Evidence Table Liz Waddell

PICO question: In patients age 30-50 with multiple sclerosis and impaired balance, are interventions to improve postural control more effective in decreasing falls risk than resistance exercise?

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| **Author****(Year) & Study Design** | **Study Purpose**  | **Participants** | **Intervention** | **Outcomes/Results** | **Author Conclusions** | **Clinical Relevance** |
| Hayes HA, Gappaier E, LaStayo PC, et al.(2011)RCT | Assess effectiveness of high-intensity LE resistance training in addition to a standard exercise program versus the standard exercise program only on LE strength, mobility, balance, and fatigue.  | 8 men and 11 women with MS. Mean age 49.Ambulatory with or without assistive device. | Exercise 3x/week, 45-60min, 12 weeksTreatment group: High-intensity resistance training on a recumbent stepper with pedal cadence 15-20rpm in addition to a standard exercise protocol.Control: Standard exercise - aerobic training on NuStep, stretching of LE muscle groups, UE resistance exercise, balance exercises on wobble board and compliant surfaces. | BBS scores increased by 1.3 vs 6 points in the treatment and control group, respectively. Mobility (stair ascent and descent time) improved in the control group, but decreased in the treatment group. Strength increased 15% vs 2% in the treatment and control group, respectively.Fatigue improved in both groups | High-intensity resistance training did not result in significant improvements in strength, and was not as effective as standard exercise alone for improving stair ascent/descent ability or balance in this group of individuals with MS.The treatment intervention has shown better outcomes in other neurodegenative diseases than was seen in this study. As such, research for other conditions may not be generalizable to MS. | The raw data shows a lot of variability in outcomes including sizeable improvements for all outcomes in both groups. This supports exercise in general for MS. Interventions need to be customized to meet the needs of each patient.  |
| Hogan N, Coote S. (2009)Literature Review | Assess current published literature evaluating all types of interventions for people with MS (PwMS) with an expanded disability status scale (EDSS) score >/= 6. | 12 studies of adults with moderate to severe MS. EDSS >=6. | PT interventions (n=4) 1) balance rehabilitation (motor & sensory strategies) vs balance rehab (motor strategies) vs conventional therapy 2) Bobath concept PT 3) facilitation based vs functional task oriented intervention 4) task oriented approach vs facilitation techniques (NDT). Aerobic exercise (n=4) 1) supervised treadmill training vs control 2&3) bicycle ergometry vs control 4) bicycle ergometry vs PT neuro-physiology based interventionResistance exercise (n=2)1) home-based progressive resistance training vs control 2) weighted leg exercise vs mobility and balance exercise vs control Other (n=2) 1) body weight support treadmill training (BWST) 2) yoga vs aerobic exercise | PT interventions - Improved balance and mobility in all treatment groupsAerobic exercise - No effect on balance and mobility, but other positive benefitsResistance training - 23% increase in transfer speed in one study, no other balance or mobility benefitsOther - Improved balance and mobility with treadmill training. No effect for yoga.  | The optimal type, frequency and duration of intervention for the MS population remains unclear. | This study supports the general effectiveness and safety of exercise for MS. Also provides evidence in favor of applying the principle of specificity to interventions. |
| Jackson K, Edginton-Bigelow K, Cooper C, et al. (2012)Single group repeated measure | Evaluate the feasibility of a 5-week group kickboxing program to measure changes in balance, mobility, and quality of life in individuals with MS associated with training. | 11 people with MS age 28-62. 9 female, 2 male. EDSS 1.0-6.5. Ambulatory with or without assistive device. | Kickboxing 1 hr, 3x/week for 5 weeks5-10min warm-up and cool downAlternate 2-3min of activity and 2-3min of rest.Weeks 1-2: common punches progressed by adding gloves and mitts/bags as targetsWeeks 3-5: kicks and kneeing movements added, progressed similarly with participants also holding targets for each other All subjects wore a safety harness. Exercise limited to 5/10 on the Borg scale. 3 instructors - avg 15 years martial arts and Muay Thai kickboxing experience | Significant improvement for gait speed, TUG, MiniBEST, DGI and ABC.No signficant change for BBS or MSQOL-54Larger improvements for EDSS >=6.0 | With proper screening and precautions, kickboxing is safe and feasible in a community setting. Following a training, participants demonstrated improvements in a variety of measures of balance and mobility but no improvements in quality of life. Group kickboxking appears to be a novel activity that may influence multiple domains of balance and mobility and may warrant further investigation. | This study provides support for sports-inspired and functional/athletic interventions for patients with MS. |
