CASE REPORT *Multiple Sclerosis* 2008; **14**: 140–142

Worsening of symptoms is associated with lower physical activity levels in individuals with multiple sclerosis

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The present study examined the relationship between the worsening of symptoms across a 3–5-year period of time and self-reported physical activity in a sample of 51 individuals with multiple sclerosis (MS). Of the 51 participants, 35 reported a worsening of symptoms over the 3–5-year period of time. The worsening of symptoms was associated with significantly and moderately lower levels of self-reported physical activity independent of depression and EDSS scores and MS-disease course ($P = 0.04$). This study provides novel evidence that a worsening of symptoms is associated with lower levels of physical activity in individuals with MS. *Multiple Sclerosis* 2008; **14**: 140–142. http://msj.sagepub.com

Key words: exercise; multiple sclerosis; physical activity; symptoms

Introduction

There is a dramatic reduction in physical activity among individuals with multiple sclerosis (MS) [1]. The symptoms associated with MS (eg, fatigue, ataxia, pain and depression) might represent a primary explanation for the physical inactivity [2]. We recently examined the cross-sectional association between symptoms and physical activity in 196 individuals with MS [3]. Participants completed a symptoms checklist – total number of symptoms experienced in the past 30 days – and a self-report measure of physical activity, and then wore an accelerometer across a 7-day period. There was a moderate, inverse correlation ($r = -0.42$) between symptoms and physical activity. Another method of identifying symptoms as a possible explanation for the reduction of physical activity in those with MS involves examining the relationship between the worsening of symptoms and physical activity behavior. The present study examined the association between worsening of symptoms across a 3–5-year period of time and self-reported physical activity levels in a sample of individuals with MS.

Method

Participants

The study was approved by an IRB and all participants provided informed consent. Participants ($n = 51$) had an established diagnosis of MS and were enrolled in a study of changes in depression and neuropsychological functioning across a 3–5-year time period ($M = 44.7$ months, $SD = 5.3$ months, range = 36–57 months). The definite diagnosis of MS was based on the McDonald criteria [4] and was confirmed by a board-certified neurologist who assessed the disease course and neurological disability using Kurtzke's Expanded Disability Status (EDSS) scale [5]. Participant characteristics are in Table 1.

Measures

Worsening of symptoms was assessed during an interview. Participants were asked the question, 'Since you were last tested for this project, have you experienced any worsening of your MS symptoms?',

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Received 2 January 2007; accepted 12 March 2007

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10.1177/1352458507079126

Table 1 Characteristics of the 51 individuals with MS who participated in this study

Variable		Mean	SD
Education (years)		14.7	2.1
Age		52.2	9.4
CMDI, mood + evaluative scales		39.0	18.1
EDSS		4.1	2.2
Symptom duration (years)		18.3	9.3
Diagnosis duration (years)		14.8	8.8
MS course	n (%)		
Relapsing-remitting	29 (57%)		
Secondary progressive	15 (29%)		
Primary progressive	4 (8%)		
Progressive relapsing	3 (6%)		
Sex			
Female	40 (80)		
Male	10 (20)		

Note: CMDI = Chicago Multiscale Depression Inventory; EDSS = Expanded Disability Status Scale; Symptom and Diagnosis Duration are indicated in years.

and responded yes or no with responses coded as 1 or 0, respectively.

Physical activity was measured by the abbreviated International Physical Activity Questionnaire (IPAQ) [6]. The abbreviated IPAQ contains six items that measure the frequency and duration of vigorous-intensity activities, moderate-intensity activities, and walking during a 7-day period. The respective frequency and duration values for vigorous, moderate and walking activities were first multiplied together. The resulting volumes of vigorous, moderate and walking activities were then multiplied again by 8, 4 and 3.3 metabolic equivalents (MET), respectively. Finally, the resulting MET values were summed to form a continuous measure of physical activity in units of total MET-minutes/week. Preliminary evidence suggests that scores from the abbreviated IPAQ measure physical activity in individuals with MS based on moderate correlations with a pedometer ($r = 0.32$) and an accelerometer ($r = 0.36$) [7].

Depression was measured using the Chicago Multiscale Depression Inventory (CMDI) [8]. The CMDI consists of vegetative, mood, and evaluative subscales, and each subscale has 14 items that are rated on a five-point scale. Subscale scores are computed by summing item scores, and because neurovegetative depression symptoms are often confounded with MS symptoms (eg, sleep disturbance, low energy, sexual dysfunction), only the mood and evaluative subscales were used as an index of depression.

