Impact of physical therapy on multiple sclerosis patients

Impacto de la terapia física en pacientes con esclerosis múltiple

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Abstract

Background: *Multiple sclerosis is the leading cause of non-traumatic disability in young adults in Mexico. The implementation of physical therapy improves the functionality, neurological symptomatology, and quality of life of these patients.* **Objective:** *The objective is to determine the effects of the implementation of physical therapy in patients with multiple sclerosis to improve their quality of life.* **Material and methods:** *Observational study in patients with relapsing remitting multiple sclerosis. Patients were assessed for disability and fatigue before and after an intervention: physical therapy, using the Expanded Disability Status Scale and the Modified Fatigue Impact Scale. Mann-Whitney U and paired t-tests were used.* **Results:** *There were 11 patients, 7 (64%) female and 4 (36%) male. Time elapsed from the start of physical therapy to diagnosis, mean 38.27, + 54.02 days. Physical therapy before intervention had a value of 1.95, and after intervention 1.68, p = 0.001.* **Conclusions:** *Physical therapy improves functionality and degree of fatigue in patients with multiple sclerosis compared to those who did not receive physical therapy.*

Keywords: Multiple sclerosis. Physical therapy. Neurological. Rehabilitation.

Resumen

Antecedentes: *La esclerosis múltiple es la causa principal de discapacidad no traumática en adultos jóvenes en México. La implementación de terapia física mejora la funcionalidad, sintomatología neurológica y calidad de vida de estos pacientes.* **Objetivo:** *Conocer los efectos de la implementación de terapia física en los pacientes con escelrosis múltiple para mejorar su calidad de vida.* **Material y métodos:** *Estudio observacional en pacientes con esclerosis múltiple remitente recurrente. Se les evaluó la discapacidad y grado de fatiga antes y después de una intervención: terapia física, utilizando la Escala Expandida del Estado de Discapacidad y la Escala Modificada del Impacto de la Fatiga. Se utilizaron los tests de U de Mann-Whitney y t pareada.* **Resultados:** *Fueron 11 pacientes, 7 (64%) mujeres y 4 (36%) hombres. Tiempo transcurrido desde el inicio de la terapia física hasta el diagnóstico, media 38.27, + 54.02 días. La terapia física antes de la intervención tuvo un valor de 1.95, y después de la intervención 1.68, p = 0.001.* **Conclusiones:** *La terapia física mejora la funcionalidad y grado de fatiga en pacientes con esclerosis múltiple comparados con los que no recibieron terapia física.*

Palabras clave: Esclerosis múltiple. Terapia física. Neurológico. Rehabilitación.

Introduction

Multiple sclerosis is a very common chronic, predominantly immune-mediated disease that damages the central nervous system[1,2] in which demyelination, gliosis, and neuronal loss (the main determinant of irreversible disability) are observed. Over time, it can lead to deterioration or permanent damage to nerve fibers[3-7]. At the beginning of the disease, it is usually relapsing-remitting, characterized by episodes of neurological dysfunction interspersed with periods of stability. However, people will develop secondary progressive disease over time; between six and ten years after onset[8-12]. It is classified into 7 categories, which are relapsing-remitting, primary progressive, secondary progressive, progressive relapsing, and occasionally isolated syndrome, fulminant, and benign are considered[13-17]. It is one of the most frequent causes of neurological disability in young adults worldwide[18-20]. The incidence and prevalence have been increasing, and the age of onset is broad, but most common between 20 and 40 years. The cause is uncertain but results from an environmental stimulus in genetically susceptible individuals[21-24].

The signs and symptoms of multiple sclerosis vary according to the severity of the nerve fiber damage[25-27]. Symptoms include fatigue (the main symptom in two-thirds of people), cognitive problems, spasticity, bowel problems, ataxia/tremor, visual problems, pain, depression, anxiety, unstable gait, and lack of coordination[28-32].

Diagnosis is established with diagnostic scales (expanded disability status scale; which with a score of 0-10 stratifies patients with sclerosis and altered sensory function to different degrees. The modified fatigue impact scale; consists of 21 questions with 4 options with a value of 1-4 points depending on the impact that fatigue has on the daily lives of patients, classifying them as normal (4-20 points); mild (21-41 points); moderate (42-80 points); and severe (80-84 points). Clinical markers, imaging, and laboratory studies are also used in the evaluation of patients, which facilitates the timely treatment of the disease[33-35]. The McDonald criteria are used to make an early diagnosis and help determine if patients have an objective clinical lesion (Table 1).

