Comparison of the physical and non-physical functioning between the patients with multiple sclerosis and healthy subjects

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ABSTRACT

الهدف: من أجل التحقق من العلاقة البدنية وغير البدنية والقدرات الوظيفية للطرفين العلويين في المرضى المصابين بتصلب متعدد ومجموعة التحكم من الأصحاء.

الطريقة: شملت الدراسة إجمالي عدد ٦٣ مريضا يعاني من التصلب المتعدد و٥٢ شخصا سليما يمثلون مجموعة التحكم حضروا إلى جامعة باموكيلي ومدرسة العلاج الطبيعي وإعادة التأهيل بتركيا في الفترة ما بين فبراير ٢٠٠٦م، إلى يونيو ٢٠٠٦م، من أجل السماح بالمزيد من الفحص، تم تقسيم ٦٣ مريضا يعاني من التصلب المتعدد إلى مجموعتين وفقا إلى قدراتهم إلى مستوى الانتقال.تم تقييم الوظيفة البدنية بواسطة مقياس الاستقلال الوظيفي (اف اي ام) و اختبار بيقبورد بوردو(بي بي تي) واختبار وظيفة جبسون لليد (جي اتش اف تي)، كما تم تقييم الوظيفة غير البدنية بواسطة بيك انفنتري للاكتئاب(بي دي اي).

النتائج: كانت أعراض الاكتئاب مرتفعة بشكل ملحوظ لدى المجموعة المصابة بالتصلب المتعدد مقابل مجموعة التحكم بناءا على (بي دي اي) نسبة الخطأ أصغر من(٠،٠٠٠١) في الأفراد المصابين بالتصلب المتعدد ، بينما هنالك علاقة إيجابية جيدة بين نقاط حالة الإعاقة الموسعة (أي دي اس اس) ونقاط (بي دي أي)،هنالك علاقة سلبية بين (أي دي اس اس) ونقاط (اف اي ام) نسبة الخطأ أصغر من (٠،٠٠٠١).

خاتمة: تصاحب بقوة الوظائف غير البد نية خاصة الاكتئاب نقاط الحياة اليومية ونقصان القدرات الوظيفية لدى المرضى المصابين بتصلب متعدد، من أجل هذا السبب نوصي بتقييم الوظائف غير البدنية لدى المرضى المصابين بالتصلب المتعدد من أجل التخطيط لأفضل برامج العلاج الطبيعي المناسب.

Objectives: To investigate the relationship between physical functioning, non-physical functioning, and upper extremity functional abilities in patients with multiple sclerosis (MS) and healthy subjects.

Methods: A total of 63 patients with MS [Expanded Disability Status Scale (EDSS) score; 3-8] and 52 healthy subjects attending the Pamukkale University, School of Physical Therapy and Rehabilitation in Denizli, Turkey were studied in the period from February 2006 to June 2006. To allow further evaluation, 63 individuals with MS were divided into 2 groups according to their ambulation ability level. The physical functioning was assessed with the Functional Independence Measure (FIM), the Purdue Pegboard Test, and the Jebsen Hand Function Test, and the non-physical functioning was assessed with the Beck Depression Inventory (BDI).

Results: Depressive symptoms were significantly elevated in the MS group versus the control group based on the BDI (p<0.0001). In MS subjects, while there was good positive correlation between EDSS and BDI scores, there was a good negative correlation between EDSS and FIM scores (p<0.0001).

Conclusion: Non-physical functioning, especially depression, is strongly associated with activities of daily living and decreases functional abilities in MS patients. For this reason, we recommend that non-physical functioning should also be evaluated in patients with MS to plan the most suitable physical therapy program.

