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Original Research

Motor Retraining (MoRe) for Functional Movement Disorders: Outcomes From a 1-Week Multidisciplinary Rehabilitation Program

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Abstract

Background: Functional movement disorders (FMDs) are conditions of abnormal motor control thought to be caused by psychological factors. These disorders are commonly seen in neurologic practice, and prognosis is often poor. No consensus treatment guidelines have been established; however, the role of physical therapy in addition to psychotherapy has increasingly been recognized. This study reports patient outcomes from a multidisciplinary FMD treatment program using motor retraining (MoRe) strategies.
Objective: To assess outcomes of FMD patients undergoing a multidisciplinary treatment program and determine factors predictive of treatment success.
Design: Retrospective chart review.
Setting: University-affiliated rehabilitation institute.
Patients: Thirty-two consecutive FMD patients admitted to the MoRe program from July 2014—July 2016.
Intervention: Patients participated in a 1-week, multidisciplinary inpatient treatment program with daily physical, occupational, speech therapy, and psychotherapy interventions.
Main Outcome Measurements: Primary outcome measures were changes in the patient-rated Clinical Global Impression Scale (CGI) and the physician-rated Psychogenic Movement Disorder Rating Scale (PMDRS) based on review of standardized patient videos. Measurements were taken as part of the clinical evaluation of the program.
Results: Twenty-four of the 32 patients were female with a mean age of 49.1 (±14.2) years and mean symptom duration of 7.4 (±10.8) years. Most common movement phenomenologies were abnormal gait (31.2%), hyperkinetic movements (31.2%), and dystonia (31.2%). At discharge, 86.7% of patients reported symptom improvement on the CGI, and self-reported improvement was maintained in 69.2% at the 6-month follow-up. PMDRS scores improved by 59.1% from baseline to discharge. Longer duration of symptoms, history of abuse, and comorbid psychiatric disorders were not significant predictors of treatment outcomes.
Conclusions: The majority of FMD patients experienced improvement from a 1-week multidisciplinary inpatient rehabilitation program. Treatment outcomes were not negatively correlated with longer disease duration or psychiatric comorbidities. The results from our study are encouraging, although further long-term prospective randomized studies are needed.
Level of Evidence: III

Introduction

Functional movement disorders (FMDs), also referred to as psychogenic or conversion disorders, are characterized by abnormal control over movements without a known organic etiology [1,2]. These disorders are commonly seen in medical practice, representing up to 16% of new patients referred to neurology clinics and up to 20% of patients treated in movement disorder clinics [3-5]. Patients with FMDs may present with an array of symptoms, including tremor, dystonia, choreiform movements, weakness, and gait or speech disturbances [1,6,7]. Patients often report a sudden onset of symptoms and may experience considerable variability of symptoms over

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time [1,8]. The management of FMD is challenging, and there are no standard treatment guidelines available.

Often, the prognosis for FMD patients is poor, and many patients fail to improve, especially those with symptoms lasting beyond one year [7,9-12]. Long term studies of FMD patients report that up to two-thirds are the same or worse at follow up [7,13]. Functional symptoms can be major sources of disability and distress for patients. When compared to patients suffering from other neurologic diseases, FMD patients report similar or greater negative impact to quality of life [1,2,14]. FMD patients are also more likely to receive disability-related state financial benefits and impose substantial costs on the US healthcare system [15].

Although FMD are often comorbid with psychopathology [7], usually anxiety and depression, psychological symptoms cannot be identified in every FMD patient [4,16]. In fact, the presence of a psychological stress factor is no longer required by *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*, criteria for the diagnosis of FMD [17,18]. Treatment with antidepressants and psychotherapy alone has demonstrated only mild to modest benefits in symptom improvement in several studies [19-22]. In recent years, a number of studies have reported good outcomes from physical therapy based interventions in either an outpatient [9,23] or inpatient setting [10,13,24,25]. Multidisciplinary inpatient rehabilitation programs may be most appropriate for more severely affected patients [26]. These programs have the advantage of reducing social and environmental factors that trigger or maintain functional symptoms and allow for a more intense treatment course [27].

We developed a 1-week multidisciplinary inpatient rehabilitation program based on motor retraining principles for the treatment of FMD patients. The purpose of this study is to evaluate patient- and physician-rated outcomes at the end of the treatment week and after 6 months. We hypothesized that patients with symptom duration of less than 5 years and no significant psychopathology would have a better response to the treatment intervention.

