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Occupational Therapy in Multiple System Atrophy: A Pilot Randomized Controlled Trial

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Abstract: **There is some evidence that rehabilitation therapies may be useful in progressive neurological conditions, but this usefulness has not been studied in multiple system atrophy (MSA) to date. The aim of this small pilot study was to identify the feasibility of a larger randomized controlled trial of occupational therapy and to report preliminary data on the impact of occupational therapy on disability, mood, and health-related quality of life in patients with MSA. Patient groups were comparable for age, gender distribution, type of MSA, and severity. The active occupational therapy intervention group experienced a significant reduction of Unified Parkinson's Disease Rating Scale (total score and Activities of Daily Living [ADL] section), and PDQ-39 scores (total scores and ADL subsection). An occupational therapy program may improve functional abilities in patients with mild to moderate MSA. A larger multicenter study is needed.**

Key words: occupational therapy; multiple system atrophy

Occupational therapy (OT) focuses on the balance and context of occupations and activities in the lives of individuals with illness and disabilities. The main aim of OT is to maintain, restore, or create a balance, beneficial to the individual, between the abilities of the person, the demands of her/his occupations in the areas of self-care, productivity and leisure, and the demands of the environment.[1] Occupational therapists are trained to maximize a person's ability to carry out activities that are important and meaningful to them.

There is a growing consensus that the comprehensive management of parkinsonism includes rehabilitation therapies.[2] According to several UK-based surveys, 13 to 25% of people with Parkinson's disease are referred to an occupational therapist.[3] Multiple system atrophy (MSA) is a less common but more aggressive cause of progressive neurological disability, usually involving poorly levodopa-responsive parkinsonism, with additional problems in many patients due to cerebellar and autonomic dysfunction. However, the effect of rehabilitation has not so far been studied in patients with MSA. We, therefore, conducted a prospective randomized controlled trial of occupational therapy intervention in patients with MSA. The aims were to identify whether a larger randomized controlled study was feasible and to provide some preliminary data on the impact of OT on disability, mood, and health-related quality of life in patients with MSA.

PATIENTS AND METHODS

Patients

Patients with a clinical diagnosis of multiple system atrophy (Quinn Criteria),[4] categorized as MSA-p (predominantly parkinsonian), MSA-c (predominantly cerebellar), or MSA-m (mixed parkinsonian and cerebellar features) with Hoehn and Yahr stages 2 to 3,[5] were recruited from the movement disorder clinics at the National Hospital for Neurology and Neurosurgery (NHNN), London, and from the Sarah Matheson MSA Trust, United Kingdom. Inclusion criteria were that (1) MSA had affected the patient's ability to participate in personal, social, work, or family based activities; (2) medication was stable; (3) patients were not currently involved in another interventional study; (4) they had had no occupational therapy input over the past year; (5) they did not require urgent occupational therapy intervention; (6) they lived within 1-hour travel from the NHNN; and (7) they were able to walk short distances (with a cane or walker if necessary). The study was approved by the Joint Research Ethics Committee of the Institute of Neurology and the National Hospital for Neurology and Neurosurgery, Queen Square, London, UK, and all patients gave their written informed consent.

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Study Design

A pretest–posttest control group design with two treatments (OT intervention and control) was used. Seventeen volunteers with a clinical diagnosis of MSA were recruited for the study. These subjects were randomly allocated to either the OT intervention group or to the control group by selecting a sealed envelope that contained a random number from a computer-generated random numbers list that allowed each patient an equal chance to be in either group.

