Pilates Method in Patients with Multiple Sclerosis

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Multiple sclerosis (MS) is a chronic autoimmune and inflammatory neurological disease that affects the myelinated axons in the central nervous system, characterized by neurological deterioration over time. The Pilates Method is a rehabilitation tool with verified benefits in pain management, physical function, and quality of life in many different physiotherapy areas. It could be beneficial for patients with multiple sclerosis (pwMS).

multiple sclerosis | pilates-based exercise | exercise therapy | neurorehabilitation | physical therapy modalities

1. Introduction

Multiple sclerosis(MS) is the most common non-traumatic disabling disease in young adults [1]. It usually starts in early adult life, typically in the third decade [2], with most patients presenting with periodic neurological relapses [3], but the disease course is unpredictable [4].

MS is one of the most common diseases of the central nervous system (2.2 million people worldwide in 2016 data) [3]. MS cases are twice as high in women as in men [5], and it is more prevalent in North America, Western Europe, and Australasia [3].

MS shows several patterns: 80% of all cases are “relapsing-remitting” MS (RRMS), characterized by exacerbations and remissions, which can turn into “secondary-progressive” MS (SPMS), with progressive disability between attacks; 15% are cases of “primary-progressive” MS (PPMS), where there is a progressive disability from the beginning; and 5% are “progressive-relapsing” MS (PRMS), where the disease worsens gradually, but also presents outbreaks [4]. However, Lublin et al. [6] recommended reviewing these descriptions of the clinical course or phenotype of MS in 2014, suggested defining phenotypes based on disease activity (based on clinical relapse rate and imaging findings) and disease progression, and recommended removing the PRMS phenotype.

MS is characterized by a wide spectrum of symptoms, including cognitive dysfunction, optic neuritis, diplopia, sensory loss, muscle weakness, gait ataxia, loss of bladder control, spasticity, and excessive fatigue [5][3][7]. In addition, patients with multiple sclerosis (pwMS) present high risk of falling (fall rate of 56%) [8].

Physical exercise has been postulated as one of the non-pharmacological strategies of interest, due to its low cost and positive effects on the physical and mental health of the MS population [9][10][11]. Although historically, exercise was not recommended for pwMS due to fear of aggravating the disease [12], current evidence indicates that physical exercise is positive for managing symptoms, restoring function, optimizing quality of life, and facilitating activities of daily living [13][14][15][16][17][18]. Tallner et al. [19] and Pilutti et al. [20] suggest that physical activity has no significant influence on clinical disease activity.

Pilates is a method of physical exercise that focuses on core stability, strength, flexibility, posture, muscle control, breathing, and mind–body connection [21]. Nowadays, the method is an accepted rehabilitation tool, with verified benefits in pain management, physical function, and quality of life when used as an intervention in many different physiotherapy areas [22][23]. This therapeutic modality of the Pilates Method could provide improvement of functional impairment to pwMS.

2. Pilates Method in Patients with Multiple Sclerosis

The purpose of this review was to identify the possible therapeutic effects of Pilates for pwMS. These were the main variables studied, as well as the influence of Pilates on each of them.

2.1. Balance

Balance was studied in 14 papers [24][25][26][27][28][29][30][31][32][33][34][35][36][37]. In each of these, one of the following scales or assessment methods was used: Timed Up and Go Test [24][25][26][29][30][31][32][34][35][36], Berg Balance Scale [38][27][30][32][34][35][36], Activities-Specific Balance Confidence Scale [26][31][33][36], Functional Reach Test [25][30], Balance Platform [24][28], Falls Efficacy Scale International [26], Fullerton Advanced Balance Scale [29], Four Square Step Test [30], Single-leg Stance [31], Trunk Impairment Scale [34], and Six-and-Spot Step Test [37]. In all 14, Pilates yielded significant improvements post-intervention. The studies of Hosseini Sisi et al. [35] and Marandi et al. [37] only compared the results for this parameter with other therapies (rebound therapy [35] and aquatic therapy [37]), and did not report significant differences between interventions. In contrast, the study by Gheitasi et al. [25], with solid methodological quality (7 on PEDro scale), found significant improvement from Pilates compared with usual physician care; and Duff et al. [29] (7 on PEDro scale), which compared Pilates with 1-h of massage per week, found significant improvement from Pilates in balance and gait.