Procedure

Participants completed an interview, filled out questionnaires and underwent neuropsychological testing as part of a longitudinal study of cognitive and emotional changes in MS. The interview gathered disease and demographic information and assessed the worsening of symptoms. The IPAQ was completed as part of a questionnaire packet that was sent to participants 1 week before neuropsychological testing. The CMDI was completed on the day of neuropsychological testing. Participants were paid $100 and provided with a written neuropsychological screening evaluation and verbal feedback.

Data analysis

Data were analyzed using SPSS for Windows (SPSS, Chicago, IL). The effect of worsening of symptoms on IPAQ scores was examined using a one-way ANOVA that was followed with a one-way ANCOVA that included CMDI, EDSS, and MS-disease course as covariates. The magnitude of mean difference was judged as small (0.2), medium (0.5) or large (0.8) based on Cohen's *d*.

Results

Of the 51 participants, 35 reported a worsening of symptoms over the 3–5-year period of time. The mean (SD) IPAQ score was 2257 (3131) and was consistent with previous research [7]. The ANOVA indicated that IPAQ scores differed based on worsening of symptoms [$F(1,45) = 4.15$, $P = 0.05$]. The mean (SD) IPAQ score for those with a worsening of symptoms was 1641 (2499), whereas the mean (SD) IPAQ score for those without a worsening of symptoms was 3573 (3958); the difference was moderate in magnitude ($d = 0.65$). The ANCOVA indicated that the effect of worsening of symptoms on IPAQ scores was independent of CMDI, EDSS and MS-disease course [$F(1,41) = 4.53$, $P = 0.04$].

Discussion

The primary finding was that worsening of symptoms across a 3–5-year time period was associated with lower levels of self-reported physical activity independent of depression, neurological disability and MS-disease course. This is consistent with previous research [3] and provides support for symptoms as a possible explanation for the rate of physical in activity among those with MS [1].

Physical activity is often prescribed for the management of symptoms in MS [9]. However, the moderate effect of worsening of symptoms on physical activity observed in the present study and reported elsewhere [3] suggests that managing

symptoms might be equally important for the promotion of physical activity. Therefore, symptoms may be both an antecedent and consequence of physical activity and researchers should consider directly testing the possibility of reciprocal determinism using longitudinal data.

This study has implications for exercise adherence in MS. There are reports that physical activity is perceived to worsen MS symptoms [10]. If physical activity worsens MS symptoms, an individual would be more likely to drop out of an exercise program. Monitoring symptoms during a physical activity program, and then altering the exercise prescription during an episode of worsened symptoms, might increase exercise adherence among those with MS.

One important limitation of this study is the dichotomous assessment of worsening of symptoms. Future studies might consider using questionnaires that provide a continuous measurement of worsening of symptoms. Despite that limitation, our study supports the view that a worsening of symptoms may lead to a reduction in physical activity in MS.

Acknowledgement

This investigation was supported (in part) by a grant from the National Multiple Sclerosis Society (PP0978) to the second author.

References

1. **Motl RW, McAuley E, Snook EM.** Physical activity and multiple sclerosis: A meta-analysis. *Mult Scler* 2005; **11**: 459–63.
2. **Crayton H, Heyman RA, Rossmanm HS.** A multimodal approach to managing the symptoms of multiple sclerosis. *Neurology* 2004; **63**(Suppl 5): S12–S18.
3. **Motl RW, Snook EM, McAuley E, Gliottoni RC.** Symptoms, self-efficacy, and physical activity in individuals with multiple sclerosis. *Res Nurs Health* 2006; **29**: 597–606.
4. **McDonald WI, Compston A, Edan G, Goodkin D, Hartung HP, Lublin FD** *et al*. Recommended diagnostic criteria for multiple sclerosis: Guidelines from the international panel on the diagnosis of multiple sclerosis. *Ann Neurol* 2001; **50**: 121–27.
5. **Kurtzke JF.** Rating neurological impairment in multiple sclerosis: An expanded disability status scale (EDSS). *Neurology* 1983; **33**: 1444–52.
6. **Craig CL, Marshall AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE** *et al*. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc* 2003; **35**: 1381–95.
7. **Gossney JL, Scott JA, Snook EM, Motl RW.** Physical activity and multiple sclerosis: Validity of self-report and objective measures. *Fam Commun Health* 2007; **2**: 144–50.
8. **Nyenhuis D, Rao S, Zajecka J, Luchetta T, Bernardin L, Garron D.** Mood disturbance versus other symptoms of depression in multiple sclerosis. *J Int Neuropsychological Society* 1995; **1**: 291–96.
9. **Schapiro RT.** Managing symptoms of multiple sclerosis. *Neurologic Clinics* 2005; **23**: 177–87.
10. **Simmons RD, Ponsonby AL, van der Mei IAF, Sheridan P.** What affects your MS? Responses to an anonymous, Internet-based epidemiological survey. *Multiple Sclerosis* 2004; **10**: 202–11.

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