Outcome Measurements

Before randomization, and 8 weeks later, all patients were assessed using the Unified Parkinson's Disease Rating Scale (UPDRS)[6] by the researcher, and asked to complete the following self-report scales: the Parkinson's Disease Quality of Life Scale (PDQ-39),[7,8] Medical Outcomes Study Short Form (SF-36),[9] and the Hospital Anxiety and Depression Scale (HADS).[10]

Occupational Therapy Program

After randomization, the intervention group received an occupational therapy program, which consisted of eight sessions of occupational therapy over 8 weeks. This program was designed to reflect current OT practice. Each session lasted 40 minutes and all patients had one home visit. The remaining seven sessions were held in the outpatient department of the National Hospital for Neurology and Neurosurgery, United Kingdom. The program was individually tailored and designed to address performance deficits in the areas of self-maintenance, productivity, and leisure[11] and was provided by a state registered occupational therapist trained to use the UPDRS. The home visit was carried out early in the program to provide an opportunity to see the patient in a more "normal" environment and to ensure all subsequent interventions were kept within the context of this environment. Individual difficulties with performance included increased effort, decreased efficiency, and decreased satisfaction throughout all activities of daily living. The control group did not receive any occupational therapy input during the trial but were offered occupational therapy input after the completion of the study.

Treatment was goal-orientated and included intervention at (1) a symptomatic level, e.g., fatigue management and management of the symptoms of postural hypotension; (2) a person level, e.g., practicing transfer techniques and feeding methods; and (3) an environmental level, e.g., provision of equipment and home adaptations/modifications, risk assessment, and management.

Statistical Analysis

The mean age, gender distribution, Hoehn and Yahr stages of the disease, the type of MSA (parkinsonian, cerebellar, or mixed), and diagnostic certainty (probable or possible) were compared between groups. Dichotomous variables were compared using the chi-squared test (Fisher's exact test value), and ordinal data using the Mann–Whitney *U* test. Preintervention scores of the UPDRS and the PDQ-39 were compared between the two groups to establish the baseline characteristics of each group and to confirm that the two groups were similar.

Mean change scores were calculated for the summary index and each dimension of all the measures in both the intervention and control group. The effect of the treatment was analyzed using the Mann–Whitney *U* test.

RESULTS

Recruitment

A total of 17 patients with multiple system atrophy (10 MSA-p, 2 MSA-c, and 5 MSA-m) were randomly assigned: 9 to the control group (88.9% probable MSA, 11.1% possible MSA) and 8 to the intervention group (75% probable MSA, 25% possible MSA).[4] The two groups were comparable for age, Hoehn and Yahr stage,[5] and type of MSA[4] (see Table 1). No patients who were approached about the study declined to take part. Two patients were excluded because they were wheelchair-dependent. No patients dropped out of the study, suggesting that assessment and treatment were tolerated well. Fewer patients were available for recruitment than anticipated. This finding was because many were participating in drug intervention studies, had already received OT input over the past year, or required urgent OT intervention.

Clinical Characteristics of Each Group

At initial assessment (before intervention), there was no significant difference between the mean total UPDRS scores in the two groups; however, the control group had significantly worse PDQ-39 quality of life scores than the intervention group. Assessment with the HADS suggested the control and intervention groups had similar levels of anxiety and depression. The key baseline characteristics and results are presented in Table 1.

Effects of Intervention

Details of the response variables for each group, before and immediately after the intervention course, are shown in Table 1. The between-group comparison of change in the total UPDRS scores showed a significant

TABLE 1. *Baseline scores and changes following OT intervention assessed with the Unified Parkinson's Disease Rating Scale (UPDRS)*