2.2. Gait/Walking

This variable was assessed in 11 studies [24][39][40][26][27][28][29][30][32][33][34] using: 6 Minute Walk Test [40][26][27][28][29][30], 12-Item Multiple Sclerosis Walking Scale [39][26][30][33], 10 Meter Walk Test [39][27][33], Timed 25-Foot Walk [26][32][34], 2 Minute Walk Test (2MWT) [24][39][30], the walking section of the Patients' Global Impression of Change Scale [39], and Rivermead Visual Gait Assessment [39]. Ten studies found significant improvements in gait post-intervention [24][39][40][26][27][28][29][30][33][34]. Of note are the studies by Arntzen et al. [39] (8 on PEDro scale), where there were significant differences in favour of Pilates with respect to standard physiotherapy care; and by Ozkul et

al. [40] (8 on PEDro scale), where Pilates presented significant improvements in gait quality when compared with relaxation exercises carried out at home. Also of interest is the significant 2MWT improvement found by Güngör et al. [24], both for patients in the Pilates group under the supervision of a physiotherapist and those doing home-based Pilates training.

Gait is a variable intimately related to balance. Two papers focused on studying both parameters combined: Kalron et al. [30] and Fox et al. [33]. The two studies compared the results obtained with the Pilates intervention with those from standard physical exercise. In Kalron et al. [30], both groups improved, although no significant differences were found between them. In contrast, in Fox et al. [33], the group doing standardised exercises obtained significant post-intervention improvements compared with those undergoing the Pilates intervention. Therefore, although Pilates has positive effects on gait and balance in pwMS, it seems that they are no better than other modes of physical exercise.

2.3. Physical-Functional Conditions

Within this variable, the reseachers include those studies which assess muscle strength: (leg extension 1 RM [29], sit-ups test [31], modified push-ups test [24][31], quadriceps and hamstrings isokinetic strength [24], and hand held dynamometer [36]), core stability (curl-up test [24][26], plank hold test [29], side bridge test [24][31], trunk flexion test [24][31], prone bridge test [31], and Biering-Sorensen test [24]), physical performance (9-Hole Peg test [32][34]; and time to roll from right to left, lie/sit, sit/stand, and repeated sit/stand [32][34]), aerobic capacity (consumption of VO_2 on treadmill, and Physiological Cost Index [41]), physical activity (accelerometer monitoring activity [39][29], Godin Leisure-Time Exercise Questionnaire [38][42]), and body composition [27]. The reported results suggest that intervention with Pilates could be a valid tool for improving strength [41][36], core stability [26][31], physical performance [32][34], aerobic capacity [41], and body composition [27] in pwMS. However, the heterogeneity of the assessment tests employed hampers data aggregation and direct comparison of the results.

2.4. Fatigue

Pilates improved fatigue significantly in pwMS in nine studies [24][38][40][42][27][28][31][32][34] of the ten that evaluated it [24][38][40][42][27][28][30][31][32][34]. Nevertheless, none of these found significant differences when compared with other interventions. Once again, different scales were used to evaluate fatigue: Modified Fatigue Scale [38][42][27][30][34], Fatigue Impact Scale [40][32], and Fatigue Severity Scale [24][28][31]. Pilates provides positive results, but whether it is better than other treatments remain unclear. Specifically, in the study by Kara et al. [32], the group doing aerobic exercises did obtain significant post-intervention improvements in fatigue, but the Pilates group did not. Nonetheless, this result needs to be interpreted with caution, because there were not significant differences between the groups, the sample size was small, and there were a lot of losses in the Pilates group post-intervention. Güngör et al. [24] also obtained significant improvements in fatigue in both the supervised Pilates training group and the home-based Pilates training group, but without differences between the groups, although there was a loss of 20% from the latter group, which could have altered the findings.

In summary, fatigue remains a poorly studied variable [3][7] despite being a widespread alteration in pwMS.

2.5. Quality of Life

Four of the studies evaluated this parameter [40][29][31][34]. Two scales were used: the Multiple Sclerosis Quality of Life-54 instrument [40][29][31], and the Multiple Sclerosis International Quality of Life Questionnaire [34]. Significant improvements were obtained for this variable in three of the four studies [40][31][34] in both the physical and mental sections of the scales; in one of which [34], the results were significantly better in the Pilates group than in the control group.

