Multi-Modal Measurement of Fatigue-Induced Gait Changes in a Person with Multiple Sclerosis during a 12-Minute Walk Test

Chen, D., 1 Cohen, E.T., 1 Muth, S., 2 Ferraro, R., 1, Meyer, L. 1
1 Rutgers, The State University of New Jersey, - School of Health Professions, New Jersey, USA;
2 Thomas Jefferson University, Pennsylvania, USA

Background
- Motor fatigability, a measurable change in performance with sustained activity, may result in changes in gait in people with multiple sclerosis (MS).
- The use of a single measuring mode may be inadequate to identify the gait deviations that may be most amenable to rehabilitation.
- A combined model that examines both temporal-spatial and kinematic measures during prolonged walking may enable clinicians to better assess these changes.

Objectives
- To examine changes in gait induced by motor fatigability by comparing temporal-spatial and kinematic parameters during the 1st and 12th minutes of a 12-minute walk test (12MWT).
- We hypothesized that temporal-spatial and kinematic measures would change between the first and last minutes of the 12MWT.

Participants
- The participant in this case example was a 65-year-old woman with a 20-year history of RRMS.
- Disease Steps = 3
- Patient-Determined Disease Steps = 4

Methods
- The participant completed the 12MWT along a modified pathway (a short oval track) with an instrumented walkway (CIR Systems, Sparta, NJ) laid over one straightaway.
- Temporal and spatial gait measures were recorded and analyzed with PKMAS Gait Analysis Software (Protkinetics, Inc., Havertown, PA).
- Kinematic data were collected for peak range of motion at the bilateral ankles, knees and hips with an 8-camera (Vicon Motion Systems Ltd., UK) 3D motion capture system, and interpreted with Motion Monitor software (Innovative Sports Training, Inc., Chicago, IL).
- Mean values were calculated for all recorded walking strides during the 1st and 12th minutes of the 12MWT.

Results: Differences in Temporal-Spatial Parameters of Gait

Results: Differences in Gait Kinematics

Conclusions
This case describes the impact of motor fatigability induced by prolonged walking on temporal-spatial parameters of gait and LE kinematics in a person with MS.

A notable deterioration in gait may be experienced by people with MS during prolonged walking.

The use of a multimodal gait analysis can well-describe these changes. For example, one hypothesis that emerges from this data is that this person’s diminished step length and velocity may be attributed to reduced peak right hip flexion/extension and bilateral ankle plantarflexion.

Further research should be conducted using similar multimodal analysis to acquire a richer and more granular description of the impact of motor fatigability on walking during prolonged activity in people with MS.

Acknowledgements
This work was funded in part by a grant from the New Jersey Health Foundation and the Rutgers, School of Health Professions Summer Student Research Program.