Consultative, Proactive Physical Therapy in Early Multiple Sclerosis

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ABSTRACT

BACKGROUND: Exercise training may be the most effective nonpharmacological symptomatic treatment for patients with multiple sclerosis (MS). Physical therapy (PT) can facilitate increased exercise through education, individualized exercise routines, goal setting, and supportive resources. However, traditional PT focuses on function restoration rather than proactive measures to prevent the advancement of morbidity. We present the application of a proactive physical therapy (PAPT) approach for individuals with MS.

METHODS: Neurologists referred patients to PT shortly after their MS diagnosis. Patients completed a shared decision-making–based evaluation of their current functional level, received education on exercise guidelines and goal-setting support, and established an exercise routine of an appropriate intensity. The patient and physical therapist communicated via email and telephone at 1 and 3 months. Assessments included physical function, Fatigue Severity Scale (FSS), and self-reported exercise at 6 months.

RESULTS: Three patients were referred directly to PAPT, and 1 transitioned from restorative PT. At 6 months, 3 patients reported regular aerobic, strengthening, and flexibility participation that met or exceeded established exercise recommendations. Two of 3 patients demonstrated clinically meaningful changes in functional outcome measures (eg, 10-meter Walk Test), a third patient remained stable in all functional outcome measures. Three patients reported significant improvements on the FSS at 6 months. The fourth patient did not complete the 6-month follow-up due to pregnancy complications but reported meeting guidelines at 3 months.

CONCLUSIONS: A PAPT model of care is feasible and effective for patients who have been newly diagnosed with MS. With minimal PT visits, patients met established exercise guidelines and maintained or improved physical function.

Int J MS Care. 2024;26:341-346. doi:10.7224/1537-2073.2023-058

Scientific evidence and expert opinions support the safety of exercise and suggest that it may be the single most effective nonpharmacological symptomatic treatment for people with multiple sclerosis (MS).[1-6] Physical activity and exercise are associated with improved physical function, walking ability, fatigue, muscular strength and endurance, and quality of life in people with MS.[7-9] Exercise guidelines established for people with MS recommend 2 to 3 days weekly of aerobic exercise for 10 to 30 minutes at a moderate intensity.[10-12] Advanced aerobic exercise recommendations include up to 5 days per week and up to 40 minutes at a moderate to high intensity.[10,11] Resistance training is recommended 2 to 3 days per week; the suggested regimen is 1 to 3 sets of 8 to 15 repetitions of 5 to 10 exercises.[10-12]

Despite strong evidence supporting the benefits and safety of physical activity and exercise participation, people with MS often do not engage in sufficient levels of physical activity to achieve health benefits.[13] They report barriers to exercise such as a lack of knowledge of the benefits of exercise, lack of time or motivation, increased fatigue at rest and with exercise, low exercise self-efficacy, financial constraints, and a lack of access to fitness resources.[14,15] Physical therapy (PT) may play an important role in facilitating increased physical activity and exercise for people with MS through education on its benefits, helping to initiate or modify an individualized exercise routine, setting exercise goals, and providing resources for local fitness options.[16,17]

The Academy of Neurologic Physical Therapy's Health Promotion and Wellness Task Force proposed a model for PT for people with chronic neurologic conditions, including people with MS, to optimize their exercise routine.[18] This task force emphasizes the importance of changing the current PT model of care from a reactive system where patients are seen after deficits and disabilities have manifested to a proactive system where PT is used to prevent or reduce the negative impact of ongoing illness and to improve function and quality of life as soon as possible to slow functional

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TABLE 1. Patient Demographics and Assessments