	OT Intervention Group	Control Group	Significance
Demographics			
Age (mean +/− SD)	57.1 ± 7.9	64.8 ± 9.3	*ns*
Gender	4M:4F	7M:2F	
Hoehn and Yahr	2 (2–3)	2 (2–3)	*ns*
MSA type	4 MSA - p:		*ns*
	2 MSA - c:	6 MSA - p:	
	2 MSA - mixed	3 MSA - mixed	
UPDRS total			
Pre-intervention	43.5 (24–53)	39.0 (17–46)	0.082
Post-intervention	41.0 (22–54)	46.5 (17–57)	
Change score	−1.5 (−8–1)	6.5 (0–14)	0.002
UPDRS ADL			
Pre-intervention	20 (12–25)	15 (7–20)	0.108
Post-intervention	16 (8–25)	19 (7–26)	
Change score	−3 (−5–0)	2 (0–9)	0.001
PDQ39 Index score			
Pre-intervention	36.6 (15.8–53.4)	51.9 (33.8–77.8)	0.027
Post-intervention	28.9 (17.6–43.1)	54.2 (29.5–80.6)	
Change score	−8.3 (−14.8–4.27)	4.01 (0.42–16.8)	0.03
PDQ39 ADL			
Pre-intervention	50 (12.5–66.7)	62.5 (29.2–91.7)	0.176
Post-intervention	39.6 (25–62.5)	70.8 (37.5–100)	
Change score	−10.41 (−16.7–25)	8.33 (4.17–12.5)	0.02

For all measures the median and range is reported and comparisons were performed using the Mann-Whitney *U* test, except for age where the mean and SD are shown and students *t* test was used. Dichotomous variables were evaluated using χ^2.

treatment effect in the intervention group. The intervention group demonstrated a nonsignificant improvement from baseline ($P = 0.065$), whereas the control group deteriorated significantly ($P = 0.018$). Comparisons of specific changes revealed that the ADL subsection scores had deteriorated significantly in the control group ($P = 0.017$) but improved in the intervention group ($P = 0.024$) with a significant between-group comparison of change ($P = 0.001$). There were no significant changes in the mental or motor subsections.

Similarly, the single index score of the PDQ-39 showed a significant between-group improvement in the health-related QOL for the OT intervention group compared with the control group (Table 1), although the within-group comparisons did not demonstrate either significant improvement or deterioration. Further analysis revealed a similar significant between-group improvement in the ADL subscale in the intervention group. Within-group comparisons demonstrated that the intervention improved significantly in ADL function ($P = 0.017$), whereas the control group deteriorated significantly ($P = 0.024$). No other subscale showed any significant difference.

There were no significant differences between the two groups in the changes on either the HADS anxiety or depression subscale or the MFES. Nor were there significant differences between the groups in the PCS and MCS scores of the SF-36.

DISCUSSION

This report is the first study of any sort relating to OT in MSA and also the first prospective randomized control trial to evaluate the effectiveness of occupational therapy in MSA. It demonstrates that patients with mild to moderate MSA may obtain functional improvement after eight sessions of occupational therapy and provides insight into the feasibility of such studies. Outcome scores suggested that the most benefit was obtained in the performance of activity of daily living, an area where OT interventions are often targeted.

There are no similar studies of MSA in the literature. However, 60% of the patients had parkinsonism, and these results may be compared with those found in studies of occupational therapy and Parkinson's disease.[12] A recent Cochrane review identified two randomized controlled studies of occupational therapy in Parkinson's disease.[12] Gauthier and colleagues compared five sessions of group occupational therapy with an untreated control group.[13] Fiorani and coworkers compared group occupational therapy and physiotherapy with individual physiotherapy.[14] Their occupational therapy intervention included game playing and basketry as major compo-

nents. Neither trial made a statistical comparison between groups, although they reported a beneficial effect. These two studies were small, and it was not possible to perform a meta-analysis, the authors of the review observing that lack of evidence does not mean lack of effectiveness.

Our study has several weaknesses. It is small and, therefore, has limited power. Although the subjects were randomly assigned, the groups were not matched at baseline and the patients in the control group appeared to deteriorate during the study period. The reason for the relatively rapid deterioration in the control group was unclear. One possibility is that patients with MSA can be quite variable on a day-to-day basis and the scores represent the patients as they were on that particular day. Relatively "minor" difficulties such as a delay in transport may lead to quite large changes in patients' functional status. To overcome all these problems, future studies, as recognized in the Cochrane reviews of therapy interventions for Parkinson's disease, will have to be multicenter.