Methods

Study Design

The study was a retrospective chart review of 32 consecutive patients admitted for a 1-week multidisciplinary motor retraining (MoRe) program for FMD between July 2014 and July 2016 at Frazier Rehab Institute in Louisville, KY. The study was approved by the University of Louisville's Institutional Review Board.

Study Subjects

Patients were admitted to the MoRe program after a diagnosis of documented or clinically established FMD was confirmed by a movement disorders specialist (K.L.) according to Fahn and Williams criteria [28] (Table 1) and functional impairment was severe enough to justify inpatient treatment. All patients were 18 years or older. Prior to admission, patients were evaluated in an outpatient setting by a movement disorder specialist, physical therapist, and psychologist for assessment and treatment planning purposes. Admission criteria included daily symptoms severe enough to justify inpatient admission as judged by the evaluation team; failure to respond to prior outpatient therapies; and expected benefit from an intensive, multidisciplinary team approach to rehabilitative care. Patients had daily symptoms interfering with activities of daily living and ambulation, required interventions from at least 2 therapy disciplines, and were able to participate in intensive therapy. Patients were not considered to be candidates for the program if they had exclusively paroxysmal symptoms, psychogenic nonepileptic seizures or other spells associated with alterations in consciousness, or were deemed to be psychiatrically unstable (eg, actively suicidal, psychotic, or abusing illicit substances). All patients admitted to the MoRe program over a 2-year period were included in the study.

Intervention

The MoRe program is based on principles of relearning normal movement control through a stepwise approach in a multidisciplinary setting. The treatment team consists of a neurologist, physiatrist, psychologist, physical, speech, and occupational therapists and a social worker. Patients are admitted to the program on Sunday evening and discharged on the following Saturday. Therapy takes place Monday through Friday, consisting of 3 hours per day of physical, occupational, and speech therapy (if applicable) and 1 hour of psychotherapy. The principles of therapy were adapted from an FMD treatment program at Mayo Clinic in Rochester, MN [9], and are in keeping with recently published consensus guidelines for the treatment of FMD [27]. Treatment begins with establishing

Table 1
Fahn and Williams diagnostic criteria for psychogenic (functional) movement disorders

A. Documented psychogenic movement disorder: persistent relief by psychotherapy, suggestion or placebo, or observed without the movement disorder when unobserved.
B. Clinically established psychogenic movement disorder: inconsistent over time or incongruent with a classical movement disorder, plus other false neurologic signs, multiple somatizations, obvious psychiatric disturbance, distractibility, or deliberate slowness.
C. Probable psychogenic movement disorder: inconsistent or incongruent, or distractible, or other false neurologic signs, or multiple somatizations.
D. Possible psychogenic movement disorder: obvious emotional disturbance.

elementary movements in the affected limb or body region, analogous to treatment of other neurologic conditions (eg, stroke), with the stated goal of neurologic normality. As simple movements are satisfactorily performed, more complex movements are added. Emphasis is placed on the quality instead of the quantity of movement. The patient is asked to focus on breathing or relaxing imagery when feeling overwhelmed. Positive gains are verbally reinforced and abnormal movements are ignored unless major and frequent intrusions suggest a need to rest. Assistive devices are removed as soon as possible. Mental practice training is used at the beginning of the first therapy session each day and follows a script (Appendix 1 in supplementary materials). Patients are instructed to practice mental practice training on their own every morning and evening. Patients also meet with a psychologist every day for a 1-hour session. Psychologists work with cognitive behavioral based materials according to a validated treatment manual for FMDs [29].

Patients were admitted under the diagnosis of a functional movement disorder (ICD-10 code G25.9). The rehabilitation stay was covered by commercial insurance (n = 17), Medicaid/Medicare (n = 13), VA benefits (n = 1), and private pay (n = 1).