	P1	P2	P3	P4*
Sex	M	F	F	F
Age, years	29	35	37	21
Time since diagnosis	4 months	6 years	2 months	3 months
PMH	NA	NA	NA	Lumbar disc degeneration
EDSS	3.5	3.5	1.5	3
DMT	Ocrevus	Ocrevus	Ocrevus	Tysabri
Evaluation				
Symptoms	LE stiffness; bladder changes	LE tingling	Decreased walking ability; brain fog; R numbness; decreased vision in R eye	Fatigue; L weakness
Barriers	LE stiffness; fear of overheating	Fear of exacerbating LE tingling; fear of falling	Fatigue; lightheadedness; lack of endurance; not knowing what to do	Fatigue; lack of motivation
Follow-up at 6 months				
Symptoms	LE tingling with high-intensity walking	None noted	None noted	No reassessment possible
Barriers	None identified	None identified	None identified	

DMT, disease-modifying therapy; EDSS, Expanded Disability Status Scale; F, female; L, left; LE, lower extremity; M, male; NA, not applicable; P, patient; PMH, previous medical history; R right.

Note: All 4 patients had commercial insurance.

*P4 dropped out of the study before the reassessment at 6 months.

decline.[19] This proactive PT (PAPT) model utilizes a relatively low number of PT sessions, making it a more approachable and sustainable option for care. Evidence is emerging on the benefits of PAPT specifically for people with MS who are in the early stages of the disease course.[20] This program applies diagnosis-specific exercise guidelines within a PT program to bridge the knowledge-to-practice gap and implement research in clinical practice. Using the CARE Case Report Guidelines,[21] this case series examines the effect of PAPT on 4 people with MS.

METHODS

Procedure: Referral and First Session

We expanded upon an existing PAPT model described in Parkinson disease.[22,23] Briefly, patients are referred to PAPT directly following a diagnosis of MS before symptoms substantially impact mobility. This model is conceptualized as low-dose PT with 1 to 4 sessions within the span of 6 to 12 months.[18]

Patients signed an informed consent and Health Insurance Portability and Accountability Act privacy document before participation in the case series. Patients attended a 90-minute evaluation, including a full clinical evaluation and an individually tailored goal setting and exercise prescription.[23] At the evaluation, functional strength was measured with the 5 Times Sit-to-Stand Test (5xSTS),[24] the 10-Meter Walk Test (10MWT), and a self-selected velocity (SSV) and a fast velocity (FV) test; functional exercise capacity was measured by the 6-Minute Walk Test (6MWT)[25]; dynamic balance was measured with the Functional Gait Assessment (FGA)[26]; higher level mobility was measured with the High-Level Mobility Assessment Tool (HiMAT)[27]; and self-reported fatigue was measured with the Fatigue Severity Scale (FSS).[28]

The 30-minute intervention portion of the evaluation consisted of education and promotion of regular exercise to meet physical activity guidelines for people with MS, including written or electronic handouts with individualized prescriptions for aerobic exercise, resistance training, balance training, and flexibility.[10-12,29] Adherence to the exercise program and long-term exercise engagement were facilitated through a shared decision-making process.[30] Barriers to exercise were identified and addressed with education and exercise training. Common MS symptoms that may impact engagement in exercise (eg, fatigue, heat sensitivity) were discussed as needed. To conclude the initial evaluation, a 1-month follow-up email, a 3-month phone call, and a 6-month in-person visit were scheduled.

Procedure: Follow-Up Visits

The 1-month email exchange and 3-month phone call (5-10 minutes long) included updates on current exercise and physical activity, current MS symptoms, barriers to exercise, updated exercise prescription, and quality improvement questions. The 6-month follow-up visit mimicked the initial evaluation, and patients were discharged with a plan to follow up for an evaluation and to review exercise behaviors and goals every 6 to 12 months.

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RESULTS

Patient Information

Four patients (P1, P2, P3, P4) were referred to PAPT, 3 by their neurologist during a standard clinic appointment and 1 by their neurologist for restorative PT. This patient completed restorative PT 2 times per week for 4 weeks and then transitioned to the PAPT model of care due to their recent diagnosis of MS, functional status, and exercise goals. All 4 patients were on disease-modifying therapy and had initial Expanded Disability Status Scale scores of 3.5 or less. **TABLE 1** includes patient background information, reported MS symptoms, and reported barriers to exercise.

