

## Multiple Sclerosis Annotated Bibliography

**Armutlu, K., Karabudak, R., & Nurlu, G. (2001). Physiotherapy approaches in the treatment of ataxic Multiple Sclerosis: A pilot study. *NeuroRehabilitation and Neural Repair, 15*(3), 203-211.**

**Brown, T., & Kraft, G. (2005). Exercise and rehabilitation for individuals with Multiple Sclerosis. *Phys Med Rehabil Clin N Am, 16*, 513-555.**

**Cattaneo, D., Jonsdittor, J., Zocchi, M., & Regola, A. (2007). Effects of balance exercises on people with Multiple Sclerosis: A pilot study. *Clinical Rehabilitation, 21*, 771-781.**

Objective: To evaluate the effects of balance retraining in a sample of people with multiple sclerosis. Design: Randomized controlled trial. Setting: Rehabilitation unit. Subjects: A consecutive sample of 44 subjects was randomized into two experimental groups and one control group. The inclusion criteria were: ability to stand independently more than 30 seconds, ability to walk for 6m. Interventions: Group 1 received balance rehabilitation to improve motor and sensory strategies. Group 2 received balance rehabilitation to improve motor strategy. Group 3 received treatments not specifically aimed at improving balance. Main outcome measure: Berg Balance Scale, Dynamic Gait Index and fall frequency were used to assess balance impairments. Dizziness Handicap Inventory and Activities-specific Balance Confidence were used to assess handicap and the level of balance confidence. Results: Frequency of falls post treatment was statistically different among groups ( $P=0.0001$ ); The Berg Balance Scale showed an overall statistically significant difference ( $P=0.0008$ ) among groups. Change pre-post scores were 6.7, 4.6 and 0.8 points for groups 1, 2 and 3. Dynamic Gait Index showed an overall near statistically significant difference among groups ( $P=0.14$ ), with change pre-post scores of 3.85, 1.6 and 1.75 points for groups 1, 2 and 3; after the exclusion of drop-outs a statistically significant difference was observed ( $P=0.04$ ). The self-administered tests (Activities-specific Balance Confidence and Dizziness Handicap Inventory) did not show clinically relevant improvements. Conclusions: 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.

**Cattaneo, D., Jonsdittor, J., & Repetti, S. (2007). Reliability of four scales on balance disorders in persons with Multiple Sclerosis. *Disability and Rehabilitation, 29*(24), 1920-1925.**

**Cattaneo, D., Regola, A., & Meotti, M. (2006). Validity of six balance disorders scales in persons with Multiple Sclerosis. *Disability and Rehabilitation, 28*(12), 789-795.**

Purpose. The aim of this study was to test concurrent and discriminant validity of several tests of static and dynamic balance in a sample of subjects suffering from MS. Method. A group of 51 patients were enrolled in the

study. The following tests were administered: Berg Balance Scale (BBS), Timed Up and Go Test (TUG), Dynamic Gait Index (DGI), Hauser Deambulation Index (DI), Dizziness Handicap Inventory (DHI), and Activities-specific Balance Confidence (ABC). The scales used in this study were initially translated into Italian. Results. The sample of subjects reported a mean of 0.98 (1.8 SD) falls in the month prior to evaluation. The tests demonstrated good concurrent validity: Higher correlation coefficients among tests tapping the same aspect and lower correlation coefficients among tests tapping slightly different aspects. ABC and DHI tests discriminated better than the others between fallers and non-fallers and appeared the best predictors of fall status. BBS and DGI were not as efficient in discriminating between groups. Conversely all tests showed good difference validity in the prediction of patients who used an assistive device.

**DeBolt, L., & McCubbin, J. (2004). The effects of home-based resistance exercise on balance, power, and mobility in adults with Multiple Sclerosis. *Arch Phys Med Rehabil, 85, 290-297.***

**Objective:** To examine the effects of an 8-week home-based resistance exercise program on balance, power, and mobility in adults with multiple sclerosis. **Design:** Experimental group design. **Setting:** General community. **Participants:** Twenty-nine women (age, 50.3<sub>-8.5y</sub>) and 8 men (age, 51.1<sub>-7.1y</sub>) were stratified by disability level and age and were randomized into exercise (n<sub>19</sub>) and control (n<sub>17</sub>) groups. **Intervention:** The exercise group had lower-extremity resistance training 3 times a week. The control group maintained current level of physical activity. **Main Outcome Measures:** Primary outcome measures included balance, as measured by anteroposterior sway, mediolateral sway, and sway velocity using the AccuSwayPLUS force platform; mobility as assessed with the Up and Go test; and leg power as assessed with the Leg Extensor Power Rig. **Results:** Leg extensor power improved significantly in the exercise group (pretest, 3.19<sub>-1.36W/kg</sub>; posttest, 3.95<sub>-1.23W/kg</sub>; *P*\_.004), although measures of balance and mobility did not change. **Conclusions:** The home-based resistance program was well tolerated by participants and offered a practical means to improve leg extensor power in a short period of time.