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It is well known that multiple sclerosis (MS) is an autoimmune and inflammatory demyelinating disease of the central nervous system. Since it is a chronic and progressive disease, physiotherapy plays a key role in its management by reducing spasticity, preventing retractions, and helping the patients to live

independently with disability.[1,2] Limitations in activities of daily living (ADL) performance in MS have a great impact on personal independence and quality of life and on the social roles of the individuals and the well-being of their families.[3-5] Several studies have described the impact of MS on ADL.[6-8] A major management aim of individuals with MS is to enable them to perform ADL as satisfactorily as possible and thereby remain as independent as possible in society.[9] The ADL performance is a broad concept that encompasses several domains: personal care, household tasks, work, and leisure.[6,10] Persons with MS may be referred to physiotherapy because of problems in upper extremity motor performance that may affect their functional abilities. Manual dexterity is a skill frequently evaluated in rehabilitation to estimate hand function. Several tests have been developed for this purpose, including Purdue Pegboard Test (PPT), 9 hole peg test and box and block test that assesses both prehension and manipulation skills with functional tasks.[11-13] The Jebsen Hand Function Test (JHFT) allows for the comparison of dominant and nondominant hands.[14] No research has evaluated the reliability and validity of this test for patients with MS, although normative data are available with divisions relative to age and gender. It has been pointed out in previous studies in the literature that depression is very common in patients with MS. In fact, symptoms of depression are severe enough to require medical intervention. Multiple sclerosis also destroys the insulating myelin that surrounds nerves that transmit signals affecting mood.[15-17] The aims of the current study were: 1) to investigate the relation between physical (Expanded Disability Status Scale [EDSS], Functional Independence Measure [FIM], PPT, JHFT, and so forth) and non-physical functioning (Beck Depression Inventory [BDI], and so forth) in patients with MS; 2) to determine the effects of their disability level in accordance with EDSS on physical and non-physical functioning in MS patients; 3) to compare the physical functioning, non-physical functioning, and upper extremity functional abilities of the patients with MS with healthy subjects.

Methods. We recruited eligible individuals with MS through contact with the local MS association in the Denizli region of Turkey from February 2006 to June 2006. Recruitment was conducted by contacting the facilitators of local self-help groups. All participants were evaluated individually by 2 trained physical therapists from Pamukkale University, School of Physical Therapy and Rehabilitation in Denizli, Turkey for the study. Individual consent of the participating patient was obtained after a disclosure statement regarding the purpose of the research. The study was supported and approved by the Committee on Research of Pamukkale University, School of Physical Therapy and Rehabilitation. Participants consisted of 63 subjects with clinically definite MS (38 females and 25 males) and 52 healthy control participants (33 females and 19 males) without any reported neurological disabilities. All participants were aged between 26-60 years, were free from any history of neurological illness or injury (aside from MS), alcohol or drug abuse, and psychiatric illness. Participants had sufficient visual acuity to see the test materials. All MS participants were selected using the following inclusion criteria: 1) an established definite diagnosis of MS, 2) stable in their MS with no ongoing relapse, 3) an EDSS score of 3-8, 4) MS relapse or corticosteroid use within the past 6 weeks, 5) activity limitations primarily related to their MS with no additional diagnosis, such as major depression or limb fractures, and so forth, that would impact on their ADL performance. Exclusion criteria for MS patients were: 1) any acute or chronic disease; 2) any speech and language problem; 3) any cognitive or communication problem; 4) any visual or hearing problem. For this study, relapses were defined as the appearance of new signs and symptoms of MS or the reappearance of old signs and symptoms, lasting at least 72 hours, in the absence of fever, and preceded by 30 days of stability. At the time of the study, only 2 patients (3.2%) were taking one of the MS disease modifying agents: interferon beta-Ib (one patient) and interferon beta-Ia (one patient). One of the patients had previously taken such medications, but had discontinued their use. Healthy volunteers with a mean age of 42.82 (SD=7.1, range 26-57) years were enrolled for descriptive purposes to determine which predictor variables deviated from normal. Exclusion criteria for healthy subjects were: 1) any neurological, musculoskeletal, psychiatric, acute or chronic disease; 2) any visual, hearing, cognitive, and communication problem. The characteristics of the 115 individuals are summarized in **Table 1**. To allow for an evaluation of the relationship between disease severity and ADL performance, 63 individuals with MS were divided into 2 groups (MS 1 and MS2) according to their ability to ambulate: 1) individuals who are able to walk 100 meters without assistance (EDSS 0.0-5.5, n=28); 2) individuals who are unable to walk without assistance and restricted to a wheelchair or bed (EDSS 6.0-8.0, n=35). The EDSS is a measure of the neurological impact of MS. It rates disease severity on a scale of 0 (normal) to 10 (death due to MS). Scores between 0 and 3.5 indicate individuals with MS who are fully ambulatory, whereas scores of 4 and above indicate limitations in ambulation. Individuals with EDSS scores of 6 require assistance on one side and can

