

The Benefits of the Rehabilitation Program in Multiple Sclerosis

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Abstract

Background: Multiple sclerosis, characterized by demyelination or loss of myelin sheaths affects the discharge of nerve impulses and the ability of the central nervous system CNS, to transmit commands, resulting in disorders of functions that are directed by the CNS such as: sight, speech, walking, writing and memory. Depending on the location of the demyelination, patients have a wide range of symptoms that differ from person to person and may change as the condition progresses. The most common symptoms are: fatigue, balance and coordination disorders, vision and sensitivity disorders, pain and depression.

Objective: In this study we aimed to demonstrate that the treatment of sclerosis by combining a drug treatment with a rehabilitation treatment, represented by physical therapy and occupational therapy, has superior therapeutic effects compared to simple drug treatment.

Methods: In order to highlight the superior therapeutic efficacy of the mentioned combination, we studied, during one year, two groups of patients: the group that respects the home rehabilitation program and the group that does not respect the home rehabilitation program. In our study, we evaluated the following parameters: number of patients with falls, timed 25-Foot Walk and Multiple Sclerosis Quality of Life-54.

Results: The results of our study highlight the superior therapeutic benefits of drug treatment associated with rehabilitation treatment.

Conclusion: Patients who follow the rehabilitation program associated with drug treatment we found the following benefits: improving body stability; increase in muscle strength in the lower limbs; improving coordination and balance while walking; improving the QoL.

Keywords: Multiple sclerosis; Rehabilitation treatment; Physical therapy; Demyelination

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Introduction

Multiple sclerosis –MS, is a progressive and disabling suffering of the central nervous system-CNS and which morphologically characterized by damage of the myelin sheath [1]. It is probable that the most common disabling neurological disease in young people (20-40 years), mostly female, occurs via a mechanism of autoimmunity, with myelin - the lipoprotein sheath that surrounds and isolates the axons - being the target of the immune attack [2]. The complexity of the specific clinical picture influences even in the early stages of the disease the quality of life of patients

diagnosed with MS, the performance of ADLs (Activities of daily living) and their involvement in specific professional activities [3], respectively. In conclusion, the axonal brain lesions, their demyelination, respectively, trigger and contribute to the disability progress starting with the incipient phases of the disease [4]. Formation and/or development of typical white substance morpho-pathological lesions which are best visualized by magnetic resonance imaging, along with the occurrence of clinical recurrences is used to estimate the activity of the disease [5]. Mainly, due to the following three aspects: diverse and variable symptomatology, increased frequency in young

people and lack of curative treatment, MS is a very severe and complicated medical condition. The disease has a pronounced socio-economic impact due to limited access and barriers in diagnosis management and necessary treatments, notably in countries in process of economic development [6].

The focus of the rehabilitation in MS is mainly on teaching patients to compensate for their physical deficiencies. Thus, expert studies show that regular aerobic exercises (30min/3x/week) can improve both the walking ability (spatiotemporal walking parameters) and physical endurance in people with MS but without severe gait impairment [7]. Partaking in physical activity, especially training in aerobics, slows the disease progression: reduces fatigue, decreases depression, improves mobility and improves the quality of life - QoL. In order to improve balance and poise, patients may join a specific exercise programme, CoDuSe, which helps patients with MS to gain more independence and improves their ability to perform ADLs [8].

The rehabilitation when diagnosed with MS involves an interdisciplinary team, which has a mandatory component and a variable component, depending on patient's symptoms.

Therefore the interdisciplinary team can include: family doctor, neurologist, urologist, rehabilitation doctor, psychologist, nurse, physiotherapist, occupational therapist, speech therapist and kinesiologist [9]. The rehabilitation team works with patients and their family on physical and psychosocial aspects in order to promote a superior QoL [10]. Benefits of the rehabilitation treatment depend on the functional stage of the pathology, on the degree of existing disabilities, respectively. Therefore, the lower are the patients' levels of disability, the clearer the benefits of the rehabilitation treatment; thus their QoL increases [11]. Life quality, depends on maximizing their health, maintenance of social relationships and professional integration appropriate to their health status. Physical therapy -PT, is effective in improving aerobic capacity, muscle strength, mobility amelioration and life quality [12].

The main purpose of this study was to highlight the effectiveness of the rehabilitation program in the treatment of patients with MS. Early detection of the disease and its correlation with appropriate drug treatment with an adequate rehabilitation treatment is followed by an increase in the QoL of the patient with MS [13]. In this study, our purpose was to show that treating sclerosis by combining a drug treatment with a rehabilitation treatment, namely PT and occupational therapy - OT, for one year, results in superior therapeutic effects as compared to a simple drug treatment carried out over the same time period.

