

Effect of Fatigue on Sensory Impairment in Multiple Sclerosis (MS)

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Introduction:

Persons with Multiple Sclerosis (MS) are known to experience fatigue with motor tasks, and fatigue is one of the most common symptoms experienced by this population. MS fatigue is known to worsen with exertion, and previous studies have shown that worsening fatigue is a factor affecting gait, endurance, and balance. The specific manner in which fatigue leads to balance loss is not known. Sensory impairment is also common in MS, and is known to be a factor in gait and balance loss. Anecdotally, MS patients have noted that sensory impairments have worsened with fatigue as well, but this has not been examined.

Purpose:

The purpose of this ongoing study is to examine whether fatigue has an effect on sensory impairment in persons with MS. We hypothesized that as fatigue increases during a sustained motor task, sensation will decrease in the lower extremities in persons with MS. If our hypothesis is correct, it would suggest that increasing neurogenic fatigue results in worsening of sensation, which may partially explain the worsening of balance with increasing fatigue in persons with MS.

Subjects

A sample of convenience (n=16) of ambulatory subjects was recruited from New York City physical therapy practices which specialized in MS. Demographic and subject characteristics including MS type, years since diagnosis, age, gender, Expanded Disability Status Scale (EDSS) level, medications, and use of assistive devices were recorded and analyzed. The Fatigue Severity Scale (FSS) was completed for baseline analysis. (Table 1)

Table 1. Demographic and Clinical Characteristics of Participants (n=16)

Age, Mean, (SD)	\bar{X} 55.9, (\pm 11.7)
Gender	
Male	5
Female	11
EDSS Score, Mean, Range	\bar{X} 3.6, range 2.0- 6.5
Type of MS	
PP	5
RR	7
SP	4
Spasticity Medication	5
Anti-fatigue Medication	5
FSS, Mean, Range, (SD)	\bar{X} 4.5, 1.2-7.0, (\pm 1.8)
MSIS-29, Mean, Range, (SD)	\bar{X} 68.2, 32-106, (\pm 21.1)

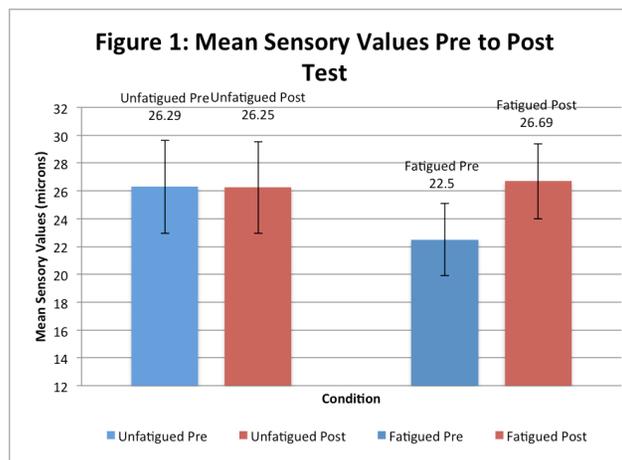
LEGEND: MS: Multiple Sclerosis; SD: Standard Deviation; \bar{X} : average value; EDSS: Expanded Disability Status Scale PP: primary progressive; RR: relapse- remitting; SP: secondary progressive; FSS: Fatigue Severity Scale; MSIS-29: Multiple Sclerosis Impact Scale 29.

Methods

A randomized crossover design was used. Informed consent and subject characteristics and demographics were obtained, followed by randomization into fatigued (F) and Unfatigued (UF) groups. All subjects received sensory testing using a biothesiometer on 5 key (B) lower extremity points (Appendix 1). Subjects in the F group then underwent a 6-minute walk (6MW) to induce fatigue, while subjects in the UF group laid supine for 6-minutes to minimize fatigue. Immediately following either 6-minute condition, biothesiometer testing was repeated. This was repeated for three separate trials over the course of a 5-day period, followed by a 2-week detraining period. Subjects then crossed over, where the subjects originally in the F group underwent the UF protocol, and the subjects in the UF group underwent the F protocol.

Results:

16 subjects completed the study. Paired sample t-test revealed a significant increase in mean pre to post scores in the fatigued condition (mean difference = 4.63, $t(14) = -6.59$, $p < .001$), indicating that fatigue resulted in worsening lower extremity sensation. In the unfatigued condition, the difference between pre to post scores (mean difference = .499 $t(14) = 0.58$, $p = .571$) was not significant, indicating no change in sensation between pre and post-test conditions.



Discussion:

Results from this study suggest that increased fatigue in persons with MS can result in worsening sensation. This may provide insight into the mechanism behind how fatigue in persons with MS can lead to impaired mobility. Sensation that worsens as a result of fatigue may be a contributing factor to the impaired balance and gait observed in this population. While this study only explores the relationship between fatigue and sensory impairment, it provides a platform for future research, which examines relationships between fatigue and the various factors associated with mobility loss. The results of this study suggest that clinicians who work with patients with MS may be able to limit the effects of impaired sensation by addressing fatigue. It also suggests that evaluation of sensation in persons with MS should be performed in both a fatigued and unfatigued state.

References

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 Thoumie, P., & Mevellec, E. (2002). Relation between walking speed and muscle strength is affected by somatosensory loss in multiple sclerosis. *Journal of Neurology, Neurosurgery, and Psychiatry*, 73, 313-315.
 Van Deursen, R. M., Sanchez, M. M., Derr, J. A., Becker, M. B., Ulbrecht, J. S., & Cavanagh, P. R. (2001). Vibration perception threshold testing in patients with diabetic neuropathy: ceiling effects and reliability. *Diabetic Medicine*, 18(6), 469-475.

Appendix 1: Locations for Sensation

Testing (in testing order):

Right big toe pulp

Left big toe pulp

Right plantar MTP 1

Left plantar MTP 1

Right medial malleolus

Left lateral malleolus

Right medial femoral condyle

Left lateral femoral condyle

Left medial malleolus

Right lateral malleolus

Left medial femoral condyle

Right lateral femoral condyle