Assessments

The following assessments were collected at baseline to capture demographics, clinical features, comorbidities, and contributing illness factors: Self-report version of the Clinical Global Impression Scale (CGI-SR) [30], Sheehan Disability Scales (SDS) [31], Health Related Quality of Life (HRQoL) [32], Health Care Visits [33], Beck's Depression Inventory [34], State-Trait Anxiety Inventory [35], Primary Care PTSD Screen [36], Sexual and Physical Abuse Screen Questionnaire [37], Linear Analogue Self-Assessment of overall well-being [38], Body Vigilance Scale [39], Emotional Response Questionnaire [40], and the Short Health Anxiety Inventory [41]. All measures are routinely administered to FMD patients in our clinical practice to gather information helping in treatment planning and identification of factors contributing to development and maintenance of symptoms. Standardized video recordings of patients were taken by a physical therapist on the first and last day of the inpatient admission and scored by a movement specialist (K.L.) according to the Psychogenic Movement Disorder Rating Scale [42]. At the end of the program, patients were asked to rate their change in symptoms compared to baseline using the CGI-SR scale and indicate satisfaction with treatment interventions on a 10-point Likert-type scale. Six months after discharge, a follow-up questionnaire is sent to patients by mail or completed during an office visit for local patients. The following measures are completed: CGI-SR, SDS, HRQoL, Linear Analogue Self-Assessment, and Health Care Visits.

Analysis

SPSS (SPSS 2013), version 22.0, was used to analyze the data. Demographic and clinical history was summarized using descriptive statistics. For the primary outcome measure, changes in CGI-SR, a repeated measures analysis of variance was performed, along with a test for linear trend assessing the reduction of severity from baseline to a 6-month follow-up. Paired samples *t* tests were performed for secondary outcome measures. Chi-square analysis was performed to assess the association of selected predictive factors on changes in CGI-SR. All *P* values were 2-tailed. Statistical significance was set by convention at $P < .05$.

Results

Patient Characteristics

The study included 32 patients, with a predominance of females (75.0%). This is consistent with a higher prevalence of FMD in women reported in the literature [8,11,14]. The mean age was 49.1 (±14.2) years and mean symptom duration at the time of admission was 7.4 (±10.8) years. Patients were classified by predominant abnormal movement. The most common movement phenomenologies were abnormal gait, hyperkinetic movements (eg, tremor, chorea or myoclonus), or dystonia (31.2% each). Weakness was the predominant symptom in 6.3% of patients. The majority of patients (87.5%) experienced more than 1 type of abnormal movement, and speech was affected in 56.3%. Assistive ambulatory devices were used by 40.6% of patients and 46.9% endorsed falls. Sudden onset of symptoms was reported in 64.5% of cases. Of the patients who could recall a precipitating factor for onset of symptoms, 61.1% reported a physical event (eg, surgical procedures, injuries, and car accidents), and 27.7% cited a psychological factor, such as stress. A high percentage of patients reported a history of depression (81.3%) and anxiety (62.5%), and 56.3% were receiving disability benefits. For further demographics and clinical characteristics, refer to Tables 2 and 3. A table with patients' comorbidities is included in the supplementary materials (Appendix 2).

Psychometric Profiles

The mean Beck's Depression Inventory score was 16.6 (±10.4), indicative of mild depression. The mean State-Trait Anxiety Inventory—S and —T scores were 40.8 (±12.6) and 44.1 (±13.9) respectively, in the range of moderate anxiety. The Primary Care PTSD Screen scale indicated that 35.5% of patients were experiencing post-traumatic stress disorder symptoms. The mean overall well-being score according to the Linear Analogue Self-Assessment scale was 29.12 (±9.66).

Table 2
Patient demographics

Gender, n (%)		
Female	24	(75.0)
Male	8	(25.0)
Age, mean (SD)	49.1	(14.2)
Marital status, n (%)		
Single	10	(31.3)
Married	19	(59.4)
Divorced	3	(9.4)
Years of education, mean (SD)	14.8	(2.7)
Employment status, n (%)		
Employed full time	2	(6.3)
Employed part time	2	(6.3)
Homemaker	2	(6.3)
Retired	5	(15.6)
Student	1	(3.1)
Unemployed	1	(3.1)
Disability	18	(56.3)
Other	1	(3.1)
Healthcare employment history, n (%)		
No	25	(78.1)
Yes	7	(21.9)
Location of residence, n (%)		
In-state	14	(43.8)
Out-of-state	18	(56.3)

