Effect of Pelvis Bone Geometry Personalization on Hip Kinematics and Moment Arms during Walking

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Introduction

• Personalized models can represent musculoskeletal systems more accurately than generic models.
• Hip joint kinematics and hip muscle length and moment arms are important in generation of force and joint torque.
• This study compared a generic scaled model and a model with personalization in pelvis bone and hip muscles.

Methods

• A generic scaled model was created using OpenSim scaling tool
• A personalized model pelvic bone model was segmented from CT images (ITK-SNAP)
  Muscle attachments were updated using affine transformation (NMSBuilder)
  Hip joint centers were updated by shape-fitting acetabular cups
• Model comparison – kinematics, muscle length and moment arm around hip joints

Results

Comparison of predication in kinematics and muscle geometry between an image-based personalized model and a generic scaled model

Discussion

• The generic scaled model underestimated hip flexion, adduction and external rotation by 4, 1 and 3 degrees.
• The personalized model predicted lower muscle-tendon length for adductor and hamstring muscles
• Moment arm about HipFE for adductors and hamstring muscles were 10 mm shorter in the personalized model

Significance

• The need of model personalization for more accurate prediction of joint kinematics and muscle geometry was highlighted.
• The effect of model personalization on prediction of dynamics will be investigated in future works.

References