There was no "placebo" control; patients were simply treated or not treated, although those in the control group were aware they had been offered OT input after the study, should they want it. This reflects current practice, whereby only a minority of patients are referred to occupational therapists. Identifying a feasible control intervention is difficult and expensive in therapy studies. Patients will often recognize sham physical interventions, using a resource as scarce as skilled therapist time for sham interventions poses ethical and managerial concerns, and transport to the hospital is difficult to access and expensive for patients with disabilities. However, our intervention patients showed improvement on some measures, whereas our control patients deteriorated during this period, which further supports the benefits of occupational therapy in MSA.

Neither the assessor nor the patients were blinded to the protocol. This strategy does not invalidate the active interventions patients' reports that ADL performance and quality of life was better, but it does prevent us from identifying whether the intervention is specific. However, the fact that patients identified improvement in global but not change in the mood or mentation subscale suggests some specific benefit as a result of the occupational therapy, not simply a nonspecific effect of intervention. In addition, the improvement documented in the ADL subsection of the UPDRS is unlikely to represent a practice effect, because the occupational therapy program did not involve the actual tasks of the ADL subsection.

The measurement tools were not designed specifically for use in MSA. At the time our study was initiated, there were no validated measures of impairment, activity limitation (disability), participation restriction (handicap), or health-related quality of life in MSA. However, a validated Unified MSA Rating Scale (UMSARS; Wenning and colleagues) is in press currently in *Movement* Disorders, and disease-specific MSA quality of life instrument currently is under development by Schrag and coworkers. Instead, the scales used were selected because they have been shown to be valid and reliable in Parkinson's disease (PD; UPDRS, [6,15,16] SF-36,[17–19] HADS,[20,21]). The majority of patients in this study had parkinsonian features, although some had additional cerebellar features. The UPDRS has been identified as an appropriate tool to measure the parkinsonian features of MSA where it correlates well with other dependency scales and has a high internal consistency[22] (although there is contamination by cerebellar motor deficits, if present). No similar work has been performed for the PDQ-39, which is why we also used the SF-36, which is psychometrically sound in PD[14–16] but is likely to have marked floor effects in the MSA population. The modified falls efficacy scale has not been validated in the MSA population but has been extensively evaluated in the normal elderly population and has face validity.[23,24] It was selected because of the presence of early axial problems and postural instability in MSA. Gaudet has identified both the UPDRS and the PDQ-39 as effective tools in measuring the impact of parkinsonism from an occupational therapy perspective.[25]

The study only involved a small patient population at stages 2 and 3 on the Hoehn and Yahr scale. Therefore, the results may not be generalizable to all patients with MSA. Consensus studies of the role of occupational therapy and physiotherapy in Parkinson's disease suggest that therapists have a role from diagnosis (teaching patients exercise and maintenance programs) to severe disability (posture, seating, provision of equipment, and adaptations).[26,27]

Finally, there is no long-term follow-up and benefits may not be maintained. There is conflicting evidence surrounding maintenance of benefit. Gauthier and collegues suggested the benefits of occupational therapy given to PD patients were maintained at 6 and 12 months after recruitment.[13] Similarly, Patti and coworkers conducted a study of rehabilitation in PD in which benefits were maintained at six months.[28] In contrast, Wade and coworkers,[29] in a study of the out-patient rehabilitation of PD, and Comella and colleagues,[30] in a study of physical rehabilitation in patients with PD, both found that initial improvements did not persist.

Given the difficulties inherent in this study of small sample size leading to suboptimal matching of the groups, variability in baseline measures, lack of blinding of the assessor, lack of disease-specific outcome measures, it is difficult to make a robust statements about the impact of OT for patients with MSA. However, patient compliance was good, and treatment well tolerated. We, therefore, believe this study demonstrates that randomized controlled trials of therapy intervention in MSA (and other progressive neurological conditions) are feasible but need to be multicenter to have sufficient statistical power. These preliminary results suggest that patients find occupational therapy interventions beneficial and that it should be considered for patients with mild to moderate disability associated with MSA.

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