

THE EFFECT OF A SINGLE BOUT OF PHYSICAL EXERTION ON LANGUAGE SKILLS IN INDIVIDUALS WITH MULTIPLE SCLEROSIS

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Introduction

Multiple Sclerosis (MS) is a progressive disorder of the central nervous system resulting in demyelination of nerve fibers and axonal injury (Bjartmar & Trapp, 2001). It affects the white matter of the central nervous system and is characterized by progressive neurological deficits with a remitting/relapsing disease course (Sliwa & Cohen, 1998). The development of scattered lesions and/or plaques within the brain produces varying combinations of motor, sensory, and cognitive-communication impairment.

Background

A dominant symptom of MS is fatigue, with 75% of individuals with MS reporting extreme fatigue. The impact of MS fatigue upon language function is less documented than cognition & this research on expressive language function in patients with MS was intended to contribute to closing the literature gap. Although fatigue, implicit as the outcome of physical exertion is well recognized, its impact upon language is notably under researched.

Communication Disorders in MS

A variety of communication disorders have been identified in individuals with MS, including dysarthria, aphasia, and cognitive impairment affecting communication (Achiron et al., 1992; Kujala, Portin, & Ruutiainen, 1996; Lethlean & Murdoch, 1993; Olmas-Lau, Ginsberg, & Geller, 1977; Wallace & Holmes, 1993).

Effects of MS Fatigue on Language Function

The impact of MS fatigue upon language function has until recently been less documented than cognition. This study exploring expressive language function in patients with MS is intended to contribute to closing the gap in the literature (Lethlean & Murdoch, 1993). Research into the language abilities of persons with MS has tended to focus upon the motor aspects of speech production rather than the cognitive aspects of semantic recall and verbal fluency (Lethlean & Murdoch, 1993).

Multiple sclerosis is a condition impacting upon executive function, semantic memory and verbal fluency (Friend et al, 1999; McKenzie & Green, 2009). Additionally, research supports the notion that individuals with MS have a reduction information processing speed (Huijbregts, 2004) leading to reduced semantic retrieval and a reduction in expressive language (Beatty, 2002). Further identified impacts on language function include; impaired naming, verbal expression and verbal fluency (Friend, Rabin, Groninger, Deluty, Bever & Grattan, 1999). Specifically, tests of verbal fluency have been found to be particularly sensitive to cognitive impairment resulting from MS (Beatty, 2002; Henry & Beatty, 2006).

Research Objectives

- 1) Does a single bout of physical exertion cause a decline in expressive language in individuals with MS
- 2) Does a single bout of physical exertion cause a decline in word finding skills in individuals with MS?
- 3) Does a single bout physical exertion increase the duration of time needed to complete confrontation-naming measures?

Study Demographics

Total number of participants: N= 24 *n*=17 (intervention) *n*=7 (control)

Disease Type: 5 had PPMS while 12 had RMMS

Mean Age: 51.41 years old (intervention); 48.15 years old (control)

Gender: 12 Females; 5 Males

Mean length of time of disorder: 12.82 years since onset

Mean EDSS for Intervention: 5.50 (equivalent to ambulatory without aid or rest for about 100 meters; disability severe enough to preclude full daily activities)

Range EDSS for Intervention: The EDSS range of scores was 3.0, indicating moderate disability with ambulatory ability, to 7.5, indicating severe disability and the inability to take more than a few steps and are typically restricted to a wheelchair.

Mean Educational Level: 15.59 year of education (intervention group) 14.71 years of education (control group)

Location: Metropolitan New York/New Jersey Area

Methods

A nonrandom, matched- subject, mixed-factor design model was used with a total of 24 participants, *n*=17 (intervention) and *n*=7 (controls). The research design was subjected to pretesting to ensure validity. Participants were assessed on a range of language tasks after undergoing one bout of cardiovascular exercise (NuStep T5 Recumbent Cross Trainer) and asked to provide a subjective fatigue score on the VAS-F. The expressive language tests included confrontation naming, assessment of expressive-language skills, verbal fluency, and assessment of a picture description. The tasks were then replicated in a counter-balanced fashion after a fatigue-equivalent rest period.

Results

Q1. Groups differed with regard to their performance on confrontation naming tests (EVT-2). A Tukey HSD *post hoc* test determined that the Intervention Fatigue Group had a significantly higher confrontation naming errors on the EVT-2 in comparison to all other groups (*p* = .005).

Q2. Groups significantly differed on their ability to generate words when given a letter of the alphabet (*p* = .025.) A Tukey HSD *post hoc* test determined that the Intervention Fatigue Group had a significantly lower on category naming compared to all other groups. A Tukey HSD *post hoc* test also determined significant group differences on the semantic category task in which subjects were instructed to generate the name of countries within 60 seconds, *p* < .001. The Intervention Fatigue Group had a significantly lower score compared to all other groups in the study.

Q3. Tests of between-subjects on the CTOPP, a test of rapid identification of letters, number, colors & objects, showed that 2 of 3 variables were significant. Groups significantly differed on the Rapid Color Naming Total Time, *p* = .042. A Tukey HSD *post hoc* test determined that the Intervention Fatigue Group had a significantly *higher* score to complete the task, meaning they required more total time compared to the control participants. Groups also significantly differed on the Rapid Object Naming Total Time, *p* = .032.

Conclusion & Discussion

The results of the study illustrate that after a single bout of fatigue individuals with MS, unlike the control group, demonstrated statistically significant changes in their language skills most notably in the areas of confrontation naming, phonemic & semantic verbal fluency, and the total amount of time necessary to name familiar objects & colors.

The study as a whole therefore confirms the hypothesis that even a single bout of physical activity can impair language function in individuals with MS. Lower scores may be anticipated, compared to the scores of the Control (non-MS) Fatigue Group, even for the Intervention Rest Group. MS negatively affects language performance, and linguistic abilities are worsened when the individual is fatigued.

In clinical terms, attention must be paid to the precondition of language intervention to ensure that the MS patient is in an optimal state of rest when assessments are made or interventions are carried out.

Further, future researchers should investigate variables such as EDSS ratings, possible links with ethnicity, lesion load, and the type of exercise performed, because these variables may all strongly influence linguistic performance for individuals with MS.