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Abstract

Most clinical gait laboratories use the conventional gait analysis model. This model uses a computational method called Direct Kinematics (DK) to calculate joint kinematics. In contrast, musculoskeletal modelling approaches use Inverse Kinematics (IK) to obtain joint angles. IK allows additional analysis (e.g. muscle-tendon length estimates), which may provide valuable information for clinical decision-making in people with movement disorders.

The twofold aims of the current study were: (1) to compare joint kinematics obtained by a clinical DK model (Vicon Plug-in-Gait) with those produced by a widely used IK model (available with the OpenSim distribution), and (2) to evaluate the difference in joint kinematics that can be solely attributed to the different computational methods (DK versus IK), anatomical models and marker sets by using MRI based models.

Eight children with cerebral palsy were recruited and presented for gait and MRI data collection sessions. Differences in joint kinematics up to 13 degrees were found between the Plug-in-Gait and the gait 2392 OpenSim model. The majority of these differences (94.4%) were attributed to differences in the anatomical models, which included different anatomical segment frames and joint constraints. Different computational methods (DK versus IK) were responsible for only 2.7% of the differences. We recommend using the same anatomical model for kinematic and musculoskeletal analysis to ensure consistency between the obtained joint angles and musculoskeletal estimates.

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1 Introduction