walk approximately 100 m with or without rest. Those with EDSS of 6.5 can walk approximately 20 m with bilateral assistance, whereas individuals with EDSS of 7 and 7.5 are essentially restricted to a wheelchair and can only walk approximately 5 m with aid (EDSS 7) or only a few steps (EDSS 7.5). Individuals with EDSS scores 8 and 8.5 cannot walk at all are restricted to bed or chair or perambulated in a wheelchair much of the day.[18]

The Functional Independence Measure (FIM) rates the amount of assistance required to perform personal ADL (P-ADL). It consists of 18 items separated into 3 domains: the motor domain, the mobility domain, and the cognitive domain. Each item is scored on a 7-level Likert scale. A score of one or 2 indicates complete dependence (total or maximal assistance), 3-5 modified dependence (moderate or minimal assistance, or supervision), and 6 indicate modified independence and 7 complete independence. The FIM motor domain consists of 8 items, assessing self-care and sphincter control; summed scores range from 8-56. The FIM mobility domain consists of 5 items, assessing transfers and locomotion, summed scores range from 5-35. The FIM cognitive domain consists of 5 items, assessing communication and social cognition; summed scores range from 5-35.[19-21]

The Beck Depression Index (BDI) was introduced by Beck in 1961. It is a 21-item self-report rating inventory measuring characteristic attitudes and symptoms of depression.[22,23] At the same time, the BDI is common used in clinical researches by health providers, especially physical therapists.

The Purdue Pegboard Test (PPT) has been used in neuropsychological assessment to assist in localizing cerebral lesions, deficits, dyslexia, hyperactivity, schizophrenia, and MS. The examiner tested 1-3 subjects at a time using standardized procedures for administering the test. A total of 3 trials were administered to each subtests using the following sequence, dominant hand, nondominant hand, both hands, and assembly. When more than one subject was tested at a time, modifications suggested in the examiner's manual were used. A digital stopwatch was used to time the trials.[11,12] The board consists of 2 parallel vertical rows of 25 holes each. Metal pins are located at the extreme right hand and left hand cups at the top of the board. Collars and washers occupy the 2 middle cups. In the first 3 subtests, the subject places as many pins as possible in the holes, first with the dominant right hand from the right hand cup, starting at the top, thereafter with the nondominant left hand from the left hand cup, finally, with both hands simultaneously, within a 30-seconds period. In the fourth subtest, the subjects use both hands alternately to construct "assemblies" which consist of a pin, a washer, a collar and another washer. The subject must complete as many assemblies as possible within one minute.[11,12,24]

The Jebsen Hand Function Test (JHFT) consists of 7 individual tasks and is performed by each hand. This is a standardized functional assessment tool that employs common objects to evaluate fine motor dexterity, reaction time, and quality of movement. Performance on both tests is measured in seconds.[14,25] The participant sits in a chair at a standard height dining table. Subjects were asked to do the tasks "as quickly as you can" and the subtests were always given in the following sequence. The tasks were:[14,25] 1. Copying a standardized text. 2. Turning 5 cards. 3. Moving small objects. 4. Stacking checkers. 5. Simulating feeding using a tea spoon and 5 kidney beans. 6. Moving empty cans. 7. Moving full cans.