One-Month Email

P1, P2, and P3 received a follow-up email 1 month after evaluation. P1 reported that he returned to aerobic exercise, 60 to 90 minutes per week on average at a moderate intensity, and continued his regular stretching program of 100 minutes per week. The physical therapist's prescription was for him to increase the frequency and duration of aerobic exercise to achieve 90 to 150 minutes per week at a moderate intensity. P2 reported regular aerobic exercise for 60 minutes per week at moderate intensity and continued her stretching program of 100 minutes per week. The physical therapist's prescription was for her to increase the frequency and duration of aerobic exercise to achieve 120 minutes per week at a moderate intensity and begin strength training 2 times per week and balance training 1 time per week. P3 reported no exercise because she was experiencing increased pain and severe fatigue and was awaiting an appointment with her neurologist for an MRI. A plan was made to check in with P3 at 3 months, unless she needed follow-up sooner. P4 was participating in restorative PT at this time.

Three-Month Phone Call

All patients completed a phone call check-in at 3 months. P1 reported that he achieved regular aerobic exercise for 150 minutes per week at moderate intensity and continued with his stretching program for 100 minutes per week. The physical therapist's prescription was to add regular strength training 2 times per week. P2 reported performing aerobic exercise 90 to 120 minutes per week at moderate intensity, beginning strength training 2 times per week, yoga 20 minutes per week, and the stretching program for 100 minutes per week. The physical therapist's prescription was to increase the frequency of aerobic exercise to achieve 150 minutes per week. P3 reported that she was starting to work with a trainer at her gym and performing aerobic exercise 45 to 60 minutes per week at moderate intensity and strength training 2 times per week. P4 reported consistently completing a daily walking routine and strength and balance exercises several times per week. She estimated a total of 240 minutes per week of dedicated exercise. In this communication, patients reported appreciation of exercise education, increased motivation to exercise, and increased confidence with choosing exercise.

Six-Month Follow-Up Evaluation

P1 remained stable in all outcome measures at the 6-month follow-up. He reported no issues with heat sensitivity and exercise and no longer identified this as a barrier to participation. He noted occasional tingling in his legs with long-distance or high-intensity ambulation but indicated this was not a barrier to exercise. He reported increasing his aerobic exercise time from 30 minutes per week to 200 minutes per week at moderate intensity, maintaining his stretching program at 100 minutes per week, and beginning a strengthening program 2 times per week.

Both P2 and P3 achieved significant functional gains in gait and functional mobility. P2 increased her fast walking speed by 0.15 meters per second and walking endurance on the 6MWT by 68 meters, both meaningful changes.[31] Her HiMAT score increased by 15 points. P3 increased her self-selected walking speed by 0.25 meters per second and her fast walking speed by 0.14 meters per second, both meaningful changes.[31] Her HiMAT score increased by 10 points. Her score on the FSS decreased from 52 to 9, indicating a significant decrease in fatigue. Both P2 and P3 reported being able to complete a regular exercise routine and were meeting or exceeding guidelines for all domains of prescribed exercise (**TABLE 2** and **TABLE S1**).

TABLE 2. Patient Outcomes

	P1		P2		P3		P4
	Eval	6M	Eval	6M	Eval	6M	Eval
SSV gait speed (m/s)	1.67	1.7	1.34	1.33	1.21	1.46	
Fast gait speed (m/s)	2.48	2.57	1.82	1.97	2.03	2.17	
6MWT (m)	700	687	595	663	708	721	
FGA (max 30)	30	30	30	30	30	30	494
5XSTS (s)	5.6	6.2	7.2	5.98	8.36	6.99	20
HiMAT (max 54)	54	51	30	45	36	46	11.1
FSS (max 63)	21	23	26	24	52	9	

5XSTS, 5 Times Sit-to-Stand Test; 6M, 6-month evaluation; 6MWT, 6-Minute Walk Test; Eval, baseline evaluation; FGA, Functional Gait Assessment; FSS, Fatigue Severity Scale; HiMAT, High-Level Mobility and Assessment Tool; SSV, self-selected velocity.
Note: P4 dropped out of the study before the reassessment at 6 months.

