The Effect of Walking-Related Motor Fatigability During the 6-Minute Walk Test on Temporal and Spatial Parameters of Gait in People with Multiple Sclerosis

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Purpose

To describe changes in temporal and spatial parameters of gait between the 1st and 6th minutes of a 6MWT in people with moderate MS-related disability.

Background

Motor fatigability, a measurable change in performance with sustained use, affects many people with MS, and may result in changes in walking and gait. A recent study described the Distance Walked Index (DWI): the percentage change in distance walked between the 1st and 6th minutes of a 6-minute Walk Test (6MWT) (Leone et al, 2015). The changes that occur in other temporal and spatial parameters of gait due to fatigability during the 6MWT have not been described.

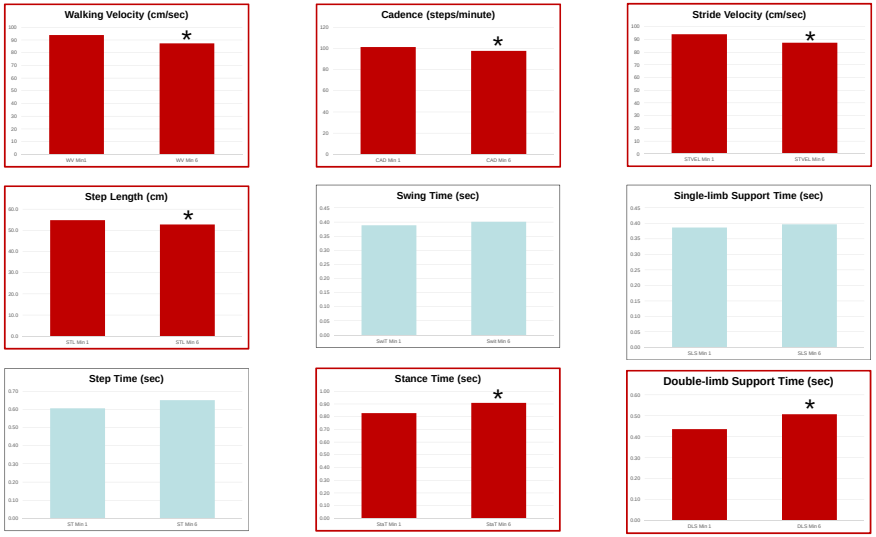
Participants

- 26 people with a confirmed MS diagnosis (20 women, 6 men)
- Median EDSS 4.0 (IQR 2.0, range 2.5-6.0)
- Able to complete a 6MWT without assistive devices

Methods

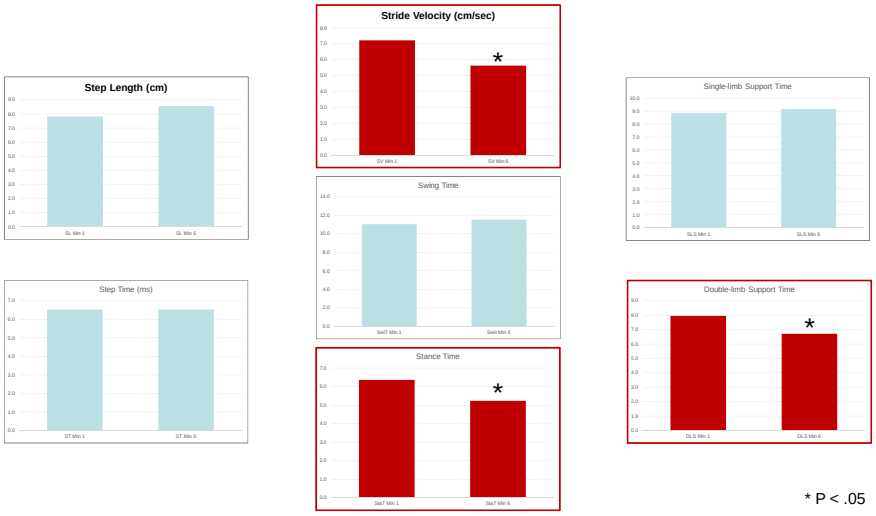
- Participants completed a 6MWT on an oval track with an instrumented walkway laid across one straightaway (Figure 1).
- Gait data was recorded for each walking pass using PKMAS software (Protokinetics, Havertown, PA, USA)
- Outcomes included mean walking velocity (WV) and cadence (CAD), and means and coefficients of variation (CV, i.e. step-to-step variability) of step length (SL), step time (ST) stride velocity (SV), stance time (StaT), swing time (SwiT), single limb support time (SLS), and double limb support time (DLS).
- Differences between 1st and 6th minutes were analyzed with parametric or nonparametric tests with an a priori alpha of .05 using SPSS version 23.0

Results: Differences in Mean Values



* P < .05

Results: Differences in Coefficients of Variation



* P < .05

Results

In the 6th minute compared to the 1st, our sample of people with MS:

- Took slower, fewer and shorter steps
- Spent more time in stance and double-limb support phases
- Had a decrease in coefficients of variation in stride velocity, stance time and double-limb support time.

Conclusions

- In the 6th minute compared to the 1st, our sample of people with MS took slower, fewer and shorter steps, and spent more time in stance and double-limb support.
- Both temporal and spatial factors contributed to the decline in WV (DWI) seen in this and other studies.
- The decrease in CV of SV, StaT and DLS must be interpreted with caution as the effect of variability on gait is equivocal: some interpret reduced variability as an improvement and others as a worsening.
- Collectively, these changes are thought to increase walking stability. Our interpretation is that fatigability induced by the repeated use of muscles of locomotion contributed to the worsening in mean values and decreases in movement variability from 1st to the 6th minutes of the 6MWT.

Future Directions

Further research is needed to develop models that identify which factors are the most robust contributors to the deterioration in walking function seen during the 6MWT.

Whether these changes are a direct result of muscle fatigability or a response to changes in other systems (e.g. sensation) should also be explored. Once clearly identified, rehabilitation programs can be designed to address the most critical factors.