

Quantification of Soft Tissue Artefacts Using Motion Capture Data and Ultrasound Depth Measurements

Authors : Azadeh Rouhandeh, Chris Joslin, Zhen Qu, Yuu Ono

Abstract : The centre of rotation of the hip joint is needed for an accurate simulation of the joint performance in many applications such as pre-operative planning simulation, human gait analysis, and hip joint disorders. In human movement analysis, the hip joint center can be estimated using a functional method based on the relative motion of the femur to pelvis measured using reflective markers attached to the skin surface. The principal source of errors in estimation of hip joint centre location using functional methods is soft tissue artefacts due to the relative motion between the markers and bone. One of the main objectives in human movement analysis is the assessment of soft tissue artefact as the accuracy of functional methods depends upon it. Various studies have described the movement of soft tissue artefact invasively, such as intra-cortical pins, external fixators, percutaneous skeletal trackers, and Roentgen photogrammetry. The goal of this study is to present a non-invasive method to assess the displacements of the markers relative to the underlying bone using optical motion capture data and tissue thickness from ultrasound measurements during flexion, extension, and abduction (all with knee extended) of the hip joint. Results show that the artefact skin marker displacements are non-linear and larger in areas closer to the hip joint. Also marker displacements are dependent on the movement type and relatively larger in abduction movement. The quantification of soft tissue artefacts can be used as a basis for a correction procedure for hip joint kinematics.

Keywords : hip joint center, motion capture, soft tissue artefact, ultrasound depth measurement

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