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P4 was unable to participate in the 6-month follow-up because of complications with her pregnancy. She was discharged from the program via a phone call follow-up after canceling her 6-month visit.

P1, P2, and P3 were discharged after the 6-month visit with a plan to follow up regularly with the physical therapist every 6 to 12 months to evaluate outcomes and review exercise goals. All patients reported success with insurance coverage for PAPT care. All patient outcomes are provided in Table 2, and patient-reported exercise and exercise prescriptions at each time point are provided in Table S1.

DISCUSSION

This case series supports the feasibility of using PAPT to increase exercise participation and improve functional and patient-reported outcomes for people with MS. PAPT includes aspects of secondary prevention by initiating treatment early in the disease course before the onset of significant symptoms rather than the typical tertiary prevention focused on restoring lost function.[18] Appropriate exercise early after diagnosis with MS has been potentially identified as one of the most promising, possibly disease-modifying treatment strategies.[1,32] When performed appropriately, exercise can significantly improve cardiorespiratory fitness, muscle strength, flexibility, fatigue, cognition, and quality of life in people with MS.[30] Although MS progression can be extremely variable, we chose a 6-month follow-up based on the model proposed by Ellis et al who studied PAPT for people with Parkinson disease.[33]

The 3 patients who completed the PAPT program had excellent maintenance or improvement of their physical function with minimal PT visits in conjunction with their independent engagement in exercise. Using an individually tailored approach rather than a protocolized one, an exercise prescription was provided at each time point to encourage each individual to meet the general or advanced exercise recommendations.[34] All 4 patients increased their exercise participation and achieved the recommended levels of exercise. P4 highlights how this consultative model of care can be applied at many stages of the disease as long as impairment levels are mild.

Although our case series addresses and applies a consultative, proactive model of PT delivery to individuals newly diagnosed with MS, limitations should be considered. Limitations include a small, homogeneous sample of individuals with a history of exercise and good insurer-sponsored health care, long-term follow-up limited to 6 months, and a retention rate of 75%. If patients had limited experience with exercise prior to PAPT or poor insurance coverage, the program may have been less successful. The clinical case series format means that our data sources were limited by clinical notes and we did not have qualitative interviews or objective physical activity data from wearable activity trackers. Future research should include an appropriately powered randomized controlled trial to establish the effectiveness of PAPT in increasing physical activity in inactive people with MS as well as maintenance and/or improvement of functional status. Further research on the sustainability of PAPT for long-term adherence with guidelines and its effect on disease and symptom severity are needed (ie, ≥ 1-year follow-up). Additionally, the facilitators and barriers to implementing PAPT in different clinical settings and identifying implementation strategies for optimizing PAPT implementation should be investigated.

CONCLUSIONS

Physical therapists play a pivotal role in promoting physical activity and exercise across the life span, especially for individuals with neurologic conditions such as MS. Individuals living with MS can benefit greatly from interactions with knowledgeable and experienced clinicians. We initiated a PAPT model for patients newly diagnosed with MS and saw success with functional activity monitoring and education. This program has been successfully utilized in persons with Parkinson disease,[23] and we believe it needs to be standardized for people with MS as well. This case series demonstrates how the program implements evidence-based practices in an outpatient clinical setting and can improve functional mobility, health, and wellness for people with MS. More research is needed with larger and more diverse sample sizes, long-term follow-up, and ways to address other patient accessibility and health literacy barriers. ■

ACKNOWLEDGMENTS: The authors gratefully acknowledge the participants in this case series.

FUNDING: This work was supported in part by the Marie Hartwig Research Fund.