2.6. Cognitive/Psychological Function

Cognitive functions were analysed in four studies [40][26][32][34], using the following scales: Brief Repeatable Battery of Neuropsychological Tests [40], Brief International Cognitive Assessment for MS [26], and Paced Auditory Serial Addition Test [32][34]. All of them obtained significant post-intervention improvements in this parameter. Of interest are the studies by Ozkul et al. [40] and Abasiyanik et al. [26], which compared the Pilates intervention with doing exercises at home (relaxation in the case of Ozkul et al. [40]), and obtained significantly better results in this variable with the Pilates intervention. Although somewhat surprising, the results in these studies open the door to incorporating measurements of cognitive parameters in future work using Pilates, as has been done in others where exercise was also the base of the intervention [43][44][45][46][47].

On the other hand, Fleming et al. [38][42] assessed depression and anxiety in pwMS, and Küçük et al. [34] assessed depression. The results do not offer any clear direction: although in Fleming et al. [38], the home-based Pilates group obtained significant improvement in comparison with the control group with regard to depression and anxiety, in earlier work [42], the same author stated that the supervised Pilates group presented a significant worsening of anxiety symptoms with respect to the home-based Pilates group. In addition, Küçuk et al. [34] did not find significant improvements in depression following the Pilates intervention. It is possible that these results are due to other factors, such as the comorbidities or severity of MS, as Kara et al. [32] report that both the Pilates and aerobic exercise groups, despite the improvement in depression experienced, did not present values significantly better than healthy adults.

2.7. Attendance/Adherence

In general, for the studies presenting data on compliance by patients with the Pilates sessions, there is an average adherence to the treatment above 80–85% [39][40][26][42][28][29][36]. The outstanding levels of adherence, in addition to the clinical results, are one of the highlights of using Pilates interventions in pwMS. Nevertheless, in the study by Fox et al. [33], the Pilates exercise group only had 66% adherence compared with 84% and 92% in the groups doing standardized exercises or relaxation, respectively. Most of the papers do not state values for compliance [24][38][25][41][27][48][30][31][32][34][35][37], which is an important limitation. Adherence is usually linked to the patient's motivation for the treatment offered [49]; hence, it is a relevant issue in a disease such as MS, a long-duration chronic illness requiring physical-functional conditions to be as stable as possible over time, to maintain the independence and autonomy of patients. Lack of adherence may reflect a deterioration in the fitness of pwMS, and greater expense in terms of healthcare and personnel resources.

2.8. Sample Characteristics

The population analysed in these studies comprised 999 pwMS, and 868 finished them (131 dropouts, 13.11%). In terms of age, patients in their third and fourth decades predominated [24][38][25][40][26][27][28][29][48][30][31][32][35][36] (only three of the studies [39][33][34] include patients aged over 60), and this is in line with the epidemiological data [2]. With regard to sex, the majority are women (602), compared with 226 men, which also matches the epidemiological data for the disease (3:1 women to men ratio [1][2]). Dropout rates may vary between sexes, as in the study by Bulguroglu et al. [31]. Surprisingly, in some of the studies, the sample consists exclusively of women [41][42][27][48][36][37] or men [25][35], which complicates cross-sex validation of the results.

The majority of the samples include MS of the RRMS type (86.76%), this being the most common form of MS [4]. In eight studies [38][25][42][31][34][35][36][37], the clinical state of the disease in the participants is unfortunately not specified.

The degree of disability in the samples was quantified in most cases using the Expanded Disability Status Scale [24][25][39][40][41][26][27][28][48][30][31][32][33][34][35][36][37], with the average scores on this questionnaire being highly variable, tending normally to an average score of 4.5 [24][39][40][26][28][30][31][32][34][35][36][37]. Only the study by Banitalebi et al. [41] included patients with a score of up to 8 on this scale: patients need to use aids for walking once their score reaches 6. Three studies employed the Patient-Determined Disease Steps Scale [38][42][29] to measure the degree of disability. The lack of standard evaluations, combined with the fact that some studies do not specify the clinical type of MS [38][25][42][31][34][35][36][37], leads to important knowledge gaps that ought to be addressed in future research. The performance of participants in Pilates programs will determine the design of the exercises, and the therapeutic objectives intended for each type of MS. Amatya et al. [4] agree that it is key to analyse these aspects to offer more effective and specific multidisciplinary treatment for each pwMS.