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| Nilsgard YE, Forsberg AS, von Koch L. (2012)RCT | Evaluate the effects of a 6-7 week Nintendo Wii Fit balance exercise programme on balance performance and walking ability in people with MS compared to no exercise. | 10 men and 32 women with MS in each group. Subjective report of impaired balance function in standing or walking. Ability to walk 100m without rest. | Wii Exercise: Individual PT-supervised sessions of 30 min of balance exercise using Nintendo Wii Fit Plus twice a week for 6-7 weeks for a total of 12 sessions. The first session started with what easier games: penguin slide, ski slalom, perfect 10, heading, table tilt. At subsequent sessions, progression to more difficult games were encouraged. Participants could choose the games they enjoyed most. The progression within each game was the default for the gaming system Control group: No exercise  | No significant differences between groups. Wii exercise: large effect sizes for FSST, DGI, MSWS-12 and also improvement in Cognitive TUG and Timed Chair Stand.Control group: Significant improvement in FSST and DGI. Note: Some contamination may have occured. Participants in the control group reported increased motivation to exercise when not allocated to the Wii group.  | In comparison with no intervention, a program of supervised balance exercise using Nintendo Wii Fit presented moderate effect sizes for several measures of balance performance. A combination of the Wii Fit as home exercise and supervised PT may be a future approach to consider. | Improvement in the TUG cognitive, TCS, and MSWS-12 were specific to the exercise group indicating that the Wii games impacted dual task and functional mobility, and gains transferred to self-reported walking ability |
| Debolt LS, McCubbin JA. (2004)Cross- sectional | To examine the effects of an 8-week home-based resistance exercise program on balance, power, and mobility in adults with multiple sclerosis. | 29 women, 8 men, mean age 51, EDSS 1.0-6.5. Able to walk 20m without rest. | 6 exercises instruction sessions in 2 weeks. 8 weeks of home exercise:5-10min warm-up of walking and stretching. Chair raises, forward lunges, step ups, heel and toe raises, leg curls. 5-10 min of whole body stretching.Progression of exercises on a weekly schedule. Participants wore a weighted vest with increased weight each week. Bimonthly home visits and weekly calls from researcher. | Exercise vs. Control:Balance - Change in AP sway: -10.3% vs 6.4%; Change in ML sway: -4.0% vs 9.4%; Change in sway velocity 2.5% vs 25.1%Power - Improved leg power 37.4% vs 6.7%Mobility - Decreased Up and Go Test 12.7% vs 1.0%Only the within group leg power improvement for the exercise group is statistically significant. | This resistance-training intervention was implemented without injury or increases in MS symptoms. The results indicate that participants were compliant with the home-based resistance program, and the program improved lower-extremity power in a short period of time. | Balance, mobility, and power can be improved in persons with MS.  |
| Cattaneo D, Jonsdottir J, Regola A. (2007)RCT | To evaluate the effects of balance retraining in a population of people with multiple sclerosis with two different ways of improving balance, one focused purely on motor retraining and the other on an integrated sensory motor retraining | Inpatient rehab patients: 13 men, 31 women, mean age 46, time since MS diagnosis mean 13.8 yrs, 15 used assistive devices.Inclusion criteria: MS - RRMS, SPMS, PPMS; ability to stand independenty for more than 3 seconds, maximum BBS score of 53, ability to walk 6m with or without AD. | 10 to 12 sessions, 45 min sessions, over 3 weeks.Group 1: balance rehabilitation to improve motor and sensory strategies. Group 2: Task-oriented balance rehab to improve motor strategies and not specifically sensory strategies.Group 3: "Conventional therapy" not directly aimed at improving balance