TACSM Abstract

The Influence of Smoothness and Speed of Stand-to-Sit Movement on Joint Kinematics and Kinetics During Stand-to-Sit

DANIEL CABRERA & KATHRYN SMITH

Department of Health and Kinesiology; University of Texas at Tyler; Tyler, Tx

Category: Undergraduate

Advisor / Mentor: Jeon, Woohyoung (wjeon@uttyler.edu)

ABSTRACT

Stand-to-sit (StandTS) is a crucial daily activity commonly used in rehabilitation settings to improve strength, postural stability, and mobility. Modifications in the movement smoothness and speed significantly influence the kinematics and kinetics of this movement. For example, rough and rapid movements result in dynamic changes in joint angles and force production patterns from each joint. Therefore, understanding the impact of speed and smoothness in StandTS movement on kinematics and kinetics can provide valuable insights for designing effective and tailored rehabilitation training programs. **PURPOSE**: To examine the impact of smoothness and speed in StandTS movements on joint kinematics, kinetics, and postural sway during the StandTS. **METHODS**: Twelve healthy younger adults participated in this study (21.5 ± 2.1 y/o). At the beginning of StandTS, participants maintained an upright standing position. Upon activating a visual light cue, participants performed StandTS at their preferred speed (reference). In the other condition, participants were instructed to perform the StandTS as smoothly as possible, minimizing the contact pressure on the seat (smooth). The outcome measures include: 1) the angular displacement of the trunk, knee and hip flexion; 2) knee and hip extensor eccentric work; and 3) postural sway (mean velocity of center of pressure (CoP) in the anterior-posterior (AP) and medio-lateral (ML) directions, along with standard deviation of center of mass acceleration (SDCoMAccel) in the vertical direction. In addition, the relationship between joint work (knee and hip) and postural sway was examined. A one-way repeated measures ANOVA was used to determine whether there were differences between two conditions. Spearman's correlation (ρ) was conducted to estimate the correlation between joint work and postural sway. **RESULTS**: There was a main effect of the sitting condition (reference vs. smooth) on controlled eccentric knee flexion angular displacement. In the smooth, a greater eccentric knee extensor flexion was observed compared to the reference, while no differences were found in trunk and hip flexion between the two conditions. The sitting condition had a main effect on joint work. The negative work in both the knee and hip joints were greater in the smooth compared to the reference. In addition, there was a negative relationship between vertical postural sway (SDCoMAccel) and knee extensor eccentric work and ML postural sway (CoP velocity) and hip extensor work. **CONCLUSION**: Compared to normal StandTS, smooth sitting allows for a greater controlled knee flexion angle and increased negative work at the hip and knee joint to absorb and control falling momentum during StandTS. Additionally, more significant knee and hip joint work reduced the postural sway in the vertical and ML directions, respectively. These findings provide insight into developing tailored rehabilitation training for older adults.