**Finlayson, M., Peterson, E., & Cho, C. (2006). Risk factors for falling among people aged 45 to 90 years with Multiple Sclerosis. *Arch Phys Med Rehabil, 87, 1274-1279.***

**Objective:** To determine the factors associated with an increased likelihood of reporting a fall in the past 6 months among people between the ages of 45 and 90 who have multiple sclerosis (MS). **Design:** Cross-sectional descriptive design by using telephone surveys. **Setting:** States of Minnesota, Wisconsin, Illinois, Indiana, and Michigan. **Participants:** Total of 1089 people with MS identified through the National Multiple Sclerosis Society and the MS registry maintained by the North American Research Committee on Multiple Sclerosis. **Interventions:** Not applicable. **Main Outcome Measure:** Self-reported fall to the ground in the past 6 months. **Results:** Exactly 52.2% of participants reported a fall in the past 6 months. Factors associated with an increased risk of a fall included being male, fear of falling, variable or deteriorating MS status in the past year, never or occasional use of a wheelchair, problems with balance or mobility, poor concentration or forgetfulness, and incontinence of bladder. **Conclusions:** There are a number of factors associated with an increased risk of falling among people aging with MS that are amenable to intervention and therefore warrant the attention of health care providers serving that population.

**Fulk, G. (2005). Locomotor training and virtual reality-based balance training for an individual with Multiple Sclerosis: A case report. *Journal of Neurological Physical Therapy, 29(1), 34-42.***

**McConvey, J., & Bennet, S. (2005). Reliability of the dynamic gait index in individuals with Multiple Sclerosis. *Arch Phys Med Rehabil*, 86, 130-133.**

ABSTRACT. McConvey J, Bennett SE. Reliability of the Dynamic Gait Index in individuals with multiple sclerosis. *Arch Phys Med Rehabil* 2005;86:130-3. **Objectives:** To determine if the Dynamic Gait Index (DGI) is a reliable tool for assessing balance in people with multiple sclerosis (MS) and to determine the validity of the DGI by using the 6.1-m timed walk. **Design:** Instrument reliability test: physical therapists viewed a videotape of 10 subjects with MS performing the DGI and scored their gait by using DGI criteria. Two weeks after the first session, therapists' viewed the videotape again and scored subjects' gait to establish interrater reliability. **Setting:** Hospital-based outpatient rehabilitation clinic. **Participants:** Eleven physical therapists and 10 people with MS. **Interventions:** Not applicable. **Main Outcome Measures:** Total DGI scores and each of the 8 DGI items were compared between and within raters (physical therapists). Time to walk 6.1m was compared with the total DGI score to examine concurrent validity. **Results:** Interrater reliability for total DGI scores was .983, with each of the 8 items ranging from .910 to .976 (intraclass correlation coefficient,  $P_{.05}$ ). Intrarater reliability for total DGI scores ranged between .760 and .986 (Pearson bivariate analysis,  $P_{.05}$ ). An inverse relationship of  $-.801$  (Pearson bivariate analysis,  $P_{.01}$ ) existed between the total DGI scores and the 6.1-m walk. **Conclusions:** The DGI is a reliable functional assessment tool that correlated inversely with timed walk, showing its concurrent validity.