CONFLICTS OF INTEREST: Edith L. Graham, MD, has served as an advisory board member for EMD Serono, Genentech, Horizon Therapeutics, and Novartis and receives research support from F. Hoffmann-La Roche Ltd. Roumen Balabanov, MD, has received consulting fees from Biogen, Sanofi, and Teva, and grant/research support from Biogen. The remaining authors have no conflicts of interest to disclose.

REFERENCES

1. Pilutti LA, Platta ME, Motl RW, Latimer-Cheung AE. The safety of exercise training in multiple sclerosis: a systematic review. *J Neurol Sci*. 2014;343(1-2):3-7. doi:10.1016/j.jns.2014.05.016
2. Döring A, Pfueller CF, Paul F, Dörr J. Exercise in multiple sclerosis—an integral component of disease management. *EPMA J*. 2011;3(1):2. doi:10.1007/s13167-011-0136-4
3. Latimer-Cheung AE, Pilutti LA, Hicks AL, et al. Effects of exercise training on fitness, mobility, fatigue, and health-related quality of life among adults with multiple sclerosis: a systematic review to inform guideline development. *Arch Phys Med Rehabil*. 2013;94(9):1800-1828.e3. doi:10.1016/j.apmr.2013.04.020
4. Platta ME, Ensari I, Motl RW, Pilutti LA. Effect of exercise training on fitness in multiple sclerosis: a meta-analysis. *Arch Phys Med Rehabil*. 2016;97(9):1564-1572. doi:10.1016/j.apmr.2016.01.023
5. Reynolds ER, Ashbaugh AD, Hockenberry BJ, McGrew CA. Multiple sclerosis and exercise: a literature review. *Curr Sports Med Rep*. 2018;17(1):31-35. doi:10.1249/jsr.0000000000000446
6. Ronai P, LaFontaine T. Multiple sclerosis and exercise. *Strength Cond J*. 2011;33:26-29. doi:10.1519/SSC.0b013e3181fd0b15

