Recommendations for programs to reduce balance impairments in individuals with multiple sclerosis: a review of the literature to determine if hippotherapy is as beneficial as therapy without the use of a horse.

***Introduction:***

 For people with multiple sclerosis (MS), ongoing physical therapy is needed to adjust to the changes that may occur as a result of the progressive demyelination and axonal loss within the CNS.1 MS is a long-term condition that beings in early adulthood, requiring the management of many disabling symptoms associated with the disease.2 The functional impairments that result from the pathologic changes of MS include the loss of strength, balance, sensation, coordination, exercise tolerance, and fatigue.1,2  Of these impairments, balance can have a huge impact on mobility and activities of daily living.3 One goal of balance rehabilitation is to decrease the amount of falls and increase the independence with activities of daily living in people with MS using various sensory and motor strategies.3,4

 Recent rehabilitation practices have included the use of animal assisted therapy as alternative approaches for patients with different neurologic conditions.1 One of these animal assisted therapies, hippotherapy, uses the movement of the horse to achieve functional outcomes with the instruction of a physical or occupational therapist.5  Hippotherapy is also considered task-oriented which has worked well for treating balance problems in people with MS.5 Advantages of hippotherapy include the increase of somatosensory input through muscles and joints through pelvic movement, changing the visual flow, and increasing the demands of the vestibular system.5 Using hippotherapy as an alternative approach to address balance impairments in people with MS may be beneficial due to the continuous need of the person to adapt to the functional impairments resulting from the disease so that they may be as independent as possible. The purpose of this paper is to analyze the question for adult people ages 30-55 years old diagnosed with multiple sclerosis, does participating in hippotherapy for 8 weeks improve balance more compared to a typical physical therapy treatment bout (intervention) for 8 weeks? By investigating the effects of these various treatment interventions for adults with MS, we as physical therapists can make appropriate recommendations that provide the most successful outcomes for our patients.

***Balance Rehabilitation without use of Animal Assisted Therapy:***

 Balance rehabilitation for people with MS has been successful through various avenues including home exercise programs, community exercise, aquatics, and one on one treatment programs. The focus of these programs are to use various motor and sensory strategies to enhance balance through strengthening, core-stability, balance retraining, stretching, and increasing aerobic capacity.2,3,4,6 Catteano et al. performed a randomized control trial of 44 subjects evaluating the effects of motor retraining, motor and sensory retraining, or a control group performing conventional therapy not directed at balance impairments on balance for people with MS.4 Motor strategies included standing and dynamic tasks with attention to postural alignment, ankle strategy, axial and postural anticipatory strategies using reaching tasks and object manipulation, dual task exercises, as well as open tasks involving a ball.4 Sensory retraining can enhance strategies that allow the CNS to adapt to the environmental demands on the balance system. These strategies included performing motor tasks in different perceptual contexts (eyes closed, foam pad, and modified lenses as well as involving head movements, eye movements, and combined eye and head movements.4 Investigators addressed balance with the use of outcome measures that include the Berg Balance Scale (BBS), the Dynamic Gait Index (DGI), number of falls, and the Activities-Specific Balance Confidence Scale (ABC) though a 10-12 session program over 3 weeks.4 Another randomized control trail conducted by Learmonth et al. assessed the effects of a 12 week, twice weekly, combined exercise in a group setting on balance, quadriceps strength, activity levels, perceived balance confidence, endurance, walking speed, and physical function in 32 subjects.2 Exercises involved components of aerobic endurance, stretching, resistance, and balance, in a circuit fashion with progressing difficulty. The investigators, too, used the BBS and ABC to evaluate the intervention’s impact on balance.2

 The use of the BBS and the ABC from both studies yielded dissimilar results. The BBS results from RCT involving Catteano et al. were statistically significant between the motor and sensory strategy group and the control group as well as the motor strategy group and the control group.4 Statistical significance was not seen between the two intervention groups. Learmonth et al. reported no evidence that the intervention had any effect on BBS scores on either group; however, the intervention group improved their score to a greater degree than the control group.2 The ABC did reach statistical significance from the community based exercise intervention at baseline and week 12 in the intervention group, with no statistical significance in the control group. Catteano et al. reported that the ABC did not show any statistical improvements.4 Additional balance measures were performed to assess the effects of the interventions by investigators in the Catteano et al. study. Post-treatment fall frequency of one or more falls reached statistical significance between groups, with the sensory and motor strategies group having the least amount of falls.4 The DGI showed statistically significant differences between the motor and sensory strategies group and the control group and close to statistical significance between the two intervention groups.4