**Nieuwenhuis, M., Van Tongeren, H., Sorensen, P., & Raunborg, M. (2006). The six spot step test: A new measurement for walking ability in Multiple Sclerosis. *Multiple Sclerosis*, 12, 495-500.**

**Paltamaa, J., Sarasoja, T., Leskinen, E., Wikstrom, J., & Malkia, E. (2007). Measures of physical functioning predict self-reported performance in self care, mobility, and domestic life in ambulatory persons with Multiple Sclerosis. *Arch Phys Med Rehabil*, 88, 1649-1657.**

ABSTRACT. Paltamaa J, Sarasoja T, Leskinen E, Wikström J, Mälkiä E. Measures of physical functioning predict self-reported performance in self-care, mobility, and domestic life in ambulatory persons with multiple sclerosis. **Objective:** To determine the associations between clinically measured physical functioning variables and self-reported performance in mobility, self-care, and domestic life in ambulatory persons with multiple sclerosis (MS), using the *International Classification of Functioning, Disability and Health* (ICF) as a framework. **Design:** Survey study. **Setting:** Community setting in Finland. **Participants:** A population-based sample of 120 ambulatory persons with MS (30 men, 90 women) with mean age 45.0\_10.8 years (range, 20–71y), mean disease duration from symptom onset 12.3\_8.8 years (range, 1–39y), and mean Expanded Disability Status Scale 2.8\_2.0 (range, 0–6.5). **Interventions:** Not applicable. **Main Outcome Measures:** The primary dependent variables were self-reported performance in self-care, mobility, and domestic life from the Functional Status Questionnaire. The physical functioning variables were drawn from the ICF activities (n\_9) and body functions (n\_14) categories. Age- and sex-adjusted odds ratios from multinomial logistic regression were estimated for the physical functioning variables associated with activities of daily living (ADL) performance. **Results:** Overall, of this cohort 31% reported difficulties or dependence in self-care, 52% in mobility, and 68% in domestic life. The most significant predictors of perceived difficulties or dependence in ADL performance were: (1) lower scores in the Box and Block Test; (2) lower Berg Balance Scale scores; (3) greater velocity moment when standing with eyes open; (4) slower ten-meter walk test times and shorter stride length at normal speed; and (5) shorter distance in the six-minute walk test.

**Conclusions:** Perceived difficulties and dependence were most prominent in domestic life. In particular, measures of activities predicted difficulties in ADL performance. Monitoring of physical functioning should be extended to those independent MS persons reporting difficulties in ADL performance.

**Peterson, E., Cho, C., & Finlayson, M. (2007). Fear of falling and associated activity curtailment among middle aged and older adults with Multiple Sclerosis. *Multiple Sclerosis, 13*, 1168-1175.**

**Romberg, A., Virtanen, A., Ruutiainen, J., Aunola, S., Karppi, S., Vaara, M., Surakka, J., Pohjolainen, T., & Seppanen, A. (2004). Effects of a 6-month exercise program on patients with Multiple Sclerosis. *Neurology, 63*, 2034-2038.**

**Abstract—Objective:** To improve walking and other aspects of physical function with a progressive 6-month exercise program in patients with multiple sclerosis (MS). **Methods:** MS patients with mild to moderate disability (Expanded Disability Status Scale scores 1.0 to 5.5) were randomly assigned to an exercise or control group. The intervention consisted of strength and aerobic training initiated during 3-week inpatient rehabilitation and continued for 23 weeks at home. The groups were evaluated at baseline and at 6 months. The primary outcome was walking speed, measured by 7.62 m and 500 m walk tests. Secondary outcomes included lower extremity strength, upper extremity endurance and dexterity, peak oxygen uptake, and static balance. An intention-to-treat analysis was used. **Results:** Ninety-one (96%) of the 95 patients entering the study completed it. Change between groups was significant in the 7.62 m ( $p = 0.04$ ) and 500 m walk tests ( $p = 0.01$ ). In the 7.62 m walk test, 22% of the exercising patients showed clinically meaningful improvements. The exercise group also showed increased upper extremity endurance as compared to controls. No other noteworthy exercise-induced changes were observed. Exercise adherence varied considerably among the exercisers. **Conclusions:** Walking speed improved in this randomized study. The results confirm that exercise is safe for multiple sclerosis patients and should be recommended for those with mild to moderate disability.

**Silkwood-Sherer, D., & Warmbier, H. (2007). Effects of hippotherapy on postural stability in persons with Multiple Sclerosis: A pilot study. *JNPT, 31*, 77-84.**

**Soyuer, F., Mirza, M., & Erkorkmaz, U. (2006). Balance performance in three forms of Multiple Sclerosis. *Neurological Research, 28*, 555-562.**

**White, L., & Dressendorfer, R. (2004). Exercise and Multiple Sclerosis. *Sports Medicine, 34(15)*, 1077-1100.**

