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Effectiveness of Group Kickboxing as a Means to Improve Gait and Balance in Individuals with MS

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Poster Abstracts from the First International Symposium on Gait and Balance in Multiple Sclerosis

Gait and Balance as Biomarkers in MS

Oregon Health & Science University • Portland, Oregon, USA • October 1, 2011

(1) TESTING A COMPUTERIZED METHOD OF ASSESSING MOVEMENT ACCURACY

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Objectives: Computerized games challenge players to move quickly and accurately, but result in game-specific scores rather than objective data. Newly developed AccuTrak software with Wii technology can challenge players to move a cursor to an on-screen target using hands or feet, but also record data that might help document coordination deficits in people with disabilities. Our purpose was to examine the reliability and validity of this method. **Methods:** Thirty-six healthy adults and nine people with multiple sclerosis (MS) used a Wii device to move a cursor and click on the center of a target appearing on a computer screen. AccuTrak software provided feedback after each set of 6 trials regarding a) the time from target appearance to click, and b) distance from the target center. Each hand performed 30 trials; each foot performed 36 trials. Time and distance data were compared left-right and hand-foot, and to self-reported movement accuracy from the Movement Ability Measure as analyzed using item response theory methods. **Results:** Intraclass correlation coefficients (ICCs) time and distance data were 0.66 and 0.90, respectively, between dominant and non-dominant hands; between hand and foot performances ICCs were 0.70 and 0.94. The correlation between objective data and logit estimates of self-reported ability to move accurately was -0.53 for time and 0.21 for distance. The time-distance relationship fit a power trendline with R^2 equal to 0.80 for healthy volunteers; volunteers with MS did not fit the same trendline. **Conclusions:** Reliability was better for distance data; concurrent validity with self-report was better with time data. Construct validity was supported in the observance of Fitts' Law with speed-accuracy trade-off in healthy volunteers; people with MS tended to have increased error even with longer times. The methodology shows promise for use when investigating coordination deficits such as those in people with multiple sclerosis.

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(2) VALIDITY OF THE DYNAMIC GAIT INDEX IN PEOPLE WITH MULTIPLE SCLEROSIS

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Purpose: To investigate concurrent validity between the Dynamic Gait Index (DGI) and measures of physical mobility and to test whether the DGI differentiates between fallers and nonfallers. **Participants:** A total of 64 individuals with multiple sclerosis (MS) were assessed. Their mean age was 50 years (SD 12 years). Forty-six individuals (72%) were female. The mean time since diagnosis was 12 years. Nine individuals used an assistive device for walking indoors, and 31 used an assistive device outdoors. Inclusion criteria were being able to walk 100 m indoors with assistance. **Methods:** The DGI consists of eight tasks including the following: walking while changing speed, walking with head turns, pivoting, walking over and around obstacles, and stair climbing. The performance is rated from 0 to 3, with higher scores indicating normal ability. The other measures were the Timed Up and Go (TUG) test, Timed 25-Foot Walk test (T25FW), Four Square Step Test (FSST), and timed stands (the time needed to rise ten times from a chair). The number of falls 4 weeks before the assessment was registered. **Analysis:** The Spearman correlation coefficient was used to estimate correlations between the DGI and the other measures. The Mann-Whitney U test was used to determine group differences between fallers and nonfallers. **Results:** The total score of the DGI was a mean of 17.3 (SD 4.7). The correlations were significantly moderate to high between the DGI and the TUG ($r = -0.77$), T25FW ($r = -0.78$), FSST ($r = -0.79$), and timed stands ($r = -0.75$). Twenty-one individuals (33%) reported one or more falls. There was a significant difference ($P = .027$) between DGI scores for fallers (15.7 [SD 4.0]) and nonfallers (18.1 [SD 4.8]). **Conclusions:** The DGI has good concurrent validity with other measures of physical mobility. It may be useful for evaluating dynamic balance in ambulatory people with MS. The DGI discriminated between fallers and nonfallers, but further studies are needed evaluating the DGI as a predictor of falls.