Descriptive statistics (mean ± SD) were given for each continuous variable and the numbers and their percentages were also calculated for each categorical variable. To find the difference regarding the means of variables among the 3 groups, Kruskall Wallis variance analysis was used. To determine which group/groups lead to the difference, Mann Whitney-U test with Bonferroni correction was also used. Pearson and Spearman's correlation coefficients were used to detect the relationship between continuous variables. A *p*-value of less than < 0.05 was considered significant. The statistical analysis was performed using the Statistical Package for Social Sciences (SPSS), version 13.

Results. Our study population had a mean age of 42.97 ± 7.60 years (ranging from 26-60 years). Gender distribution was 61.7% women and 38.3% men (**Table 1**). Mean age of MS patients was 43.09 (SD=7.97, range 26-60) years. Mean disease duration was 11.76 (SD=7.97) years. The average score of EDSS for MS patients was 6.05±1.23 (range 3-8). The average scores for Group 1 and Group 2 were 4.87±0.67 (range 3-5.5) and 7.00±0.59 (range 6-8). The difference between Group 1 and Group 2 is significant ($p<0.0001$) (**Table 2**). The average score of BDI is shown in **Table 2**. Depressive symptoms were significantly elevated in the MS group versus the control group based on the BDI ($f=20.39$, $p<0.0001$). A significant difference between the 3 groups was found ($p<0.0001$). Namely, Group 2 had a higher depression score compared to Group 1 and healthy controls ($p<0.0001$) (**Table 2**). Among MS patients, the FIM scores of Group 2 (motor, mobility, cognitive domains, and total score) were found to be lower than Group 1 (**Table 2**). The results of the study showed that the MS patients in Group 2 had a lower speed in JHFT and PPT than the individuals in Group 1. The difference between all groups was significant. In comparison with healthy subjects, a significant

Table 1 - Descriptive statistics by groups.

Characteristics	Group 1 (n= 28)	Group 2 (n= 35)	Healthy Controls (n=52)
		n (%)	
Age (years)			
Mean ± SD	42.21 ± 7.43	43.80 ± 8.42	42.82 ± 7.21
Range	34-60	26-60	26-57
Gender			
Male	9 (32.1)	16 (45.7)	19 (36.5)
Female	19 (67.9)	19 (54.3)	33 (63.5)
Hand dominance			
Right	21 (75)	31 (88.6)	44 (84.6)
Left	7 (25)	4 (11.4)	8 (15.4)
Marital status			
Unmarried	3 (10.7)	3 (8.6)	4 (7.7)
Married	21 (75)	30 (85.7)	47 (90.4)
Widowed	4 (14.3)	2 (5.7)	1 (1.9)
Educational level			
Primary/Secondary school	9 (32.1)	6 (17.15)	7 (13.5)
High school	16 (57.1)	25 (71.4)	39 (75)
University	3 (10.7)	4 (11.4)	6 (11.5)
Health insurance			
Yes	24 (85.7)	33 (94.3)	48 (92.3)
No	4 (14.3)	2 (5.7)	4 (7.7)
Time since diagnosis (years)			
Mean ± SD	13 ± 8.79	10.77 ± 7.22	-
Range	2-32	1-32	-

Table 2 - Comparison of the EDSS, BDI, and FIM scores by groups.