impairments.Motor strategies: ankle strategy, limits of stability, axial and postural anticipatory strategies, gait trainingSensory strategies: Compensation and habituation of most impaired system. Tasks with head and eye movements added. | BBS significant difference between groups 1 & 3 and between groups 2 & 3.DGI significant difference between groups 1 & 3, near significant for 2 & 3.Reduction in number of patients reporting falls were significant for all groups.Difference between pre and post scores for group 1 vs 2 vs 3:BBS: 6.7 vs 4.6 vs 0.8DGI: 3.85 vs 1.06 vs 1.75ABC: 2.32 vs 12.55 vs 0.90DHI: 4.87 vs 2.29 vs -2.17Number of patients reporting falls in prior month:Pre - 8 vs 5 vs 6 and Post - 1 vs 1 vs 3 | Balance rehabilitation appeared to be a useful tool in reducing the fall rate and improving balance skills in subjects with multiple sclerosis. Exercises in different sensory contexts may have an impact in improving dynamic balance. | Balance rehabilitation may have a positive effect on subjects with MS. Exercises carried out in different perceptual conditions appeared to be important in improving dynamic balance. Balance rehabilitation should be included in a multidimensional approach aimed at reducing a subject's level of handicap. |
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| Jackson K, Mulcare JA, Donahoe-Fillmore B, et al. (2007)Cross-sectional | To investigate the effects of a multidimensional home exercise program on balance in individuals with MS. | 5 male, 9 female, mean age 50.4, EDSS 4.3 (1.5-6.5), time since MS diagnosis 9.5yr.Able to ambulate 10m independently, maintain static balance for 5 minutes, not participating in a regular balance or strengthening program | 3x/week for 6 weeks. Most exercises were performed seated or standing in a corner with a chair place in front of the subject. Exercises: Standing with eyes closed, tossing ball between hands, standing with head movement, marching in place, visual fixation on stationary target with head movement, eye movement between stationary targets, ankle sways, partial squats, heel raises and toe raises, anterior chest and gastroc stretch.Subjects were called during weeks 1,3, and 5 to advance the exercises. Progressions included narrowing stance and standing on 3" foam. | % change in pre to post scores:\*BBS 12.3%Sensory Organization Test: Eyes open (EO) 1.1%Eyes closed (EC) 9.0%EO sway-referenced visual surround (SV) 1.0%\*EO on a moveable sway-referenced surround (EO/SS) condition 6.0%\*EC with sway-referenced surround (EC/SS) 32.4%EO with a sway-referenced visual surround and movable sway-referenced surface (SV/SS) 32.4%.\*Composite SOT 12.2%Limits of stability:Movement velocity 0.0 deg/s\*Max excursion 8.9%\*Endpoint excursion 13.7%Directional control 7.2%\*significant improvement | A multidimensional home exercise program can improve some measures of balance in people with MS who have varying levels of disability. A home training program is safe and feasible. | For motivated patients, a home balance training program is effective at improving balance and reducing falls risk.The exercises are generally simple to perform and safe, they would be easy to replicate and teach to patients.  |
| Romberg A, Virtanen A, Ruutiainen J(2005)RCT | Determine if a 6 month exercise program effects functional impairment and/or health-related quality of life in people with mild to moderate MS. | 114 subjects with MS in an inpatient rehab setting (95 included in statistical analysis).30-55 yearsEDSS 1.0 to 5.5 | Exercise group:Weeks 1-3: inpatient rehabilitation program with supervised training, 5 resistance training sessions and 5 aerobic training sessions.Weeks 4-26: HEP - resistance training 3-4x/week and aerobic training 1x/week. Participants periodically contacted by phone and kept an exercise journal.Control group: No intervention | Exercise group:Significantly improved their MSFC score including the T25FWT component of the MSFC. No significant change in disability was seen from the FIM, in health realted QOL from the MSQOL-54, or in depression seen from CES-D.Control group: MSFC score decreased. | The resistance training program focused on limb strengthening, and task-specific training resulted in positive functional outcomes. | Task-specific home exercise programs that focus on lower extremity strengthening can result in improved gait speed in people with mild to moderate MS. Gait speed is correlated to falls risk, so it can be inferred that this intervention also reduces falls risk. |

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