Does hippotherapy improve balance in persons with multiple sclerosis: a systematic review

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Aim. Multiple sclerosis (MS) leads to changes in balance due to the breakdown of a number of neurological processes. Hippotherapy utilizes the movement of the horse to provide sensory feedback and has been used as a therapeutic intervention for different neurological conditions. Little is known about the effects of hippotherapy in MS. The purpose of this study is to systematically review and examine the evidence for hippotherapy as an intervention to improve balance in persons with MS.

Methods. Major electronic databases were searched for articles relating to hippotherapy, MS and balance. Only full length articles published in peer reviewed journals that were written in English or translated into English were included. Articles were assessed using a modified quality index that was used for descriptive purposes only and did not exclude any study from the review. Results. All studies examined in this review were either case-control or case-series. Collectively all three studies reported improvements in balance. Pre-test and post-test Berg Balance Scale scores in two studies revealed that primary progressive MS demonstrated the greatest amount of change after hippotherapy compared to other subtypes of MS.

Conclusion. Hippotherapy has a positive effect on balance in persons with MS and has an added benefit of enhancing quality of life. The data is limited and further research will lead to a greater knowledge base and has the potential to increase accessibility for hippotherapy to be used as a rehabilitation modality.

KEY WORDS: Equine-assisted therapy - Multiple sclerosis - Postural balance - Review literature as topic.
physiological and psychosocial benefits, it can also be used as an active treatment modality designed to address specific impairments. Hippotherapy is a form of AAT that uses the horse as a modality to assist in attaining functional gains.

Hippotherapy uses the movement of the horse to promote a disassociation of the pelvis and trunk, which is thought to elicit righting and balance reactions. In contrast, therapeutic riding is a form of AAT where the primary goal is the development of riding skills. Historically, horseback riding has played an important role in society. However, it was only during the 1960s that it obtained prominence as a therapeutic intervention due to the work of a group of European physicians. Hippotherapy has since gained a worldwide following, as evidenced by the attendance of more than 1000 interested professionals representing 40 nations at the most recent international congress on therapeutic riding.

Hippotherapy has been used as a therapeutic intervention for a number of different neuromotor conditions including MS, spinal cord injury and cerebral palsy. A recent systematic review found hippotherapy to be an effective intervention aimed at improving hip and trunk stability and gross motor function, compared to “standard” therapy, in children with cerebral palsy. To our knowledge no literature review has been conducted on the effectiveness of hippotherapy in the treatment of balance problems in persons with multiple sclerosis.

Therefore, the purpose of this study is to systematically review and examine the evidence for hippotherapy as an intervention to improve balance in persons with MS.

Materials and methods

Our specific research question was “Does hippotherapy as an intervention improve balance in persons with MS?” The choice of electronic databases and search strategies was made in consultation with a senior medical reference librarian. The search strategy was designed to include a broad range of research regarding the effect of hippotherapy on balance in persons with MS. In July 2009 these databases were searched: MEDLINE (1950-2009), AMED (1985-2009), EMBASE (1947-2009), ERIC (1965-2009), Scopus (1841-2009), ISI Web of Science (1900-2009), CINAHL (1981-2009), PsychINFO (1806-2009), Science Direct (1823-2009) and PEDro (1929-2009) using these terms: hippotherapy, horse, riding, horseback riding, horseback riding therapy, equine movement therapy, equine assisted therapy, therapeutic riding, AND balance, postural balance, equilibrium, posture, postural reactions, postural sway, dynamic balance, AND multiple sclerosis. Search terms were entered into each database using either MeSH or keyword headings specific to the requirements of the database. A supplementary search of references in relevant articles was conducted and, where appropriate, authors of published and unpublished research were contacted for further information. In addition, the wider literature was searched for background purposes and for further investigation.

Articles for inclusion in the review were those published in peer-reviewed journals which addressed the terms of: hippotherapy, MS, and an outcome measure of balance. Only full length articles written in English or translated into English were included due to limited access to translation facilities. All study designs were considered for inclusion, from case-studies through to randomised controlled trials. Papers were excluded if they were completely unrelated (i.e., pharmacological) or were not full length published articles. Two members of the research team independently reviewed the titles, abstracts and if necessary full length articles, to identify possible studies for inclusion according to the predetermined selection criteria. Results were compared and if no consensus was reached a third reviewer was consulted.