 Positive balance outcomes were also observed in two other studies with dissimilar study designs using differing balance programs.3,6 DeBolt et al. conducted a pretest-posttest experimental group design of 37 subjects with balance assessments involving anterior and posterior sway (A/P sway), medial and lateral sway (M/L sway) and sway velocity.6 Subjects completed a home-based resistance exercise program for 8 weeks with 6 instructional sessions prior to the start of the intervention. Exercises for the intervention group involved chair raises, forward lunges, step-ups, heel-toe raises, and leg curls and were progressed in intensity, while the control group was asked to continue with their regular physical activity regimen.6 Freeman et al. examined the effects of an individual 8 week intervention of 2 sessions per week involving core stability exercises using a multi-centre series of 8 single case studies.3 Included in the intervention was a 15 minute home exercise program involving the same exercises. Exercises were not described in detail; however, they did vary in difficulty. Activation of the transverse abdominis was required in a neutral spine alignment prior to the initiation of each exercise.3 Investigators measured changes in balance using the forward and lateral reach.

 In both studies, balance outcomes did not reach statistical significance but did show improvements.3,6 The home exercise resistance program decreased A/P sway by 10.3% compared to a 6.4% increase in the control group. The control group also showed an increase in M/L sway by 9.4% compared to a decrease of 4.0% in the intervention group.6 Investigators looking at core stability exercises in the Freeman et al. study determined that there was a trend toward improvement (very close to statistical significance) in the forward reach and lateral reach of the 8 subjects.3 Four weeks after withdrawal of the intervention, the results of these outcome measures deteriorated.3

***Conclusions for*** ***Balance Rehabilitation without use of Animal Assisted Therapy:***

 Overall, for all four studies involving various methods of rehabilitation not using AAT, it appears that the RCT’s showed the most significant improvements in balance measures with the motor and sensory strategies intervention showing statistically significant improvements in the BBS, reported falls, and the DGI.4 Whereas the group exercise program with various components showing statistically significant improvements in the ABC scale.2 There were trends toward improvements seen in the home exercise resistance program with a pretest-posttest experimental design in A/P sway and M/L sway.6 Positive trends were also seen in the case-series of 8 subjects in forward and lateral reach using a one on one intervention focusing on core-stability. Rehabilitation without the use of AAT involving balance components may be beneficial on balance outcomes for people with multiple sclerosis.

***Balance Rehabilitation with use of AAT:***

 There are few studies investigating the effects that hippotherapy has on balance in people with MS. One study by Silkwood-Sherer et al. with a pilot pretest-posttest design investigated these effects compared to a control group (receiving no rehabilitation during the study) with MS using the BBS and the Tinetti Performance Oriented Mobility Assessment (POMA).5  Subjects completed an individually designed 14 week bout of hippotherapy one time per week for 30 minute sessions. Included in the intervention were components of changing direction, positioning, and gait of the horse after a 5 minute warm-up and before a 5 minute cool-down.5 Another study by Munoz-Lasa et al. compared 27 people in two groups using a similar design to a Cohort.7 Balance changes were examined after 10 weeks of hippotherapy one time per week for 30-40 minute sessions using the POMA and a global self-rated change.7 Sessions were also individually tailored and included exercises to challenge motor skills while maintaining balance and posture in all body positions while the horse walked.7 The control group completed traditional physical therapy with components of aerobic exercise, balance, strength, and flexibility.7

 Results from these two studies showed a statistically significant increase in balance for the intervention group on the POMA, with the Silkwood-Sherer et al. study reporting the most significant changes occurring between the pre-and mid-term tests (after 7 weeks of intervention).5 There were no statistical changes on the POMA for the control groups of each study. For the Munoz-Lasa et al. study, 9/12 patients in the intervention group declared slight improvement in balance on the global rating of change scale as compared to 3/14 declaring slight improvement in the control group receiving traditional physical therapy.7 An additional balance measure, the BBS, was tested in the Silkwood-Sherer et al. study and showed a statistically significant change. 5 This again was more significant between the pre and midterm testing periods. Between groups comparison showed no statistical differences between pretest scores or midterm scores. Statistical significance was seen between groups for the posttest Berg sores but not the for the POMA scores. 5

 Another study investigating the BBS is a single subject experimental design A-B-A performed by Hammer et al.8 This study examined the balance effects (among many other dependent variables) hippotherapy has on individuals with MS for 10 weekly sessions for 30 minutes each session.8 Again, the session were individually tailored to include trunk rotation, changing direction, trotting, and maintaining balance while hands are in the air, eyes closed, and lying prone on the horse.8 Measurements were taken during 3-4 weeks pre-treatment (phase A1), 10-11 weeks of intervention (phase B) and at 3-4 weeks post-treatment (phase A2). Like the Silkwood-Sherer et al. study, the BBS showed statistical improvements. From phase A1-B, 4 subjects showed statistical improvements and from phase A1-A2 five subjects showed statistical improvements.5 Qualitatively, balance improvements were seen in 8 subjects.5

