**Recommendation Title:** Development of Models to Study the Relationship Between the Observed Abnormal Gait, Lower Extremity Structure, and Underlying Etiology

**Recommendation Code:**  A11

**Category:** Research

**Recommendation**

**Background**

The vast majority of individuals with neuromusculoskeletal pathologies present clinically with aberrant activities of daily living (ADL), posture and/or locomotion. Currently clinical gait analysis does a good job identifying what the abnormalities are in a patient's gait for a limited subset of neuromusculoskeletal pathologies. Abnormalities in movement patterns, joint moments and timing of muscle activity can all be measured and documented. Gait Analysis does less well, however, at definitively identifying the underlying cause or long-term consequences of a specific abnormality in the gait pattern. In specific, distinguishing compensation from primary problems often depends highly on the experience and intuition of the interpreting clinician.

The role of lower-extremity structure in biomechanical function and pathomechanics also needs to be evaluated. The particular alignment and orientation of the joints within the lower extremity is critical to the overall function of the kinetic chain. For example, is the alignment and orientation of the knee important to the etiology, severity and treatment of knee Osteoarthitis (OA)? Does foot and ankle malalignment contribute to knee OA?

The difficulties in establishing a cause and effect link between gait abnormalities, aberrant structure, and pathology stem from deficiencies in the knowledge of the mechanics and neural control of normal and pathological gait. Neuromusculoskeletal models can provide a theoretical framework from which to study this relationship for a given pathology. This knowledge and objective gait data will enhance the assessment, treatment planning, and prognostic capabilities of clinicians who manage patients with impairments, functional limitations, and disabilities.

**Objectives**

1) To improve models of the neuromusculoskeletal system and their validity for simulating lower extremity function, pathomechanics, and neural control. These models may be comprehensive or pathology specific and include but not be limited to; osseous geometry, soft tissue material properties, muscle dynamics, skeletal dynamics, and neural control.

2) To utilize these models to improve our knowledge of how the structure, control, and neuromusculoskeletal dynamics contribute to the pathomechanics of patients with impairments, functional limitations, or disabilities.

3) In conjunction with movement data utilize these models to develop techniques to definitively identify the underlying cause and long-term consequences of a specific abnormality in a patient's gait pattern.

**Recommended Actions**

It is recommended that agencies develop funding mechanisms to support research to meet the above objectives.