A modified version of the Downs and Black quality index was used to provide information on the included articles. The original version of this index was designed to evaluate a range of research methodologies and has previously demonstrated high internal consistency and inter-rater reliability for non-randomised studies. A modified version of the original index has been used in recent reviews. A modified Downs and Black index using 23 of the 27 items was adopted in this review. Due to the varying number of questions used to assess each study, the most appropriate method of presenting quality assessment results was with a percentage score as previously published. In addition a second percentage was calculated by dividing the “yes” scores by all the items including non-applicable data. Two reviewers independently assessed study quality. Results were compared and discussed and if no consensus was reached a third
The electronic database search generated 13 articles relating to hippotherapy, balance, and MS (Figure 1). Three articles met the inclusion criteria and were quality assessed resulting in an average quality score of 83% (range 78-94) and are presented in Table I. The reviewer was consulted. The quality score was used for descriptive purposes only and did not exclude any study from the review.

**Results**

The electronic database search generated 13 articles relating to hippotherapy, balance, and MS (Figure 1). Three articles met the inclusion criteria and were quality assessed resulting in an average quality score of 83% (range 78-94) and are presented in Table I. The three articles included: a pilot case-control study, a single study experimental design type A-B-A and a pilot case-series study. A summary of the studies is presented in Table II.

Key data was extracted using an a priori template and, where possible, data were pooled for further analysis. The mean age for all participants (N=36) was 43.3 years (range 24-72) with a female to male ratio of 3:1 (27:9). All participants were diagnosed with MS by either a physician or a neurologist. The mean time since diagnosis reported in two studies was 11.47

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**Table I. Quality assessment scores.**

| Question | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | %* | %† |
|----------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Silkwood-Sherer et al. 2007 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 78 | 78 |
| Hammer et al. 2005 | 1 | 1 | 1 | N | 1 | 1 | 1 | 1 | N | 1 | 1 | 1 | 1 | N | 1 | 1 | 1 | N | N | N | 1 | 1 | 0 | 94 | 70 |
| MacKay-Lyons et al. 1988 | 1 | 1 | 1 | N | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | N | 1 | 1 | 1 | N | N | N | 1 | 0 | 78 | 61 |

All questions were scored on the following scale: yes=1, unable to determine=0, no=0, non-applicable=N. Percentages were calculated as follows %*: number of yes scores divided by all the applicable items, %†: number of yes scores divided by all items including non-applicable data.
In all studies participants were excluded if they were experiencing a relapse, and two studies excluded participants with previous riding experience. The mean time and duration for the hippotherapy intervention was 7.75 hours (range 5.0-13.5) over 11.2 weeks (range 9-14) respectively, and interventions were completed both outdoors and indoors. In
all studies, an experienced therapist (physiotherapist in two studies,\textsuperscript{29, 30} professional background not reported in the other \textsuperscript{31}) assessed the patient and formulated a treatment plan, while a trained riding instructor had control of the direction, pace and movement of the horse. All hippotherapy interventions included balance exercises while on the horse.

The Berg Balance Scale (BBS) is a valid and reliable outcome measure in the MS population,\textsuperscript{32} and was the common instrument used in the two most recent studies.\textsuperscript{29, 30} Silkwood-Sherer \textit{et al.}\textsuperscript{29} found a statistically significant change in the BBS scores in the intervention group (\(P=0.012\)), with the greatest change in BBS scores occurring from beginning to the midpoint (week 1-7) of the intervention (\(P=0.016\)). Hammer \textit{et al.}\textsuperscript{30} noted significant improvements in pre-test and post-test scores in 3 out of 11 patients. This study also included a non-specified qualitative component, which demonstrated balance improvement in eight patients. Combining the results of Silkwood-Sherer \textit{et al.}\textsuperscript{29} and Hammer \textit{et al.}\textsuperscript{30} involving BBS and type of MS, it was noted that the highest initial BBS scores were reported for patients with relapsing remitting multiple sclerosis (RR-MS). Patients with primary progressive multiple sclerosis (PP-MS) reported the lowest initial BBS scores and also demonstrated the greatest change pre-test to post-test BBS score following hippotherapy.

An additional balance outcome measure used by Silkwood-Sherer \textit{et al.}\textsuperscript{29} included the Performance Oriented Mobility Assessment, which demonstrated statistical improvement (\(P=0.006\)). Hammer \textit{et al.}\textsuperscript{30} also incorporated the Timed up and Go and Walking Figure of 8, while MacKay-Lyons \textit{et al.}\textsuperscript{31} used a computerised force platform that measured centre of pressure displacement to analyse postural sway. The above outcome measures did not reach the level of statistical significance.

**Discussion**

The purpose of this review was to identify the effectiveness of hippotherapy as an intervention for balance in persons with MS. Based on three studies which met the a priori inclusion criteria there is emerging, but limited, evidence that balance can be improved by using hippotherapy as an intervention in the MS population.