Table 3
Patient clinical characteristics

Age of symptom onset, mean (SD)	41.6	(15.0)
Symptom duration in years, mean (SD)	7.4	(10.8)
Predominant symptom, n (%)		
Gait	10	(31.2)
Hyperkinetic movements	10	(31.2)
Dystonia	10	(31.2)
Weakness	2	(6.3)
Multiple movements present, n (%)		
Yes	28	(87.5)
No	4	(12.5)
Paroxysmal, n (%)		
Yes	4	(12.5)
No	28	(87.5)
Sudden onset, n (%)		
Yes	19	(61.3)
No	12	(38.7)
Precipitating factors, n (%)		
Physical	11	(68.8)
Psychological	5	(31.2)
Physical and psychological	2	(11)
History of depression, n (%)		
Yes	26	(81.3)
No	6	(18.8)
History of anxiety, n (%)		
Yes	20	(62.5)
No	12	(37.5)
History of physical abuse, n (%)		
Yes	12	(40.0)
No	18	(60.0)
History of sexual abuse, n (%)		
Yes	14	(46.7)
No	16	(53.3)
PTSD symptoms, n (%)		
Yes	11	(35.5)
No	20	(64.5)

Outcomes

On the CGI-SR, patients rated symptom improvement at discharge and 6-month follow-up (Table 4). Subjective symptomatic improvement was defined as symptoms being "much improved" or "very much improved," whereas "no change," symptoms being "much worse," or "very much worse" were defined as no subjective symptomatic improvement. At discharge, 86.7% of patients reported symptomatic improvement, which was maintained in 69.2% at the 6-month time point. Five patients were lost to follow-up. Self-rated symptom severity at baseline was 5.24 (±1.30) on a 7-point Likert-type scale, with higher numbers indicating more severe symptoms. After the treatment week, symptom severity significantly decreased to 4.56 (±1.33) at discharge and to 4.12 (±1.36) at the 6-month follow-up ($P = .004$). There was a statistically significant reduction of disability in the social life domain of the SDS, but not in work and family life domains. HRQoL measures showed a significant decrease in "mentally unhealthy days" at 6-month follow-up, although general health was unchanged. Self-reported physician visits decreased from 12.42 (±17.88) at baseline to 9.88 (±14.57) in the 6 months following the treatment intervention ($P = .49$); emergency department visits reduced from 2.30 (±8.25) to 1.13 (±2.16) ($P = .38$)

In addition to patient self-rated measures, standardized videos were taken on the first and last day of the MoRe program and rated according to the Psychogenic Movement Disorder Rating Scale. Scores demonstrated a significant decrease from 30.03 (±11.83) at baseline to 12.28 (±9.90) at day 5, ($P < .001$), indicating a 59.1% improvement in abnormal movements and speech patterns. Examples of patient videos before and after treatment are available in supplementary materials (Videos 1–3). Changes in patients' ambulatory status by the end of the treatment week led to significantly less use of gait-assistive devices (Table 5). Independent ambulatory status increased from 59.4% to 87.5%, whereas use of a wheelchair decreased from 21.9% to 3.1% ($P = .05$). Patient age, symptom duration, a history of sexual or physical abuse, and psychiatric comorbidities were not predictive of treatment outcome as defined by a change in CGI-SR. Female gender was associated with significantly better outcomes at the 6-month follow-up (Table 6).

Program Assessment

The MoRe program was very well received by patients and the different treatment components were rated highly. Mean scores for patient-rated benefits from physical, occupational, and speech therapies, psychology, and mental practice training were 9.2, (±1.3), 8.7 (±2.0), and 8.6 (±2.0), respectively, on a 10-point Likert-type scale. Additionally, 96.6% of patients indicated they

Table 4
FMD symptom severity and quality of life measures at baseline and after treatment