(3) CHANGES IN VISION, BALANCE, GAIT, AND DIZZINESS WITH BALANCE-BASED TORSO-WEIGHTING: A CASE REPORT ON A WOMAN WITH MULTIPLE SCLEROSIS

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Background: Dizziness, loss of vision, and balance and gait problems are common symptoms of multiple sclerosis (MS). The immediate results of Balance-Based Torso-Weighting (BBTW) on vision, gait, balance, and sensory organiza-

tion tests (SOTs) using the NeuroCom BalanceMaster are reported. Dizziness Handicap Inventory (DHI) scores after 1 month are included. **Case Description:** A 49-year-old female with a 9-year history of MS (Expanded Disability Status Scale score, 4.5–5 equivalent) exhibited impaired gait, motor function, and standing balance with visual tracking. She reported significant dizziness. Patient goals were to improve walking, balance, and dizziness. **Assessment:** The patient received a BBTW assessment and was fit with a strategically weighted BalanceWear orthotic with one and three-quarters pounds placed specifically for her loss of balance to perturbations and challenges to static balance control. Due to balance loss observed during visual tracking, she received an optometric evaluation of visual function, refraction, and eye health before and after donning the orthotic. Balance and mobility tests were performed under the same situation. **Treatment:** Immediately after the assessments, the only treatment provided was the patient's wearing the balance orthotic 8 hours per day and performing prescribed optometric vision therapy twice per day. **Outcomes:** Same-day improvements in vision, balance, and gait were found. Visual changes included normalized horizontal and vertical pursuits and improved convergence, eye alignment, stereopsis, and fixation disparity. The result on the Timed 25-Foot Walk (T25FW) test changed from 6.3 to 5.5 seconds. The result on the Timed Up and Go (TUG) test changed from 9.4 to 7.8 seconds. The Dynamic Gait Index (DGI) changed from 14/24 to 24/24. The composite SOT score changed from 47% to 75%. One month after treatment, the DHI score changed from 66/100 to 38/100. **Discussion:** This case report is the first to report the use of BBTW and a balance orthotic to improve vision, DGI, DHI, and SOT tests in a woman with MS. The strategically weighted balance orthotic seemed to be a useful treatment for this client.

(4) GAIT PARAMETERS WITH AND WITHOUT BALANCE-BASED TORSO-WEIGHTING IN PEOPLE WITH MULTIPLE SCLEROSIS

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Objectives: Up to 85% of people with multiple sclerosis (MS) show balance and gait impairments. Balance-based torso-weighting (BBTW), a novel intervention in which patients wear light weights on the trunk, has effected immediate improvements in balance and gait in people with MS. In this study, we examined gait parameters with and without BBTW. **Methods:** Eighteen volunteers (ages 25–68 years) participated: 14 with MS (Expanded Disability Status Scale [EDSS] score equivalent 2–6, 10 with EDSS ≤ 3) and 4 controls. Participants walked across a 24-foot GaitRite instrumented gait mat three times “as fast as they could safely.” After being weighted using a BBTW protocol (weights 0.75–2.75 pounds, average 0.92% body weight), participants repeated the walking trials. Paired *t* tests compared velocity, step parameters, and cadence with and without weighting. **Results:** In people with MS, mean velocity and percentage of gait cycle in single (SLS) and double (DLS) limb support showed statistically significant results with a mean (SD)

velocity of 182.3 (27.6) cm/sec for the weighted trials and 177.5 (26.4) cm/sec for the nonweighted trials. SLS averaged 41.2% (1.4%) with weights and 40.8% (1.4%) without weights; DLS averaged 17.2% (2.9%) with versus 17.9% (2.9%) without weights. Cadence, step length, and step width showed no significant difference between the two conditions. Without weights, none of the variables were significantly different between people with MS and controls. **Discussion:** The increase in velocity in our sample was not considered clinically significant at less than 3%, but the change confirms previous studies recording velocity improvement with BBTW in people with MS with more significant gait impairments (average unweighted fast-walk velocity 110 cm/sec). In addition, our data provide insight regarding the gait parameters that change along with velocity (SLS, DLS) in people with MS who show no difference from controls at baseline. The evidence indicates that BBTW can affect gait parameters in people with MS that may be associated with improved balance.

