

The 14th Pan-Pacific Conference on Rehabilitation

Conference theme: Physical Rehabilitation

TITLE: People With Mild-to-Moderate Dementia Exhibit Increased Prefrontal Cortical Activity and Connectivity During Stepping Tasks Requiring Executive Control: A Cross-Sectional fNIRS Study

AIMS: To compare prefrontal cortical activation patterns and functional connectivity between older adults with mild-to-moderate dementia (MMD) and healthy older adults (HOA) during stepping tasks with different executive demands.

METHODS: This study recruited 26 HOA and 27 MMD who could walk independently for 10 meters. Participants were instructed to perform four trials of simple stepping (SS; repeated steps to the same target) and four trials of choice stepping (CS; steps to different targets), presented in randomized order, on a plastic stepping mat. Prefrontal cortical activity during the stepping tasks was measured using functional near-infrared spectroscopy (fNIRS). Cortical activation and functional connectivity between the HOA and MMD groups and between the SS and CS were compared.

RESULTS: The HOA group showed significantly increased cortical activity during CS compared to SS, with activation in the left dorsolateral prefrontal cortex (DLPFC) ($p=0.029$), right DLPFC ($p=0.044$) during tasks, and right frontopolar cortex (FPPFC) during starting phase ($p=0.046$). Compared with the HOA, MMD showed a significant increase in right DLPFC ($p=0.009$) and left DLPFC ($p=0.034$) during SS. The MMD exhibited heightened prefrontal functional connectivity in both SS and CS compared to the HOA, particularly in the connectivity between the right and left FPPFC ($p = 0.042$).

CONCLUSIONS: Older adults with mild-to-moderate dementia exhibit compensatory overactivation in the prefrontal cortex even during stepping tasks that require less executive control, along with impaired task-related modulation. These findings provide insights into a neurophysiological basis for reduced stepping adaptability in people with dementia.