	Baseline n = 32		Discharge n = 32		6-mo Follow-up n = 27		
	Mean	(SD)	Mean	(SD)	Mean	(SD)	*P* Value
CGI-SR*							
Symptom Severity‡	5.2	(1.3)	4.6	(1.3)	4.1	(1.4)	.004†
Symptom Improvement§	—	—	2.1	(1.5)	3.0	(1.9)	.04
Total PMD Scale Score (video)‖	30.0	(11.8)	12.3	(9.9)	—	—	<.001
Total Phenomenology Score	17.0	(10.3)	6.0	(6.0)	—	—	—
Total Function Score	13.0	(4.3)	6.3	(4.9)	—	—	—
HRQoL							
General Health¶	3.3	(0.9)	—	—	3.3	(0.9)	>.99
Physically unhealthy days (no. days/mo)	17.0	(12.8)	—	—	16.7	(10.3)	.92
Mentally unhealthy days (no. days/mo)	16.4	(12.5)	—	—	11.2	(10.0)	.03
Activity limitation days (no. days/mo)	19.2	(12.3)	—	—	16.8	(10.4)	.33
HCV**							
Physician visits	12.4	(17.9)	—	—	9.9	(14.6)	.49
ED visits	2.3	(8.3)	—	—	1.1	(2.2)	.38
Overall Well-Being††	29.1	(9.7)	—	—	30.4	(11.4)	.59
SDS‡‡							
Work Impairment	7.6	(3.6)	—	—	6.6	(3.6)	.25
Social Life Impairment	6.9	(2.7)	—	—	5.2	(3.1)	.007
Family Life Impairment	5.9	(3.2)	—	—	5.0	(3.1)	.14

ED, emergency department.
* Clinical Global Impression Scale—Self-Report.
† Reflects significance for test of linear trend.
‡ Score range 1-7. Higher scores indicate greater severity.
§ Score range 1-7. Higher scores indicate less improvement.
‖ Hinson's Psychogenic Movement Disorder Scale: score range 0-128. Higher scores indicate greater severity.
¶ Health Related Quality of Life: score range 1-5. Higher scores indicate poorer health.
** Health Care Visits. Number of visits in the past 6 months.
†† Overall Well-Being Linear Analog Self-Assessment: score range 0-50. Higher scores indicate greater overall well-being.
‡‡ Sheehan Disability Scales: score range 0-10. Higher scores indicate greater impairment.

would elect to repeat the program if given the opportunity and 100% stated that they would recommend the program to other patients with FMD.

Discussion

In this retrospective study, we report the outcomes of 32 patients who underwent a multidisciplinary inpatient rehabilitation program for FMD. The majority of patients experienced symptom improvement at discharge and 6-month follow-up according to both self-reported and physician-rated measures. Improvements in symptom severity and ambulatory status were promising, especially given the long average symptom duration of 7.4 years. In addition to improvements in motor symptoms, patients showed a significant increase in "mentally healthy days" on the HRQoL and social life on the SDS at 6-month follow-up. The lack of significant increase in "physically healthy days" may be confounded by the presence of comorbid disorders, as the measure does not distinguish between symptoms due to FMD versus other medical issues. Work life was not improved at follow-up, which could be due to the long symptom duration and high rate of patients on disability at baseline in our population.

Table 5
Patient mobility changes

	Admission		Discharge		
	n	(%)	n	(%)	*P* Value
Ambulatory	19	(59.4)	28	(87.5)	.05
Cane	3	(9.4)	2	(6.3)	—
Walker	3	(9.4)	1	(3.1)	—
Wheelchair	7	(21.8)	1	(3.1)	—

Left untreated, FMD is often chronic and disabling. Patients with medically unexplained symptoms, including FMD, have consistently been shown to have high levels of health care utilization [43,44]. This places a significant burden on both the patient and the medical system [44-46]. Although we did not find a significant reduction in health care utilization at the 6-month follow-up, the self-report questionnaire we used is susceptible to inaccurate recall and bias. However, because patients with FMD tend to have high levels of health care utilization, it would be valuable for future studies to prospectively examine changes in the use of medical resources after treatment. Successful treatment of FMD is expected to lead to significant cost reductions for health care systems, especially if patients are treated early after diagnosis.

Given the multidisciplinary nature of our treatment intervention, it is difficult to determine which parts of the program were most important in achieving symptom