 Lastly, Bronson et al. conducted a systematic review involving two of the previous mentioned studies by Hammer et al. and Silkwood-Sherer et al. and an additional study by MacKay-Lyons et al.1 MacKay-Lyons et al. conducted a pilot case series of 10 subjects participating in a biweekly 9 week hippotherapy intervention.1 The intervention included 30-45 minutes of arm/leg swing exercises, and trunk exercises while on the horse. No statistical significant improvements in the measurement of center of pressure measuring upright postural control were seen. Subjective improvements in balance during ADL’s were reported in only 4 patients.1 The review concluded that, based on the three studies, there is emerging yet limited evidence that hippotherapy can be used in the MS population to improve balance.1

***Conclusions for*** ***Balance Rehabilitation with use of Animal Assisted Therapy:***

 POMA and BBS scores showed statistically significant improvements when compared to a group participating in no therapy and a group participating in traditional physical therapy.5,7 Evidence for hippotherapy on balance impairments in people with MS is limited, but does display some positive results for its use in this population. More research is needed in this area.

***Limitations of the evidence:***

 Limitations can be seen in all of the studies. The hippotherapy studies (AAT) have limitations involving standardization of therapy, small sample sizes, and lack of randomization.1,5,7,8 The study by Hammer et al. discussed the ceiling values of their subjects possibly creating a ceiling effect with their outcome measures.8 The strength of the evidence is lacking in the hippotherapy studies due to the study designs (pilot study with comparison group, single subject experimental design), with the Munoz-Lasa et al. study being the most similar to a Cohort which provides stronger results.5,7,8 For a study not involving AAT by Learmonth et al., the sample size, wide range of balance, fatigue, and mobility problems of the participants, and the compliance of 71% was an issue.2 Small sample sizes were also seen in the studies by Freeman et al. and DeBolt et al.3,6 Catteano et al., the other RCT discussed possible ceiling effects decreasing the amount of improvement, low number of sessions, and the need for a follow-up assessment to strengthen their study.4

***Applying the evidence to clinical practice:***

 Each study has positive results in some form or another but the magnitude of the results differed quite a bit. This could be due to the assortment of intervention programs, the inclusion criteria, small sample sizes and variance in outcome measures. The majority of participants in all of the studies were female making it difficult to generalize to males with MS. The RCT by Catteano et al. did a good job at expanding their inclusion criteria across the spectrum of MS types.4 Participants were also able to stand independently in and upright position for more than 3 seconds, and walk for 6 meters with or without an assistive device (AD).4 The other RCT by Learmonth et al. included people that had a confirmed diagnosis of any form of MS, had an Extended Disability Status Scale of 5 (ambulatory without aid or rest for about 200 meters) to 6 (constant bilateral assistance required to walk about 20 meters without resting).2 DeBolt et al., a Cohort, also included adults with any form of MS and the ability to walk for 20 meters with or without an AD.6 Freeman et al. had similar inclusion criteria.3 For the studies with use of AAT, the inclusion criterion was similar. Each study allowed participants with any form of MS.1,5,7,8 One similarity of all hippotherapy studies is that none of the participants had previous riding experience.1,5,7,8

 The majority of participants in all of the studies (AAT and no use of AAT) had relapsing-remitting MS which is important to keep in mind when trying to generalize these results. When assigning a hippotherapy program to a patient with MS, assessing their level of mobility, access to a hippotherapy program, level of balance deficits, forms of payment (if insurance will pay or not), additional therapy needed in conjunction, level of disability, and psychological function are all important factors to consider. When assigning hippotherapy to a patient as a balance intervention, addressing these components will help to ensure that the person will benefit from the program.

***Improving the evidence:***

 After reviewing these articles, there is a clear gap in literature pertaining to hippotherapy as an intervention for balance for individuals with MS. The hippotherapy studies published had small sample sizes and variable programs. The study by Munoz-Lasa et al. was the only AAT study found with a control group that participated in alternate therapy that included aerobic, balance, strengthening, and flexibility exercises.7 Evidence for hippotherapy is emerging and these studies add to the evidence of its effectiveness. Beneficial research for the use of hippotherapy would include comparison groups to traditional or alternative therapies, larger sample sizes, randomization, and stronger study designs. Being able to compare to other studies that have been conducted with strong evidence will provide more conclusive results as to the effects hippotherapy has on balance for people with MS.

***Conclusions:***

 MS is a chronic condition that requires ongoing physical therapy to improve and adjust to functional mobility decline. Due to the variability of deficits seen in people with MS, individualized exercise programs consisting of components to better address functional needs are necessary to provide the most effective outcomes. Postural instability and balance can heavily affect mobility and adl’s in people with MS.5 Hippotherapy may be an option to address balance impairments for individuals with MS. It also may be a successful alternative to continue to maintain balance improvements once other programs have been completed. Determining the optimal length of a hippotherapy program is necessary to strengthen the evidence. Further research is required and should progress to stronger study designs with comparisons between hippotherapy and various programs without the use of AAT.

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