Treatment is aimed at controlling symptoms and improving motor functionality through monoclonal immunomodulators that specifically bind to the CD20 antigen of B lymphocytes, inducing cell death through apoptosis and preventing relapses, thereby delaying the progression of the disease[35-38].

Table 1. McDonald criteria 2017

Clinical scenario	Findings
≥ 2 attacks (relapses) and ≥ 2 objective clinical lesions	Sufficient evidence (although additional evidence is desirable)
≥ 2 attacks (relapses) and 1 objective clinical lesion	Spatial dissemination demonstrated by MRI or CSF. A future clinical attack affecting a different site
1 attack (relapse) and ≥ 2 objective clinical lesions	Temporal dissemination demonstrated by MRI or a subsequent clinical attack
1 attack (relapse) and 1 objective clinical lesion	Spatial dissemination demonstrated by MRI or CSF. A future clinical attack affecting a different site and temporal dissemination demonstrated by MRI or a subsequent clinical attack

MRI: magnetic resonance imaging; CSF: cerebrospinal fluid.

Physical rehabilitation therapy is individually adapted according to the patient's needs (before and after receiving the diagnosis, during a relapse, progressive multiple sclerosis, and advanced multiple sclerosis) and likewise determines whether physical therapy will be carried out in a hospital, outpatient, or at home. It consists of standing hip extension with support (30 seconds rest between each set, 3 sets of 12 repetitions), kayak paddles with a bar (grab a stick and act as if you are paddling to one side and the other, with your knees slightly bent), step-ups (step up onto a step or box one leg at a time, start the climb with one leg, 30 s rest between sets), boxing shadow (walk down the hallway throwing punches forward for 60 s), hip abduction with chair support (3 sets of 12 repetitions each leg, 30 s rest between sets), alternating hip flexion towards the opposite elbow (touching the opposite knee with the elbow and alternating sides with each step for 60 s), knee lifts or skipping (raising the knees at a steady pace for 60 s), standing heel raises with support (3 sets of 12 repetitions supported by a chair, 30 s rest between sets), walking (steady pace and moving the arms energetically for 120 s). The main objectives of physical therapy are to restore motor function and improve range of motion, as well as gait pattern, preventing neurological symptoms from developing more aggressively and a possible relapse[35-38].

This study aims to determine the impact of individualized physical therapy in patients with multiple sclerosis in a tertiary care hospital.

Table 2. EDSS score results before and after treatment in patients included in the study

Time	Mean	Standard deviation	Standard error	n	p*
Before	1.9545	0.7568	0.2282	11	0.00001
After	1.8182	0.6431	0.1939	11	
Difference	−0.1364	0.2335	0.0704	11	

*Mann-Whitney U test. n: sample size; p: probability; EDSS: Expanded Disability Status Scale.

Table 3. Mean MFIS results before and after treatment in patients included in the study

Time	Mean	Standard deviation	Standard error	n	p*
Before therapy	55.7273	12.362	3.7273	11	0.00001
After therapy	47.0909	13.4719	4.0619	11	
Difference	-8.6364	8.3579	2.52	11	

*Mann-Whitney U test. n: sample size; p: probability; EMIF: Modified Fatigue Impact Scale.

Material and methods

We conducted a descriptive study from February 2024 through July 2024. Patients of both sexes, older than 18 years, with relapsing-remitting multiple sclerosis with a Denver developmental screening test score of < 4 and complete medical records were included. The modified fatigue impact scale questionnaire, which consists of 21 questions with a value of 1-4 points depending on the impact of daily fatigue and classifying them accordingly, was used, such that obtaining a lower score means a better prognosis.

Longitudinal follow-up was conducted during physical therapy for their evaluation, adapting the plan of 10 physical therapy sessions in order to maintain range of motion and improve muscle strength.

For statistical analysis, the Mann-Whitney U and paired t tests were used using the Statistical Package for the Social Sciences (SPSS) version 25 for Windows. Measures of central tendency and dispersion were used. At no time was the well-being of the participants in this study put at risk in accordance with the Declaration of Helsinki. This study was submitted for approval by the Research and Ethics Committee of the participating medical unit. The results were used for scientific purposes, and the anonymity of the participating patients was preserved at all times.