Table 6
Predictive Factors of Treatment Outcomes

	Clinical Global Impression Scale									
	Discharge					6 Month Follow-up				
	Improvement*		No Improvement*		*P* Value	Improvement*		No Improvement*		*P* Value
Gender, n (%)										
Female	22	(91.6%)	2	(8.3%)	.22	15	(83.3%)	3	(16.7%)	.03
Male	6	(75.0%)	2	(25.0%)	—	3	(37.5%)	5	(62.5%)	—
Age, Mean (SD)	47.8	(13.5)	58.3	(18.0)	.17	47.3	(16.5)	52.4	(13.0)	.45
Symptom duration, n (%)										
<1 y	4	(80.0%)	1	(20.0%)	.44	4	(100.0%)	0	(0.0%)	.47
1-5 y	14	(82.4%)	3	(17.6%)	—	8	(57.1%)	6	(42.9%)	—
>5-10 y	1	(100.0%)	0	(0.0%)	—	1	(100.0%)	0	(0.0%)	—
>10 y	9	(100.0%)	0	(0.0%)	—	5	(71.4%)	2	(28.6%)	—
Abuse history, n (%)										
Yes	14	(87.5%)	2	(12.5%)	>.99	11	(84.6%)	2	(15.4%)	.097
No	12	(85.7%)	2	(14.3%)	—	6	(50.0%)	6	(50.0%)	
Psychiatric History, n (%)					.83					>.99
Anxiety only	1	(100.0%)	0	(0.0%)	—	1	(100.0%)	0	(0.0%)	—
Depression only	6	(85.7%)	1	(14.3%)	—	4	(66.7%)	2	(33.3%)	—
Anxiety and depression	16	(84.2%)	3	(15.8%)	—	10	(66.7%)	5	(33.3%)	—
None	5	(100.0%)	0	(0.0%)	—	3	(75.0%)	1	(25.0%)	—

* Subjective symptomatic improvement was defined as very much improved, much improved, or improved according to the Clinical Global Impression Scale—Self-Report (CGI-SR). No subjective symptomatic improvement was defined as no change, worse, much worse, or very much worse according to the CGI-SR.

improvement. We believe that the principles of motor retraining with a stepwise reintroduction of normal movement patterns and continuous positive reinforcement by the treatment team are crucial to the success of our program. The psychological training sessions are tailored toward identifying provoking factors that may trigger symptoms and places a strong focus on recognizing and improving unhelpful thought and behavioral pattern in FMD patients. Mental imagery has been shown to be helpful for rehabilitation of other neurologic disorders such as stroke [47] and supplements the cognitive-behavioral treatment approach. We cannot exclude that other factors of the intervention, such as increased attention to patients during the hospitalization and separation from the home environment, may also contribute to success.

We were unable to identify factors predictive of treatment outcomes. Although other studies have reported worse prognosis for patients with symptom duration longer than 1 year [7,8,23], we did not find symptom duration to be predictive of outcome. Age, presence of psychiatric comorbidities, and history of abuse were also not predictive of treatment outcome. Female gender was associated with subjective symptomatic improvement at six-month follow-up, but the high proportion of females included in our study may have confounded this result. These findings are encouraging and suggest that FMD patients should be offered participation in intense rehabilitation even in the presence of a chronic symptom course and a history of psychiatric comorbidities. As a caveat, patients with severe untreated psychiatric conditions such as suicidality or active substance abuse were not considered candidates for our program.

Results from this study are comparable to several other inpatient rehabilitation studies of FMD [10,13,24,25], which varied in duration from 3 weeks to over 3 months. The MoRe program stands out by its short duration of only 1 week, structured progression from simple to complex movement patterns, and integration of physical and psychological therapy components. Importantly, the program was very well received by patients. Together, this suggests that short-term multidisciplinary treatment programs for FMD may be amenable for implementation at other rehabilitation centers. This study adds to the growing literature supporting rehabilitation-based interventions for FMDs [48]. Of note, 56.3% of the patients in our study were referred from out of state. This highlights an unmet need for FMD treatment programs at other centers. Given the high prevalence of FMDs primarily affecting patients in their most productive years, optimizing care for this patient population is of crucial importance. We believe that destigmatization of FMDs and the multidisciplinary team approach are important for treatment success.

We acknowledge several limitations of our study. First, our sample size was relatively small and 6-month follow-up data could only be obtained from 84.4% of patients. Furthermore, our study was retrospective and did not include a control group. Prospective studies comparing different treatment modalities with longer follow-up of patients and determination of factors contributing to symptom relapse are important goals for future research. Additionally, the rating of patient videos was done by a physician involved in this study, and this could be a source of bias. Finally, we did not see a significant improvement in health care utilization or physically healthy days. This could be due to a variety

of factors including the self-report measure that did not ask patients to isolate their physician and emergency department visits related to their functional neurologic symptoms. Further, 84.4% of patients had comorbid medical conditions including chronic pain that could affect both of these outcomes. Despite these limitations, our results are encouraging and demonstrate that FMD patients can benefit from admission to a short-term rehabilitation program, even when presenting with longstanding symptoms.