Materials and Methods

A number of 63 patients who underwent specialized treatment in the Multiple Sclerosis Center, Oradea, and who agreed to take part in this study were selected based on subjective and objective anamnestic criteria. Our study ran for two years, between 2017 and 2019. All patients partaking in our study were administered a drug treatment (since the disease was diagnosed) and rehabilitation treatment (since each subject joined the study)

that included, for the most part, PT and according to the needs, OT activities. All subjects of the study underwent an 8 week recovery treatment, comprising at least 3 sessions of PT and OT. Subsequent to this period, each subject was recommended to continue the rehabilitation treatment at home; each patient was to be evaluated both during the study and upon its completion or after 1 year.

Criteria for inclusion in the clinical trial: confirmed multiple sclerosis diagnosis, patients's written acceptance to take part in this study, undergoing rehabilitation treatment in the Multiple Sclerosis Center – Oradea, observance of the recommended drug and recovery treatments during the study and observance of the monitored parameters assessment. Exclusion criteria from the clinical trial: patients' refusal to partake in or to continue the study, alteration of patient's general condition during the study, regardless of the cause that determined this aspect, any kind of neoplasms, disabling comorbidities, mental illness.

The drug treatment, tailored according to the stage of the disease and patient's compliance consisted of:

- **Treatments that modify the evolution of the disease:** Immunomodulatory drugs, immunosuppressants;
- **Pain-flare treatment:** Glucocorticoids, are the major indication for the treatment in case of relapse in any clinical-evolutionary form of SM;
- **Symptomatic treatment:** Adapted and individualized according to needs.

OT concerns all patient's ADL, its purpose being to keep the patient engaged in social activities and independently, in self-care activities, for as long as possible; there are expert studies confirming the benefits of OT: the occupational therapists possess the knowledge and the necessary skills to help patients with MS manage their functional deficiencies, maintain the highest possible functional level and thus, be involved in achieving a superior way of living [14,15].

When it comes to MS the PT program: must be individualized and tailored to each patient's functional stage and must consider patient's age, sex and degree of dependence and the goal is to improve these patients' QoL. When applied in cases of patients with MS, PT it improves not only their physical capacity, but also their mood. It has been shown that an improved cardiorespiratory function also improves cerebrovascular function which evinces that PT significantly improves the brain function in these patients [16].

One feature in what concerns the patients with sclerosis is that the PT program, the specific activities of OT as well as the drug treatment should not be interrupted. The patient should continue to follow the program throughout his/her life.

Due to subjective reasons of medical discipline, none of the patients in the study was recommended to observe the rehabilitation treatment (PT and the TO activities) at home. Dependent on this aspect, the subjects of our study were divided into two groups:

1. The group that observes the home rehabilitation program - study lot, consists of 31 subjects, of which 1 patient showed an alteration of the overall state (dizziness and lipothymia) after 4 months reason for which the patient was excluded from the study; there are 30 patients left;
2. The group that does not observe the home rehabilitation program - control group, initially comprises of 32 subjects, of which 2 refused to continue the treatment and so remained 30 patients.
3. To stress the superior therapeutic efficacy of the association drug treatment – rehabilitation program as compared to the simple drug treatment in treating MS, we followed, in the two groups of the study, the evolution of the following parameters over one year period:
4. **Number of patients with falls:** objective parameter monitored by counting the patients who fell during the study; the evaluation was performed after 3 and 6 months following the commencement of the study and also at the end, after 1 year from the initiation of the study;
5. **Timed 25-Foot Walk:** objective parameter that represents a quantitative functional test to assess lower-limb mobility and functional performance and which basically, consists in timing patient's walking over a 25 foot distance (approximately 7.62 meters) [17]; the patient is instructed to perform the test as quickly and as safely as possible (the use of assistive devices: sticks, crutches etc. is permitted); the assessment was done before the commencement of the study and at the end, after 1 year from the initiation of the study;
6. **Multiple Sclerosis Quality of Life-54 (MSQOL-54):** subjective parameter that specifically assesses the quality of life in patients with multiple sclerosis [18]; this scale was designed based on the SF 36 scale, (Short Form Health Survey Questionnaire with 36 items) to which 18 elements were added in order to address specific MS problems; this is a 54 question assessment tool that generates 12 subscales (physical health, role of limitations consistent with physical and emotional problems, pain, cognitive function, emotional well-being, energy, health perception, social function, health concern, sexual function, overall quality of life) and two additional singular items (satisfaction with the sexual function and alteration of the health status); the assessment was done before and at the end of the study.