(5) EFFECTS OF VESTIBULAR REHABILITATION ON MULTIPLE SCLEROSIS-RELATED FATIGUE AND UPRIGHT POSTURAL CONTROL: A RANDOMIZED CONTROLLED TRIAL

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Background: Fatigue and impaired upright postural control (balance) are the 2 most common findings in people with multiple sclerosis (MS), with treatment approaches varying greatly in effectiveness. **Objectives:** The aim of this study was to investigate the benefits of implementing a vestibular rehabilitation program for the purpose of decreasing fatigue and improving balance in patients with MS. **Design:** The study was a 14-week, single-blinded, stratified blocked randomized controlled trial. **Setting:** Measurements were conducted in an outpatient clinical setting, and interventions were performed in a human performance laboratory. **Patients:** Thirty-eight patients with MS were randomly assigned to an experimental group, an exercise control group, or a wait-listed control group. **Intervention:** The experimental group underwent vestibular rehabilitation, the exercise control group underwent bicycle endurance and stretching exercises, and the wait-listed control group received usual medical care. **Measurements:** Primary measures were a measure of fatigue (Modified Fatigue Impact Scale), a measure of balance (posturography), and a measure of walking (Six-Minute Walk Test). Secondary measures were a measure of disability due to dizziness or disequilibrium (Dizziness Handicap Inventory) and a measure of depression (Beck Depression Inventory-II). **Results:** Following intervention, the experimental group had greater improvements in fatigue, balance, and disability due to dizziness or disequilibrium compared with the exercise control group and the wait-listed control group. These results changed minimally at the 4-week follow-up. **Limitations:** The study was limited by the small sample size. Further investigations are needed to determine the underlying mechanisms associated with the changes in the outcome measures due to the vestibular rehabilitation program. **Conclusion:** A 6-week vestibular rehabilitation program demonstrat-

ed both statistically significant and clinically relevant change in fatigue, impaired balance, and disability due to dizziness or disequilibrium in patients with MS.

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(6) EFFECTIVENESS OF GROUP KICKBOXING AS A MEANS TO IMPROVE GAIT AND BALANCE IN INDIVIDUALS WITH MULTIPLE SCLEROSIS

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In recent years, there has been a particular emphasis on identifying and delivering appropriate therapeutic interventions that address the significant balance and gait impairments that affect individuals with multiple sclerosis (MS). Group interventions implemented in community settings have been especially of interest, including tai chi classes. Recently, the authors conducted a preliminary study to examine whether group kickboxing, which requires more vigorous movements, might be a feasible intervention. Initial findings showed promise and led the authors to pursue a more rigorous follow-up study, with the objective of determining whether a 5-week group kickboxing class improved clinical measures of balance and gait in individuals with MS. Eleven individuals completed the 5-week kickboxing program, which met three times a week for an hour each session. Clinical measures, including the Mini Balance Evaluation Systems Test (BESTest), Berg Balance Scale (BBS), Timed Up and Go (TUG) test, and Dynamic Gait Index (DGI) outcomes, were collected at baseline, before the intervention, and after the intervention. Quiet-standing balance was also measured, and self-reported survey data were collected. Data were analyzed using a Friedman ANOVA-by-ranks test with a Wilcoxon signed rank test as the post hoc comparison. Statistically significant improvements were seen after the intervention in the Mini BESTest, TUG, DGI, and Activities of Balance Confidence. The largest improvements were observed on the Mini BESTest, with a mean of 21.9% improvement between pre- and post-test scores. Participants showed the majority of improvement on tasks that required reactive postural control movements. These movements were similar to skills that were practiced during kickboxing (ie, rapid change of base of support upon kicking). This supports the concept of task-specific transfer, and may indicate why more static-type measures like quiet standing did not indicate similar improvement. Overall, though improvements were not necessarily clinically significant, they did demonstrate the potential and feasibility of the kickboxing concept.