Variable score	Group 1 (n= 28)	Group 2 (n= 35)	Healthy Controls (n=52)	*P*-value
EDSS	4.87±0.67	7.00±0.59	-	0.0001
FIM				
Motor domain	31.14±1.75	26.97±1.68	56±0.00	0.0001
Mobility domain	29.07±2.01	24.51±1.72	35±0.00	0.0001
Cognitive domain	28.03±2.45	25.00±1.30	35±0.00	0.0001
Total score	88.25±5.36	76.48±3.72	126±0.00	0.0001
BDI	14.07±1.27	16.45±1.46	1.07±0.92	0.0001

Kruskal Wallis analysis of variance was used, EDSS - Expanded Disability Status Scale, FIM - Functional Independence Measure, BDI - Beck Depression Inventory

difference was also found in favor of healthy controls (**Table 3**). In MS subjects, while there was a good positive correlation between EDSS and BDI scores, there was a good negative correlation between EDSS and FIM scores (p<0.0001). **Table 4** also shows that there is a good negative correlation between BDI and FIM scores (p<0.0001). While a poor positive correlation between EDSS and all subtests scores for dominant hand in JHFT was found (except writing), there was a good negative correlation between EDSS and PPT subtests' scores (except assembly) (**Table 5**). **Table 5** shows that there is significant correlation only between BDI and JHFT scores (writing with dominant hand, p<0.001). However, no significant correlation between BDI and PPT scores was found. In MS subjects, a negative correlation between FIM scores and JHFT subtests (except nondominant hand tasks) was found. However, a positive correlation was found between FIM scores and PPT subtests (except assembly task) (**Table 5**).

Discussion. In the current study, we examined the relation between physical functioning, non-physical functioning, and upper extremity functional abilities of patients with MS and healthy control subjects. The first specific objective was to investigate the relationship between physical (EDSS, FIM, PPT, and JHFT) and non-physical functioning (BDI) in patients with MS. The current results showed that all patients with mild to moderate MS have similar limitations in the performance of ADL, mostly related to mobility domain. The results were similar to previous studies.[6,26,27] In the previous studies, FIM was used to assess limitations in P-ADL in individuals with MS and improvements following inpatient rehabilitation. In these studies, the effects on P-ADL have also been reported as the summed scores of the motor and cognitive domains of the FIM.[26-28] Sharrack et al[29] assessed 25 MS patients and also found that these FIM motor items were more affected than the other motor items. Similar to these studies, some items in the FIM are more affected than the others, in our study the summed FIM scores and items showed the effects of disease severity on the ADL performance.

In our study, approximately all of the individuals were rated as dependent by the FIM, namely, a FIM motor and mobility score of 77 or below. The median EDSS score was 6. Our results are lower than the previously reported mean motor FIM score and similar to the EDSS score. Although the disease severity was similar to the previous studies, it was seen that the summed motor FIM scores was higher between the different EDSS scores in the present study (79 at EDSS 6, 78 at EDSS 6.5, and 64 at EDSS 7-8.5).[6,27,29]

Only 2 patients have FIM cognitive scores of 34 or 35, and more than 93% of the individuals were rated

Table 3 - Comparison of PPT and JHFT scores among groups.

Variable Score	Group 1 (n = 28)	Group 2 (n = 35)	Healthy controls (n =52)	*P*-value
PPT				
Dominant hand, number of pins	8.71±1.18	7.71±0.82	18.01±1.93	0.0001
Non dominant hand, number of pins	6.92±1.08	5.71±0.85	15.71±1.25	0.0001
Both hands, pairs of pins	8.10±0.95	7.02±0.78	14.21±1.22	0.0001
Assembly, pieces	11.25±1.53	10.22±0.94	34.23±4.65	0.0001
JHFT				
Writing				
Dominant hand	70.92±4.85	68.28±3.51	45.48±2.26	0.0001
Non dominant hand	130.07±4.83	127.91±5.18	100.51±7.58	0.0001
Turning 5 cards				
Dominant hand	2.76±0.28	3.08±0.31	2.55±0.35	0.0001
Non dominant hand	4.22±0.28	4.24±0.25	3.54±0.51	0.0001
Picking up and placing in a tin				
Dominant hand	4.66±0.31	4.85±0.22	4.32±0.26	0.0001
Non dominant hand	4.90±0.26	5.08±0.24	4.83±0.32	0.003
Stacking for draughts pieces on a board				
Dominant hand	7.38±0.26	7.60±0.29	6.51±1.16	0.0001
Non dominant hand	7.87±0.38	8.07±0.42	7.01±0.84	0.0001
Simulated feeding				
Dominant hand	3.09±0.30	3.32±0.32	3.07±0.23	0.0001
Non dominant hand	3.51±0.21	3.67±0.18	3.48±0.21	0.002
Lifting 5 empty tins				
Dominant hand	2.05±0.26	2.21±0.17	2.03±0.20	0.001
Non dominant hand	3.00±0.28	3.13±0.26	2.87±0.37	0.005
Lifting 5 full tins				
Dominant hand	3.22±0.24	3.48±0.35	3.14±0.34	0.0001
Non dominant hand	3.73±0.26	3.80±0.20	3.60±0.22	0.001