Conclusions

We have shown positive outcomes from a 1-week multidisciplinary inpatient rehabilitation program for FMDs, although with limited statistical significance. The program combines effective rehabilitation strategies with daily psychological treatment sessions and mental imagery training. Treatment benefits were seen in 86.7% of patients and were maintained in 69.2% at 6-month follow-up. Additionally, the program was very well received by patients. There is an urgent need to create more treatment interventions for FMDs and perform prospective treatment outcome studies with larger numbers of patients and longer follow-up periods.

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Video Gallery: To view the online videos, use your smartphone camera QR Reader App to scan and capture this QR Code or visit http://www.pmrjournal.org/article/S1934-1482(18)30245-4/addons.

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Appendix 1

Instructions for Mental Practice

Goal setting: Patient is to pick 1 or 2 activities to practice over the course of the week.

Patient is introduced to Mental Practice by the physical therapist and is guided to perform the training at the beginning of each physical therapy session. Patients may be asked to recall their mental imagery during therapy sessions when abnormal movements reoccur and given encouragement that they will be able to relearn normal movements. Patients are instructed to perform mental practice training on their own every morning right after getting up or while still in bed and every evening before going to sleep.

1. Relaxation (about 3 min)

- Close your eyes
- Imagine you are in a warm and safe place
- Focus on your breath
- Take a deep breath in (pause) and let it all out
- Take another breath in (pause) and let it out
- Make a fist with the right hand (pause) and let it relax
- Make a fist with your left hand (pause) and let it relax
- Circle your right ankle (pause) and let it relax
- Circle your left ankle (pause) and let it relax
- Feel all remaining tension in your body (pause) and let it go

2. Mental Practice (about 5 min)

Guide the patient to imagine performing the goal activity (eg, walking down a corridor or using the hand to drink from a cup) without abnormal movements. Provide great details on how the normal movements are performed and include emotional cues, stating how good it feels to move normally and freely.

3. Refocusing in the room (about 2 min)

- Keep your eyes closed and focus on your breath again
- Take a deep breath in (pause) and let it out
- Notice how calm and relaxed you feel right now
- Open your eyes
- When you feel ready, we will start with the physical part of our therapy today

Appendix 2

Patient Comorbidities

Patient no.	Comorbidity
1	Hyperlipidemia, obstructive sleep apnea, chronic pain
2	—
3	Hypertension
4	—
5	—
6	Diabetes, hypertension, obstructive sleep apnea
7	—
8	—
9	Chronic pain
10	Migraine
11	Hemochromatosis, asthma, esophageal reflux, sinus tachycardia, congenital nystagmus
12	Carpal tunnel syndrome, esophageal reflux, hypothyroidism, osteoarthritis, obstructive sleep apnea
13	Chronic pain
14	Coronary artery disease, diverticulosis, esophageal reflux, hyperlipidemia, hypertension
15	Hypertension, migraine
16	Sickle cell anemia, migraine, restrictive lung disease
17	Migraine
18	IBS, sleep apnea, migraine, hypertension, fibromyalgia
19	Gastroparesis, headache, lower back pain, osteoarthritis, GERD
20	Gastroparesis, kidney transplant, Horner syndrome
21	Malignant melanoma
22	Chronic constipation, fibromyalgia, hypercholesterolemia, chronic pain
23	Arthritis, restless legs syndrome, sleep apnea, esophageal reflux, hypertension
24	Atrial flutter, congestive heart disease, pulmonary hypertension, obstructive sleep apnea
25	Hypertension, hyperlipidemia
26	Diabetes , hypertension
27	Low back pain
28	Addison's disease, fibromyalgia, migraine, chronic pain
29	Hypothyroidism, diabetes, hyperlipidemia
30	Diabetes, headache, hypertension, postconcussive syndrome, peripheral neuropathy, syncope
31	Hyperlipidemia
32	Hearing loss, hepatitis C, esophageal reflux, asthma, headache

GERD, gastric esophageal reflux disease; IBS, irritable bowel syndrome.