(7) BALANCE IMPAIRMENTS ACROSS MULTIPLE CONTEXTS WITH MULTIPLE SCLEROSIS: ASSOCIATING CLINICAL AND INSTRUMENTED MEASURES

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Objective: To identify balance impairments associated with multiple sclerosis (MS) during objectively recorded tasks and to associate those impairments with subjective clinical mea-

asures of impairment. **Method:** Thirteen subjects with MS and 13 matched subjects without MS performed three laboratory tasks: cued step initiation, cued forward leaning to the limits of stability, and responding to toes-up platform rotations. Center-of-pressure displacements and passive-marker kinematics objectively recorded parameters of each behavior. Subjects were also evaluated on the Balance Evaluation Systems Test (BESTest) as a clinical measure of balance impairments. **Results:** Compared to subjects without MS, the subjects with MS exhibited 1) longer durations of anticipatory postural adjustments and delayed foot-lift latencies during step initiation, 2) smaller lean displacements with a more variable maintenance of the lean position, and 3) delayed and larger center-of-pressure displacements in response to platform rotations. The subjects with MS exhibited significantly lower BESTest scores than subjects without MS on the total exam as well as on subsections pertaining to mechanical constraints, limits of stability, anticipatory postural adjustments, and gait. BESTest scores were significantly correlated with Expanded Disability Status Scale scores as well as instrumented measures of step velocity, lean displacement, and displacements in response to a loss of balance. **Conclusion:** MS is associated with impaired balance across contexts of step initiation, leaning to limits of stability, and postural responses to an induced loss of balance. The BESTest is sensitive to these impairments and to increasing disease severity. **Funding/Support:** The study was funded by a University of Vermont College of Nursing & Health Sciences Research Incentives grant.

(8) A PROSPECTIVE EVALUATION OF BALANCE, GAIT, STRENGTH, AND PSYCHOLOGICAL STATUS TO PREDICT FALLING AND PHYSICAL ACTIVITY IN WOMEN WITH MULTIPLE SCLEROSIS

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Objective: To identify measures of balance, gait, and strength that predict falls in women with multiple sclerosis (MS). To also examine which physical parameters along with psychological status best predict physical activity. **Method:** This prospective study included 99 women with MS. Balance was assessed using the Limits of Stability (LOS) test and the Sensory Organization Test (SOT). Leg-muscle strength was measured with isokinetic dynamometry. Gait parameters were measured via an instrumented walkway. Fear of falling and mental health status were also assessed, as was self-reported level of physical activity. The participants reported their falls for 1 year, and reports were used to classify people with at least one fall or with at least two falls (recurrent fallers). **Results:** A total of 159 falls were reported by 48% of the participants. Light physical activity (350 min/wk) was more prominent than combined moderate and vigorous activity (189 min/wk) for the study sample. Expanded Disability Status Scale (EDSS) scores, leaning forward to the LOS, and standing sway within a visually referenced surround significantly predicted people with at least one fall as well as recur-

rent fallers. Stance-phase asymmetries and base-of-support width during gait, as well as the force and power produced during leg extension or flexion, additionally predicted recurrent fallers. Physical activity was best predicted by fear of falling, which was driven by disability status and ambulation profiles. **Conclusion:** In addition to advancing disease status, impaired forward LOS and visually dependent sway (as well as gait asymmetries and leg-strength deficits for recurrent fallers) predict future falls in women with MS, suggesting the need to target these impairments for preventative treatment. Physical activity was independently predicted by fear of falling rather than physical measures, and increasing fear of falling was independently associated with increasing disease severity and gait impairment rather than with falls. **Funding/Support:** This study was funded by the National Multiple Sclerosis Society (grant PPO848) and the John C. Erkkila, M.D. Endowment For Health and Human Performance.