Mann Whitney-U test with Bonferroni correction was used
PPT - purdue pegboard test, JHFT - jebsen hand function test

Table 4 - Correlations among the 3 outcome variables of the subjects with multiple sclerosis.

Variance Score	EDSS	FIM				BDI*
		Motor domain*	Mobility domain †	Cognitive domain †	Total score*	
EDSS						
R		-0.919	-0.938	-0.759	-0.96	0.471
p-value		0.0001	0.0001	0.0001	0.0001	0.0001
FIM						
Motor domain		-	-	-	-	
R	-0.919					-0.406
p-value	0.0001					0.001
Mobility domain		-	-	-	-	
R	-0.938					-0.492
p-value	0.0001					0.0001
Cognitive domain		-	-	-	-	
R	-0.759					-0.468
p-value	0.0001					0.0001
Total score		-	-	-	-	
R	-0.96					-0.426
p-value	0.0001					0.0001
BDI						-
R	0.471	-0.406	-0.492	-0.468	-0.426	
p-value	0.0001	0.001	0.0001	0.0001	0.0001	

* Pearson correlation analysis was used. † Spearman's correlation analysis was used
EDSS - expanded disability status scale, FIM - functional independence measure, BDI - beck depression inventory

Table 5 - Correlations between EDSS, FIM, BDI, and functional abilities of the subjects with multiple sclerosis.

Variable Score	EDSS		FIM								BDI*	
			Motor domain*		Mobility domain†		Cognitive domain†		Total score*			
	R	*P*-value	R	*P*-value	R	*P*-value	R	*P*-value	R	*P*-value	R	*P*-value
PPT												
Dominant hand, no. of pins	-0.344	0.01	-		0.266	0.05	0.36	0.01	0.325	0.01	-	
Non dominant hand, no. of pins	-0.534	0.0001	-		0.518	0.0001	0.433	0.0001	0.517	0.0001	-	
Both hands, pairs of pins	-0.425	0.001	-		0.401	0.001	-		0.381	0.01	-	
Assembly, pieces	-		-		-		-		-		-	
JHFT												
Writing												
Dominant hand	-		-		-		-		-		-0.408	0.001
Non dominant hand	-		-		-		-		-		-	
Turning 5 cards												
Dominant hand	0.359	0.01	-		-0.364	0.01	-0.306	0.05	-0.363	0.01	-	
Non dominant hand	-		-		-		-		-		-	
Picking up and placing in a tin												
Dominant hand	0.252	0.05	-		-0.266	0.05	-0.409	0.001	-0.312	0.05	-	
Non dominant hand	-		-		-		-		-		-	
Stacking for draughts pieces on a board												
Dominant hand	0.250	0.05	-		-0.254	0.05	-		-		-	
Non dominant hand	-		-		-		-		-		0.294	0.05
Simulated feeding												
Dominant hand	0.387	0.01	-		-0.401	0.001	-0.337	0.01	-0.407	0.001	-	
Non dominant hand	-		-		-		-		-		0.291	0.05
Lifting 5 empty tins												
Dominant hand	0.353	0.01	-0.358	0.01	-		-		-		-	
Non dominant hand	-		-		-		-		-		-	
Lifting 5 full tins												
Dominant hand	0.333	0.01	-		-0.365	0.01	-0.32	0.01	-0.347	0.05	-	
Non dominant hand	-		-		-		-		-		-	