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7. Pilutti LA, Greenlee TA, Motl RW, Nickrent MS, Petruzzello SJ. Effects of exercise training on fatigue in multiple sclerosis: a meta-analysis. *Psychosom Med*. 2013;75(6):575-580. doi:10.1097/PSY.0b013e31829b4525
8. Snook EM, Motl RW. Effect of exercise training on walking mobility in multiple sclerosis: a meta-analysis. *Neurorehabil Neural Repair*. 2009;23(2):108-116. doi:10.1177/1545968308320641
9. Motl RW, Sandroff BM. Benefits of exercise training in multiple sclerosis. *Curr Neurol Neurosci Rep*. 2015;15(9):62. doi:10.1007/s11910-015-0585-6
10. Kalb R, Brown TR, Coote S, et al. Exercise and lifestyle physical activity recommendations for people with multiple sclerosis throughout the disease course. *Mult Scler*. 2020;26(12):1459-1469. doi:10.1177/1352458520915629
11. Kim Y, Lai B, Mehta T, et al. Exercise training guidelines for multiple sclerosis, stroke, and Parkinson disease: rapid review and synthesis. *Am J Phys Med Rehabil*. 2019;98(7):613-621. doi:10.1097/phm.0000000000001174
12. Latimer-Cheung AE, Martin Ginis KA, Hicks AL, et al. Development of evidence-informed physical activity guidelines for adults with multiple sclerosis. *Arch Phys Med Rehabil*. 2013;94(9):1829-1836.e7. doi:10.1016/j.apmr.2013.05.015
13. Kinnett-Hopkins D, Adamson B, Rougeau K, Motl RW. People with MS are less physically active than healthy controls but as active as those with other chronic diseases: an updated meta-analysis. *Mult Scler Relat Disord*. 2017;13:38-43. doi:10.1016/j.msard.2017.01.016
14. Streber R, Peters S, Pfeifer K. Systematic review of correlates and determinants of physical activity in persons with multiple sclerosis. *Arch Phys Med Rehabil*. 2016;97(4):633-645.e29. doi:10.1016/j.apmr.2015.11.020
15. Learmonth YC, Motl RW. Physical activity and exercise training in multiple sclerosis: a review and content analysis of qualitative research identifying perceived determinants and consequences. *Disabil Rehabil*. 2016;38(13):1227-1242. doi:10.3109/09638288.2015.1077397
16. Ploughman M. Breaking down the barriers to physical activity among people with multiple sclerosis–a narrative review. *Phys Ther Rev*. 2017;22(3-4):124-132. doi:10.1080/10833196.2017.1315212
17. Moffat F, Paul L. Barriers and solutions to participation in exercise for moderately disabled people with multiple sclerosis not currently exercising: a consensus development study using nominal group technique. *Disabil Rehabil*. 2019;41(23):2775-2783. doi:10.1080/09638288.2018.1479456
18. Rafferty MR, Held Bradford EC, Fritz S, et al. Health promotion and wellness in neurologic physical therapy: strategies to advance practice. *J Neurol Phys Ther*. 2022;46(2):103-117. doi:10.1097/npt.0000000000000376
19. Dalgas U, Langeskov-Christensen M, Stenager E, Riemenschneider M, Hvid LG. Exercise as medicine in multiple sclerosis-time for a paradigm shift: preventive, symptomatic, and disease-modifying aspects and perspectives. *Curr Neurol Neurosci Rep*. 2019;19(11):88. doi:10.1007/s11910-019-1002-3
20. Riemenschneider M, Hvid LG, Ringgaard S, et al. Investigating the potential disease-modifying and neuroprotective efficacy of exercise therapy early in the disease course of multiple sclerosis: The Early Multiple Sclerosis Exercise Study (EMSES). *Mult Scler*. 2022;28(10):1620-1629. doi:10.1177/13524585221079200
21. Riley DS, Barber MS, Kienle GS, et al. CARE guidelines for case reports: explanation and elaboration document. *J Clin Epidemiol*. 2017;89:218-235. doi:10.1016/j.jclinepi.2017.04.026
22. MacDonald J, Doyle L, Moore JL, Rafferty MR. Sustainment of proactive physical therapy for individuals with early-stage Parkinson's disease: a quality improvement study over 4 years. *Implement Sci Commun*. 2021;2(1):111. doi:10.1186/s43058-021-00205-x
23. Rafferty MR, MacDonald J, Byskosh A, et al. Using implementation frameworks to provide proactive physical therapy for people with Parkinson disease: case report. *Phys Ther*. 2019;99(12):1644-1655. doi:10.1093/ptj/pzz129
24. Fry D, Pfalzer L. Reliability of four functional tests and rating of perceived exertion in persons with multiple sclerosis. *Physiother Can*. 2006;58:212-220. doi:10.3138/ptc.58.3.212
25. Agarwala P, Salzman SH. Six-Minute Walk Test: clinical role, technique, coding, and reimbursement. *Chest*. 2020;157(3):603-611. doi:10.1016/j.chest.2019.10.014
26. Forsberg A, Andreasson M, Nilsagård Y. The functional gait assessment in people with multiple sclerosis: validity and sensitivity to change. *Int J MS Care*. 2017;19(2):66-72. doi:10.7224/1537-2073.2015-061
27. Williams GP, Greenwood KM, Robertson VJ, Goldie PA, Morris ME. High-Level Mobility Assessment Tool (HiMAT): interrater reliability, retest reliability, and internal consistency. *Phys Ther*. 2006;86(3):395-400.
28. Ghajarzadeh M, Jalilian R, Eskandari G, Ali Sahraian M, Reza Azimi A. Validity and reliability of Persian version of Modified Fatigue Impact Scale (MFIS) questionnaire in Iranian patients with multiple sclerosis. *Disabil Rehabil*. 2013;35(18):1509-1512. doi:10.3109/09638288.2012.742575
29. Halabchi F, Alizadeh Z, Sahraian MA, Abolhasani M. Exercise prescription for patients with multiple sclerosis; potential benefits and practical recommendations. *BMC Neurol*. 2017;17(1):185. doi:10.1186/s12883-017-0960-9
30. Elwyn G, Frosch D, Thomson R, et al. Shared decision making: a model for clinical practice. *J Gen Intern Med*. 2012;27(10):1361-1367. doi:10.1007/s11606-012-2077-6
31. Perera S, Mody SH, Woodman RC, Studenski SA. Meaningful change and responsiveness in common physical performance measures in older adults. *J Am Geriatr Soc*. 2006;54(5):743-749. doi:10.1111/j.1532-5415.2006.00701.x
32. Riemenschneider M, Hvid LG, Stenager E, Dalgas U. Is there an overlooked "window of opportunity" in MS exercise therapy? perspectives for early MS rehabilitation. *Mult Scler*. 2018;24(7):886-894. doi:10.1177/1352458518777377
33. Ellis TD, Colón-Semenza C, DeAngelis TR, et al. Evidence for early and regular physical therapy and exercise in Parkinson's disease. *Semin Neurol*. 2021;41(2):189-205. doi:10.1055/s-0041-1725133
34. Canning KL, Hicks AL. Benefits of adhering to the Canadian Physical Activity Guidelines for adults with multiple sclerosis beyond aerobic fitness and strength. *Int J MS Care*. 2020;22(1):15-21. doi:10.7224/1537-2073.2018-061