Collectively all three studies reported improvements in balance. Silkwood-Sherer \textit{et al.}\textsuperscript{29} reported significant improvements in BBS scores for the intervention group. Hammer \textit{et al.}\textsuperscript{30} found significant improvements in 3 out of 11 patients using the BBS and, when a qualitative measure was added to the analysis, balance improvements were reported in 8 patients. In contrast, MacKay-Lyons \textit{et al.}\textsuperscript{31} using a computerised force platform, found a non-significant trend towards decreasing postural sway. This differs from the other studies as this technique is a measure of static balance, and therefore could not be directly compared to the other studies as it did not include the BBS. However, it should be noted that this study was published prior to the development of the BBS.\textsuperscript{35}

Further exploration of the data from two studies\textsuperscript{29, 30} allowed analyses of sub-types of MS, using the BBS as the common outcome measure. A comparison between type of MS and pre- and post-test BBS scores revealed that persons with PP-MS showed the greatest change after hippotherapy. PP-MS baseline scores are typically lower\textsuperscript{34} and, therefore, may have had a greater opportunity to improve. RR-MS demonstrated the highest pre-test BBS scores, which limited potential for quantifiable improvement, suggestive of an apparent ceiling effect.

Despite the broad search strategy only three articles met the inclusion criteria.\textsuperscript{29-31} Our findings are typical of hippotherapy research as it has been limited due to small sample sizes, lack of standardised outcome measures, and results reported in non-peer reviewed journals.\textsuperscript{35} There were a number of studies that did not meet the inclusion criteria of English full length articles as they were of European origin and published in other languages.\textsuperscript{36-39} However, from the English titles and abstracts they appeared to be relevant and thus warrant further investigation. The articles included in the systematic review were of moderate/high quality when analysed using a modified quality index score.\textsuperscript{25} All papers examined in this review were either case-control or case-series studies, which at best would correspond to 2b level of evidence based on the classification proposed by Sackett \textit{et al.}\textsuperscript{40}

There were many limitations of the included articles. Sample sizes were small (\(N≤11\)) and patients were not randomly selected, which is important due to the variable nature of MS. The ceiling effect of the BBS may have limited statistically significant changes in balance. All studies indicated if patients had previous riding experience. An experienced rider may be less influenced by the activity, resulting in a smaller change.
Hippotherapy is a multi-modal therapeutic approach targeting all levels of the International Classification of Function, Disability and Health (ICF), and thus is of relevance to the rehabilitation of persons with MS. Hippotherapy uses the natural movement of the horse approximating human gait to integrate sensory and motor systems required for balance. In addition to addressing this dimension, the model also encourages treatment at the activity and participation levels. Hippotherapy gains may promote activity by increasing balance and enhancing the ability to complete activities of daily living. Hippotherapy also promotes participation by offering an alternative activity to individuals with MS with limited mobility, and has the added benefit of providing a recreational dimension. The psychosocial benefits of hippotherapy/therapeutic riding have been well documented. Psychosocial outcomes were included in two of the studies of this review to highlight improvements in health related quality of life. Additionally, these studies reported high compliance rates which corresponds to a measure of participation as viewed within the ICF framework.

There were several limitations to this review, most notably our strict inclusion criteria of English full length articles published in peer reviewed journals. Our search strategy revealed articles published in languages other than English, and detailed hand searching revealed congress proceedings that did not meet our inclusion criteria but could potentially add to the knowledge base of hippotherapy. As our included selection of articles was small there is the possibility that the overall results may have been underestimated. A future systematic review that encompasses all research including those articles not published in English may produce further evidence supporting the use of hippotherapy as an intervention in persons with MS.

Further research is required to investigate hippotherapy as a rehabilitation modality for patients with MS. Suggestions for improvement include larger sample sizes, randomisation of participants, control groups, and a longer follow up period due to the natural fluctuation of the disease. Research regarding the use of a standardised treatment protocol is needed to reveal the optimal length of intervention. The balance outcome measure selected should be sufficiently sensitive to detect change across a wide spectrum of impairments to decrease the likelihood of a ceiling effect. This would also allow potential pooling of data for future reviews. Comparison between hippotherapy and other treatments aimed at improving balance has the potential to influence policies and practices in the rehabilitation of persons with MS.

Conclusions

Hippotherapy has a positive effect on balance in persons with MS and has an added benefit of enhancing quality of life. The data is limited and further research will lead to a greater knowledge base, and has the potential to increase accessibility for hippotherapy to be used as a rehabilitation modality.

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