* Pearson correlation analysis was used. † Spearman's correlation analysis was used.
EDSS - expanded disability status scale, FIM - functional independence measure, BDI - beck depression inventory, PPT - purdue pegboard test, JHFT - jebsen hand function test.

as dependent, namely, a FIM cognitive score of 29 or below. In a previous study of 201 MS patients with EDSS 5-9, the mean FIM cognitive score on admission to rehabilitation was 30, ranging from 11-35. These authors argued that the FIM cognitive score has limited usefulness for the measurements of cognitive disability in MS patients.[30,31] As similar to previous studies, the high FIM cognitive scores in our study were found. These results indicated that our sample represented a selected subgroup of individuals with moderate to severe MS and minimal recordable disability regarding comprehension, social interaction, and so forth.

In the literature, there has been a strong correlation between depressive symptoms and subjective self report functioning,[16,17,32,33] however, the results of the current study showed that BDI scores were found not to be significant predictors of performance on the ADL and upper extremity functional abilities.

The second objective of the present study was to determine the relationship between the physical and non-physical functioning in MS patients according to their disability level in accordance with EDSS score. To allow for an evaluation of the relationship between disease severity and physical and non-physical functioning, 63 patients were divided into 2 groups. The results show that there was a significant difference between the 2 groups according to the EDSS scores. Our results are similar to those reported by Cohen et al[10] who investigated the relationship between the EDSS and ADL performance from self-reports in 43 individuals with MS. Mansson et al[6] assessed 44 MS patients (EDSS 6-8.5) and also found that some FIM motor items were more effected than the other items. At the same time, we found a significant difference between all FIM domain scores and total FIM scores between

both groups. The same difference in the depression level was also found. The depression score of Group 2 was higher than Group 1. Thus, the current results support and extend previous findings that depressive symptoms may distort patients' perception of their ADLs and upper extremity functional abilities.[32,34,35]

The PPT, an assessment used to measure upper extremity fine motor dexterity as well as gross motor coordination, can be used in MS patients.[12] A few studies have evaluated the reliability and validity of this test for persons with MS, even though no research has been carried out to use the JHFT in the MS population.[12,13] The current results also indicated better upper extremity functional scores in Group 1, reflecting that the higher EDSS score has positive effects on upper extremity functional abilities.

The third specific aim was to compare the physical and non-physical functioning and upper extremity functional abilities in patients with MS and healthy subjects. The FIM is one of the most widely used *P*-ADL assessment tools, however, previous studies have shown that the FIM score may not adequately assess individuals who are more or less independent in P-ADL. Problems in ADL motor skills can also lead to increased demands on ADL process skills, because the ability to use alternative or compensatory strategies is reduced. The current results show that there was a significant difference among 3 groups (Group 1, Group 2, and healthy controls) in upper extremity functional abilities. We concluded that the JHFT results were similar to PPT results. In fact, these results reflect that the JHFT may be also used with MS patients as standardized.

There are 2 limitations of the study. The first is that only BDI was used to evaluate non-physical functioning. We should also have used a generic or special quality of life questionnaire to measure non-physical functioning. The second, was not evaluating the fatigue level of the patients. This is an important consideration, as the incidence of depression is higher in MS than in the general population.[17,36-38] The results obtained from this study show that depression is a very important factor, which has many negative effects on ADL and upper extremities functional abilities in MS patients. As part of routine MS care, health care providers should screen or question both patients and their caregivers about this specific aspect in order to collect the most suitable information about MS patients.

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