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TABLE S1. Patient-Reported Exercise and Exercise Prescription by Time Point

Patient 1							
Time point	Baseline		1-month		3-month		6-month
	Reported	Prescribed	Reported	Prescribed	Reported	Prescribed	Reported
Aerobic	3/w 10 min light	3/w 20 min mod	***2-3/w 20-30 min mod**	3-5/w 20-30 min mod	***5/w 30 min mod**	5/w 30 min mod	***5/w 40 min mod**
Resistance	None	None	None	2/w 10 min mod	None	2/w 10 min mod	***2/w 20 min mod**
Balance	None	None	None	None	None	None	None
Flexibility	***5/w 20 min light**	5/w 20 min light	***5/w 20 min light**	5/w 20 min light	***5/w 20 min light**	5/w 20 min light	**5/w 20 min light**
Patient 2							
Time point	Baseline		1-month		3-month		6-month
	Reported	Prescribed	Reported	Prescribed	Reported	Prescribed	Reported
Aerobic	None	3/w 10 min mod	***3/w 20 min mod**	4/w 30 min mod	***3-4/w 30 min mod**	5/w 30 min mod	***2/w 45 min vig 4-5 /w 20 min mod**
Resistance	None	None	None	2/w 10-20 min mod	***2/w 20 min mod**	2/w 20 min mod	***3/w 20 min mod**
Balance	None	None	None	Yoga 1/w 20 min	***Yoga 1/w 20 min**	Yoga 1/w 20 min	***Yoga 2/w 10 min**
Flexibility	None	3/w 10 min light	***5/w 20 min light**	5/w 20 min light	***5/w 20 min light**	5/w 20 min light	***7/w 10 min light**
Patient 3							
Time point	Baseline		1-month		3-month		6-month
	Reported	Prescribed	Reported	Prescribed	Reported	Prescribed	Reported
Aerobic	None		None	None[a]	***3/w 45 min mod**	5/w 30 min mod	***5-6/w 30 min mod**
Resistance	None		None	None	***2/w 20 min mod**	2/w 20 min mod	***3/w 20 min mod**
Balance	None		None	None	***2/w 10 min**	2/w 10 min	***Yoga 5/w 30 min**
Flexibility	None		None	None	***3/w 10 min light**	3-5/w 10 min light	***5/w 10 min light**

Light, light intensity; mod, moderate intensity; vig, vigorous intensity.
Bold indicates that the patient met the therapist's exercise prescription.
* indicates that the patient met the MS-specific exercise guidelines.
[a]The patient was experiencing a flare-up at this time.

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