Statistical Analysis

Data processing was carried out by using the SPSS 20 program. The Student method (test-t) and 2 were used to calculate average parameter values, frequency ranges, standard deviations, statistical significance tests. For average comparison, ANOVA (Bonferroni) was used and the statistical significance level was 0.05. The statistical indicator "sensitivity to change" was also used and it was assessed by calculating the "effect size" - ES. The sensitivity to change can be assessed within various types of clinical research or long-term observational studies. In order to measure the sensitivity to change, we used the "effect size" (ES) statistical calculation system.

ES is a method that standardizes the magnitude of a change of a variable over a period of time. This represents the average change for a variable expressed in standard deviation units and permits the comparison of one variable's change values in a study. Equally, ES can be used to compare the same variables between different studies.

The calculation formula for ES is the following:

$$ES = (m1-m2)/s1,$$

where: ES = Effect size

m1 – The value of the initial score average

m2 – The value of the average score after a specific period

s1 – The standard deviation value of the initial score

The interpretation is <0.2 = unimportant change, 0.2 – 0.49 = minor change, 0.5 – 0.8 = moderate change, 0.8 sau >=major change

Results

The descriptive statistical analysis of the two studied groups and highlighted in **Table 1**, accentuates the following: 71.6% women and 28.3% men, 88.3% of the study subjects come from urban areas while the remaining 11.6% from rural environment. The average age was 41.87 ± 9.62 (min. 21/max. 64), with a mean BMI of 25.54 ± 3.94 (min. 18.2/max.34.2), with a condition duration averaging to 17.88 ± 14.66 (min. value 1/max. value 58). **Table 1** shows the characteristics of the entire batch of subjects.

For the description of the features of the two groups, the following parameters were taken into account: sex, age, origin, body mass index (BMI) and the time interval: diagnosis - recovery treatment initiation (**Table 2**). In terms of features, there are no significant differences between the two lots ($p > 0.05$).

Comparing the characteristics of the two groups, as highlighted in **Table 2**, one notices that there are no significant differences between the two lots, as they are homogeneous study batches which also allow their comparison and the intergroup analysis.

In what concerns inferential statistical analysis, an important parameter in assessing the rehabilitation treatment effectiveness is the number of patients with falls, therefore this parameter was assessed after 3, 6 and 12 months (**Table 3**).

Table 1 Subject characteristics (60 subjects).

No.	Subject characteristics	Average \pm SD	Min.	Max.
1	Age (years)	41.87 ± 9.62	21	64
2	BMI (kg/m ²)	25.54 ± 3.94	18.2	34.2
3	Condition duration (months)	17.88 ± 14.66	1	58
4	Sex	No./ Percentage %: 60/100%	Women: 43/71.6%	Men: 17/28.3%
5	Origin	No./ Percentage %: 60/100%	Urban: 53 /88.3%	Rural: 7/11.6%

Table 2 Batch characteristics.

Subject characteristics		Average ± SD	p-value
Age (years)	Control batch (min-max: 21-64)	41.93 ± 9.68	0.859
	Experimental batch (min-max: 24-60)	41.80 ± 9.73	
Sex	Control batch	F/B: 73.3%/26.6%	0.779
	Experimental batch	F/B: 70.0%/30.0%	
Origin	Control batch	U/R: 86.6%/13.3%	0.685
	Experimental batch	U/R: 90.0%/10.0%	
BMI (kg/m ²)	Control batch (min-max: 18.2-33.6)	25.35 ± 3.92	0.706
	Experimental batch (min-max: 18.8-34.2)	25.74 ± 4.04	
Duration of the condition (months)	Control batch (min-max: 1-58)	18.17 ± 14.78	0.882
	Experimental batch (min-max: 1-50)	17.60 ± 14.79	

Table 3 The evolution of number of patients with falls.

Evaluation	Number patients with falls		Patients with sole fall		Patients with multiple falls	
	No.	%	No.	%	No.	%
Study lot						
0-3 months	13	43.33	9	30.00	4	13.33
3-6 months	10	33.33	8	26.67	2	6.67
6-12 months	4	13.33	4	13.33	0	0.00
0-12 months	13	43.33	3	10.00	10	33.33
Control lot						
0-3 months	13	43.33	7	23.33	6	20.00
3-6 months	13	43.33	8	26.67	5	16.67
6-12 months	17	56.67	12	40.00	5	16.67
0-12 months	17	56.67	4	13.33	13	43.33

During the first 3 months, falls were recorded in 43.33% of the patients, in both batches. Compared to the control batch, in the study batch multiple falls were insignificantly less frequent (13.33% vs 20.00%, $p = 0.492$). During the next 3 months (3-6 months) falls were recorded in 33.33% of the patients in the study batch, an insignificantly lower percentage than in the control batch (43.33%, $p = 0.430$). The assessment of the 6-12 month period showed that in the study batch the patients' falls recorded reached a 13.33% percentage, a significantly lower percentage than for the control batch (66.67%, $p < 0.001$). During this period, patients in the study batch suffered only sole fall, as recorded, while in the control batch multiple falls represented 16.67%.