Results

A total of 11 patients with relapsing-remitting multiple sclerosis were included. The mean age was 36.09, median 34, (± 7.89) years. Regarding sex, 7 (64%) were women and 4 (36%) were men. The time elapsed from the diagnosis of the disease to the start of physical therapy had a mean of 38.27, minimum 6, maximum 8, median 12 (± 54.02) days.

The treatment of patients was based on the use of 3 immunomodulators, Rituximab 5 (46%), Natalizumab 2 (18%), and Interferon 4 (36%). Regarding the score obtained on the expanded disability status scale, the symptoms before physical therapy had an average of 1.95 (± 0.75), and after therapy with an average of 1.81 (± 0.64) (Table 2).

The relationship between the average modified fatigue impact scale score before therapy had an average of 55.72 (± 12.36) and after therapy, an average of 47.09 (± 13.47) was obtained (Table 3).

When linking the expanded disability status scale with the time of physical therapy in patients with multiple sclerosis using the non-parametric Mann-Whitney U test, a p < 0.00001 and a t of 9.21 were observed (Table 3).

Regarding the relationship of the modified fatigue impact scale, a p = 0.00001 and a calculated t value of 9.21 were obtained using the Mann-Whitney U test (Table 3).

Discussion

Autoimmune demyelinating multiple sclerosis has an incidence of 2.1:100,000 patients globally[39-41]. Physical therapy intervention helps improve functionality and

neurological symptoms[42]. This study presents physical therapy as an important pillar in the management of patients with this disease[43].

A mean age of 36.09 years (± 7.892) was obtained. Walton and McGinley report that the mean age of diagnosis is 32 years, consistent with our study group[44].

The most prevalent gender is female with 64%. Zolfaghari-Baghbadorani et al. report that this disease is 3 times more common in the female gender, which coincides with most studies where we find a higher prevalence in the female gender of autoimmune diseases[45].

The time of onset of the disease had a mean of 38.27, median of 12, and (± 54.02). Parsaei et al. mention in the journal Nature in 2018 that the age of onset is between 20 and 40 years, which coincides with the age range of diagnosis for the patients in this study[46].

The most used disease-modifying therapy is Rituximab (46% of cases). This is an anti-CD20 monoclonal antibody that has reduced efficacy in progressive disease compared to relapsing-remitting multiple sclerosis, which is important since the patients in the study meet the criteria for this type of multiple sclerosis.

The improvement of the disease in functionality was evaluated with the expanded disability status scale using a paired parametric t-test before and after treatment with a $p = 0.816$ (± 8.35), which was not significant. Diego et al. report that physical rehabilitation is well tolerated, effective in improving muscle function and physical fitness to improve balance, gait, and functional movements of the upper extremities. The modified fatigue impact scale questionnaire was applied with a paired parametric t-test, finding a $p = 0.0065$, which was significant[47]. Asano et al. observed that rehabilitation interventions indicate a significant in reducing the impact and severity of fatigue reported by patients compared to drugs, thus supporting the result[14,48]. The disability status was evaluated with the expanded scale, obtaining a significant time ($p = 0.00001$), with a calculated t of 27.83, which is relevant for physical therapy. Feng et al. mention that studies in animal models of multiple sclerosis indicate that physical exercise improves the main manifestations of the disease, acting as a pro-myelinating and immunomodulatory therapy[49].

The modified fatigue impact scale was assessed with the non-parametric Mann-Whitney U test ($p = 0.00001$). Hvid et al. demonstrated that rehabilitation interventions have effects on reducing the impact or severity of fatigue reported by the patient compared to medication, being significant and similar when compared with the results of our study[50]. It is concluded that the study gives favorable results for the use of physical therapy in patients with an expanded disability status scale of less than or equal to 4 to reduce fatigue, improve their functionality, and consequently have a favorable impact on their quality of life.

Conclusions

There is improvement in motor functionality, including functional movements of the extremities, and in reported fatigue after the use of physical therapy, compared to those who did not receive physical therapy in patients with multiple sclerosis. Therefore, the application of scales in functionality with clinical improvement and the early initiation of physical therapy are recommended.

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical considerations

Protection of people and animals. The authors declare that no experiments 1 on humans or animals have been carried out for this research.

Confidentiality, informed consent, and ethical approval. The study does not involve personal data of patients, nor does it require ethical approval. The SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The authors declare that they did not use any type of generative artificial intelligence for the writing of this manuscript.

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