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(9) UNDERSTANDING FALLS IN MULTIPLE SCLEROSIS: ASSOCIATION WITH MOBILITY STATUS, CONCERNS ABOUT FALLING, AND ACCUMULATED IMPAIRMENTS

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Objective: Falls among people with multiple sclerosis (MS) are a serious health concern; the percentage of people restricting activity due to concerns about falls is not known. Both mobility function and accumulated impairments are associated with fall risk in older adults, but not in those with stroke. This study 1) estimated the percentage of people with MS reporting falls, concerns about falling (CAF), and associated activity restrictions (AR), and examined the relationship among these factors and fall status; and 2) explored the association between fall status and both mobility function and number of accumulated impairments. **Design:** Cross-sectional survey. **Methods:** A total of 575 people with MS completed a survey providing information about sociodemographics, falls, CAF, AR, mobility function, and accumulated impairments. Chi-square statistics explored the association among these factors. **Results:** Among all participants, 61% reported CAF and 67% reported AR. Among nonfallers, 25.9% reported CAF and 27.7% reported AR. Mobility function was associated with fall status ($P < .001$); the highest percentage of people reporting falls were those with moderate mobility restrictions, and the lowest percentage were those with the highest level of mobility restriction. Falls were associated with accumulated impairments ($P < .001$), with the highest percentage of those with 10 impairments reporting 2 or more falls. **Conclusions:** CAF and AR are common in people with MS, even in nonfallers. The association between fall status and mobility appears curvilinear; while fall risk increases with declining mobility function, at a certain threshold, further declines may be associated with reduced falls, possibly due to reduced fall risk exposure.

(10) BALANCE REHABILITATION IN MULTIPLE SCLEROSIS: A PRELIMINARY COMPARISON OF CONVENTIONAL TRAINING WITH NINTENDO® WII FIT™ GAME PLAY

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Background: Balance and gait disturbances are commonly observed, but poorly managed, in individuals with multiple sclerosis (MS). This ongoing pilot study compares the effects of Nintendo® Wii Fit™ game play (WII), conventional balance training (TRAD), and a true control (CON) on balance and mobility outcomes among home-dwelling people with MS. **Methods:** Fourteen female and 4 male MS patients (mean \pm SD age, 41.2 \pm 6.7 years) with self-reported balance deficits underwent clinical assessment using the Berg Balance Scale (BBS) and Mini Balance Evaluation Systems Test (BESTest) before and after 3 weeks of supervised balance training sessions (3 sessions/wk, 30 min/session). Participants also completed questionnaires regarding balance confidence (Activities of Balance Confidence; ABC), walking ability (12-item Multiple Sclerosis Walking Scale; MSWS-12), and fatigue (Modified Fatigue Impact Scale; MFIS). Effect sizes from pre- to post-testing were calculated for each group and outcome measure to demonstrate magnitude of change. **Results:** Both training protocols had greater effects on BBS scores than CON ($n = 4$, $d' = -0.31$), with TRAD ($n = 6$, $d' = 0.93$) having a larger effect than WII ($n = 8$, $d' = 0.47$). There were similar trends for ABC ($d' = 0.16$, 0.50, and 0.26), MSWS-12 ($d' = -0.34$, 0.41, and 0.16), and MFIS ($d' = -0.58$, 0.28, and -0.29) for CON, TRAD, and WII, respectively. Mini BESTest scores did not follow this trend, with CON producing the greatest effect size. **Discussion:** These preliminary results suggest that balance rehabilitation training using WII and TRAD may both be effective in improving balance, confidence, perceived walking ability, and fatigue when compared to CON, with TRAD being potentially more effective than WII after 3 weeks of supervised training for this subset of individuals with MS. **Funding/Support:** This investigation was supported by a grant from the National Multiple Sclerosis Society.