We notice the that the fall incidence in the study batch followed a downward trend between assessments (43.33% after 3 months - 13.33% after 12 months), while in the control batch an upward trend was visible (43.33% after 3 months - 56.67% after 12 months). As compared to the 3-month assessment, there wasn't any fall recorded for 9 patients in the study batch, while in the control batch 4 patients were recorded to have suffered falls.

In both batches, the average falls rate decreased from one assessment to another (**Table 4**). Regardless of the evaluation, the falls average in the study batch was lower than in the control batch: 1.38 vs 1.46, $p = 0.696$ after 0-3 months; 1.20 vs. 1.38, $p = 0.311$ after 3-6 months; 1.00 vs 1.35, $p = 0.186$ after 6-12 months.

In the study lot, the 3-6 month assessment recorded a minor effect of the treatment ($ES = 0.34$) as compared to the 0-3 month

assessment, and in the next 6 months the effect became moderate ($ES = 0.63$). This leads to the conclusion that compliance with the rehabilitation treatment, both in terms of its performance and duration, has a positive impact on the stability in patients with MS, which, in turn, leads to a lower number of falls accompanied by fracture and trauma risks. When compared, the treatment effect was minimal in the control lot, for the 0-3 month vs. 3-6 month assessment as well as for the following 6 month assessment: ($ES = 0.16$, respectively $ES = 0.06$).

Assessment of the Timed 25-Food Walk test (**Table 5**) revealed that there were not noticed any significant differences between the study lot and the control lot in terms of the initial time required to complete the 25 steps (7.060 vs 7.003, $p = 0.809$). However, after 12 months, the difference became significant (6,133 vs. 6,757, $p = 0.002$).

Regarding the study lot, the time required for the patients to walk that distance decreased significantly (from 7,060 to 6,133, $p < 0.001$) as compared to the control lot where the decrease was insignificant (from 7,003 to 6,757, $p = 0.250$). In terms of treatment's effect on the walking time, the study lot obtained very good results ($ES = 0.98$) while the control lot's score was low ($ES = 0.29$).

As to the quality of life - MSQOL-54 and in what concerns the final score and its subscales, one notices there are not any significant differences ($p > 0.05$) between the two studied batches (**Table 6**) according to the intergroup analysis of the initial assessments of

Table 4 Average falls.

Assessment	Study lot		Control lot		p
	(min-max)	Md+SD	(min-max)	Md+SD	
0-3 months	1-3	1.38 ± 0.53	1-2	1.46 ± 0.50	0.696
3-6 months	1-2	1.20 ± 0.32	1-2	1.38 ± 0.47	0.311
ES	0.34			0.16	
6-12 months	1-1	1.00 ± 0.00	1-3	1.35 ± 0.50	0.186
ES	0.63			0.06	
0-12 months	1-6	2.62 ± 1.04	1-7	3.53 ± 1.63	0.096

Table 5 Timed 25-Foot Walk.

Assessment time	Study lot	Control lot	p
Initial	7.060 ± 0.942	7.003 ± 0.863	0.809
After 12 months	6.133 ± 0.675	6.757 ± .832	0.002
ES - treatment effect	0.98	0.29	

Table 6 Quality of life - MSQOL-54.

MSQOL score	Study lot	Control lot	p
	Initial		
	55.73 ± 9.11	56.07 ± 7.26	0.874
MSQOL-54 subscales influenced during study			
Physical health	54.50 ± 11.62	55.83 ± 12.67	0.673
Role limitation - physical problems	47.50 ± 13.69	46.67 ± 15.72	0.828
Sexual function	51.33 ± 9.37	50.27 ± 9.02	0.657
Pain intensity	61.77 ± 10.44	59.17 ± 9.37	0.314
Health alteration	42.50 ± 11.65	41.67 ± 11.99	0.787
Sexual function satisfaction	40.83 ± 12.25	38.33 ± 12.69	0.441
After 12 months			
MSQOL score	69.30 ± 9.44	67.80 ± 8.26	0.515
MSQOL-54 subscales influenced during study			
Physical health	68.50 ± 9.93	61.17 ± 11.04	0.009
Role limitation - physical problems	60.83 ± 15.52	52.50 ± 16.54	0.049
Sexual function	62.70 ± 9.55	55.50 ± 8.49	0.001
Pain intensity	74.23 ± 12.02	64.77 ± 8.39	0.001
Health alteration	64.17 ± 16.97	54.17 ± 4.80	0.018
Sexual function satisfaction	57.50 ± 17.56	48.33 ± 17.29	0.046

the subjects from the two studied batches. In evolution, at the end of study, in the control lot, the rehabilitation program there was a statistically significant improvement of the initial results but only on certain MSQOL-54 subscales: physical health, role limitation - physical problems, sexual function, pain intensity, health alteration, sexual function satisfaction.

