynski[(2)], Philipp Damm[(2)]

[(1)]**ETH Zurich, Switzerland**
bt@ethz.ch, pschuetz@ethz.ch, seyyed.hosseini@hest.ethz.ch

[(2)]**Julius Wolff Institute, Charité - Universitätsmedizin Berlin, Germany**
Joern.Dymke@charite.de, adam.trepczynski@charite.de, Philipp.Damm@charite.de

Keywords: Internal loading conditions, In vivo kinematics, Moving fluoroscope, EMG, Ground reaction forces, Telemetry, Tibio-femoral joint contact forces

Summary: Combined knowledge of the functional kinematics and kinetics of the human body is critical for understanding a wide range of biomechanical processes including musculoskeletal adaptation, injury mechanics, and orthopaedic treatment outcome, but also for validation of musculoskeletal models. Until now, however, no datasets that include internal loading conditions (kinetics), synchronized with advanced kinematic analyses in multiple subjects have been available. Our goal was to provide such datasets and thereby foster a new understanding of how in vivo knee joint movement and contact forces are interlinked – and thereby impact biomechanical interpretation of any new knee replacement design. In this collaborative study, we have created unique kinematic and kinetic datasets of the lower limb musculoskeletal system for worldwide dissemination by assessing a unique cohort of 6 subjects with instrumented knee implants (Charité – Universitätsmedizin Berlin) synchronized with a moving fluoroscope (ETH Zürich) and other measurement techniques (including whole body kinematics, ground reaction forces, video data, and electromyography data) for multiple complete cycles of 5 activities of daily living.
The cohort of subjects presented mean peak tibio-femoral joint contact forces during walking of 2.74 BW, 2.73 BW during sit-to-stand, 2.57 BW during stand-to-sit, 2.64 BW during squats, 3.38 BW during stair descent, and 3.39 BW during ramp descent. Internal rotation of the tibia ranged from 3° external to 9.3° internal. The greatest range of anterio-posterior translation was measured during stair descent (medial 9.3 ± 1.0 mm, lateral 7.5 ± 1.6 mm), and the lowest during stand-to-sit (medial 4.5 ± 1.1 mm, lateral 3.7 ± 1.4 mm). The first sample dataset is now available online for public use in biomechanical and orthopaedic research and development at https://cams-knee.orthoload.com/. The complete CAMS-Knee datasets are planned for public release in late 2018.