2.9. Characteristics of the Pilates Interventions

The type of Pilates intervention is specified in the majority of the cases, with mat work being the preferred modality [24][38][25][39][40][26][42][27][28][29][48][31][32][33][34]. In Duff et al. [29], the Pilates group did sessions of mat work and fitness equipment, whereas in Bulguroglu et al. [31], a mat work group was compared with one using Pilates exercise machines, and with a control group doing relaxation and respiration exercises at home. The Pilates intervention on the mat is likely preferred for economy and space reasons, as well as for its convenience for group therapy sessions. However, in Bulguroglu et al. [31], although both modalities achieved significant post-intervention improvements, there is significantly greater improvement in the exercise machine group when looking at vertebral mobility using the Trunk Flexion Test. It would be useful for future studies to analyse whether working with machines offers greater benefits than mat work, in both therapeutic and cost-effectiveness terms.

It is also challenging to evaluate the benefits offered by at-home video-guided Pilates interventions for pwMS. The studies [38][42] that presented this intervention offer encouraging results. The Pilates intervention guided by DVD obtained good results in relation to symptoms of anxiety, depression, and fatigue. It is unclear whether the DVD modality is a better choice than the supervised intervention, from both the therapeutic and cost-effectiveness points

of view. It would be helpful to analyse DVD-guided Pilates intervention as a sole treatment, or as a complement to the work of health professionals, as well as the requirements necessary (for instance, workload recommended), or the potential options for tracking the workload or motivation of pwMS to continue with the Pilates program.

In the majority of the studies, the session duration ranges from 45 to 60 min [38][25][39][40][26][42][27][28][29][32][34][35][36][37], with weekly frequency mainly established at two [24][38][42][29][31][32][34][36] or three [25][39][40][41][27][28][48][35][37] sessions per week, except for three with one session/week [26][30][33]. Most interventions lasted 8 [24][38][26][42][27][28][48][31][32][34][35][36] or 12 weeks [25][41][29][30][33][37]. Because in most of the studies there was no long-term monitoring after the intervention, it is unclear whether the outcomes attained are maintained. Only the study by Arntzen et al. [39], the one with the shortest intervention (6 weeks), tracked outcomes up to 30 weeks. These results point to sustained benefits for gait in the Pilates group after 18 (walking speed, perceived limitations, and distance walked) and 30 weeks (distance walked). The reseachers propose to schedule follow-up assessments in order to define whether the effects of the Pilates persist, in addition to establishing, in cases where the treatment is suspended (such as for vacation), after how long the treatment ought to be resumed to avert a significant loss of the benefits achieved.

The sessions took place for individuals in six studies [24][38][42][30][31][33], and for groups in five studies [39][26][29][34][36], whereas in nine studies, was not specified [25][40][41][27][28][48][32][35][37]. Eight studies [25][41][29][30][31][35][36][37] do not provide details regarding the Pilates program applied. Future research should be more precise in how the interventions are described, as this would facilitate replication, comparison, and evolution of the protocols.

With regard to the session supervision, the professional in charge was a physiotherapist in 11 studies [38][39][40][26][28][30][31][32][33][34][36], 5 of which specified that a Pilates certification was held [26][30][31][33][36]. In six studies [25][41][27][48][35][37], the professional responsible for directing the sessions is not specified. From The reseachers point of view, the physiotherapist is the ideal person for conducting these interventions in patients, optimally with a Pilates specialisation, to guarantee more effective and safer sessions while following the guidelines of the method properly.

2.10. Adverse Effects and Dropouts

Whether the intervention had adverse effects is relevant for pwMS. Adverse effects during the intervention were specified in four studies [24][39][28][32], with a total of nine cases (five for exacerbation of symptoms, two for relapse, and two due to the work intensity). In seven studies [41][27][48][31][34][35][37], it is not specified whether there were any adverse effects, although there were some dropouts. Adverse effects should be reported, and the cause of dropping out should be clarified, as well as the possible link with undesired effects of the treatment, to provide assurance in future research with Pilates in pwMS. It is also relevant for the validity of the outcomes to be verified.

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