There were not obtained any significant changes of the initial results on the other subscales. The final evaluation saw the MSQOL score significantly increased in both lots, without a significant difference between them (p = 0.515). In the control group, there was not any statistically significant improvement of the initial results of any of the MSQOL-54 subscales. The effect of the treatment on the quality of life of the patients (Table 7) in the two batches studied was a major one (ES = 1.44- control batch, ES = 1.62- study batch).

The effect of the treatment on the subscales influenced by the study was a major one in the study lot (ES > 0.80); the highest

was noticed in the health change item (ES = 1.86) and the lowest in the role limitation - physical problems item (ES = 0.97). As to the effect of the treatment in the control lot, this was substantial in the case of the health alteration item (ES = 1.04), moderate in the case of sexual function (ES = 0.58), pain intensity (ES = 0.60) and satisfaction sexual function item (ES = 0.79) and low in the case of physical health (ES = 0.42) and limitation of role-physical problems items (ES = 0.37).

Discussion

By comparatively assessing the two studied lots in terms of the patients with falls, it was noticed that during the first 3 months there were not any significant changes between them. In the 3-6 month interval a decrease of subjects having fall once (23%) or several times (60%) was noticed, in the study group. The difference between the two lots is even clearer for the 6-12 month interval. Thus, it ensures that the results of the rehabilitation program determined an obvious decrease of falls in

Table 7 The effect of the treatment on the quality of life.

MSQOL score	Study lot	Control lot
	1.62	1.44
MSQOL-54 Subscales influenced during study		
Physical health	1.03	0.42
Role limitation - physical problems	0.97	0.37
Sexual function	1.21	0.58
Pain intensity	1.19	0.60
Health alteration	1.86	1.04
Sexual function satisfaction	1.36	0.79

these subjects. According to the results of our study, confirmed by expert studies [19,20], a regular PT program associated with specific OT activities to increase stability and with appropriate drug treatment, over a period of about 6 months leads to an improvement in stability along with a consecutive decrease in the relapse number. According to Carling [21] partaking in the CoDuSe program was perceived to facilitate daily life among people with MS.

A comparison of the evolution of the initial/final results for the two studied lots shows clearly the favorable impact of the rehabilitation program regarding the decrease of the time required to perform the 25FW test. These results are also correlated with data from the literature [22,23] and stress the beneficial effects of specific PT exercises on stability, muscle strength, and locomotion/gait of the patient with MS.

Considering the QoL, by comparatively assessing the results obtained by the two lots, one notices the positive impact the rehabilitation program had on the QoL of patients with MS. This aspect is also confirmed by results obtained during other expert studies [24,25]. Hence, it ensures that PT exercises improve the QoL of the patients with MS. In assessing the impact on QoL in patients with MS, however, some particular aspects must be considered. Thereby, an inverse relationship was proven in patients with MS between QoL and cognitive function. Patients with MS and with a significantly impaired cognitive function tend to have a narrow perspective on their general condition, which can, in turn, lead to a better perception of QoL. Conversely,

patients with a normal cognitive function reported the highest levels of depression and the lowest levels of QoL.

Depression is one of the most common symptoms of MS [26]. The negative impact of depression on QoL has been demonstrated by expert studies [27]. The depressed patients will provide a higher negative assessment of their general state than those who are not depressed, regardless of the pathology MS stage. Thus it inevitably ensues that there is a certain overlapping between low mood ratings and QoL. All these aspects lead us to assert that for a more accurate assessment of the QoL of patients with MS a specific and detailed assessment of cognitive function and depression of these patients is required.

Conclusion

The results of our study reflect the benefits of the rehabilitation program in patients with MS, so in patients who follow the rehabilitation program associated with drug treatment we found the following benefits:

- Improving body stability
- Increase in muscle strength in the lower limbs
- Improving coordination and balance while walking
- Improving the QoL

In particular, it should be noted that patients with significantly impaired cognitive function tend to have a better perception of QoL, while patients with normal cognitive function have a lower level of QoL.

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