(11) BARRIERS TO PHYSICAL ACTIVITY FOR MEN AND WOMEN WITH MULTIPLE SCLEROSIS

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Multiple sclerosis (MS) is a debilitating disease that affects thousands of Canadians of all ages. Although a physically active lifestyle is recommended for these individuals, little research has addressed their actual activity level and the ways in which their illness may impede their access to such activities. **Purpose:** The purpose of this study was to determine the current state of physical activity participa-

tion among individuals living with MS in Ontario, and to highlight any barriers or facilitators they faced in their active pursuit of these opportunities. **Objectives:** The purpose was divided into two main lines of inquiry: 1) to identify the current level of physical activity participation and commitment to be physically active among men and women with MS in Ontario; and 2) to identify any barriers (or facilitators) they may experience in their pursuit of physical activity opportunities in their respective communities. **Methodology:** Using a mixed-methods design, the researchers employed both quantitative and qualitative measures to meet these objectives. **Results:** Eighty-seven men and women completed a modified version of the Physical Activity Scale for Persons with Physical Disabilities (PASIPD). This survey collected general sociodemographic and health-related information, as well as information specifically pertaining to their disease. This tool was completed online or as a self-administered paper and pencil tool. Following completion of the online questionnaire, 31 men and women completed the semi-structured interview, which explored their experiences of having MS and how it affected their day-to-day life, most notably with regard to their participation in physical activities in and around their home. The interview guide was developed using the PASIPD and the International Classification of Functioning, Disability, and Health (ICF) framework as guides. These audiotaped interviews were completed by telephone and subsequently transcribed verbatim. This poster will report specifically on these qualitative results. **Results:** While many of the participants described their lives as continuing to be active in many ways since development of their illness, they described a number of barriers that did impede their pursuit of physical activity, largely in terms of issues surrounding changes in balance and gait over the course of the illness. **Discussion:** Knowledge of disease progression and the impact it has on one's lifestyle over time is essential in order to develop appropriate intervention programs to address these issues of access.

(12) THE ACUTE EFFECTS OF FUNCTIONAL ELECTRICAL STIMULATION ON WALKING PERFORMANCE IN PEOPLE WITH MULTIPLE SCLEROSIS

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Decreased dorsiflexion of the ankle during the swing phase (foot drop) is a common gait problem for people with multiple sclerosis (MS). This may require gait compensation strategies to permit foot clearance, which can result in decreased efficiency of walking. Although increased attention is focused on a potential role for functional electrical stimulation (FES), no studies have explored the acute effects of FES on gait kinematics in people with MS. The purpose of this study was to explore the acute effects of FES on gait kinematics and walking performance of people with MS. **Method:** Twelve eligible consenting people with MS (9 men, 3 women; mean \pm SD age, 47.8 \pm 6.6 years; Expanded Disability Status Scale

score, 2–6) were assessed on four occasions at least 3 days apart. On each occasion, three-dimensional gait analysis with and without FES was undertaken, and participants completed a Timed 10-Meter Walk (T10MW) test and a 6-Minute Walk (6MW) test with and without FES. The FES was administered using the Odstock Dropped Foot Stimulator (ODFS III, Salisbury, Wiltshire, UK). **Results:** No accommodation/learning effect was observed over the four testing sessions; therefore, all analyses were based on the average (FES/no FES) data of the affected leg. Compared to no FES, in the FES-assisted gait trials, dorsiflexion and knee flexion at initial contact and peak knee flexion in swing showed statistically significant ($P < .05$) improvements toward a more normal gait pattern. No significant effects of FES were observed for the hip and pelvic kinematics. The T10MW was significantly improved with FES, but the 6MW was not. **Conclusion:** This study showed that even without habituation, the acute application of FES in people with MS improved ankle and knee kinematics, resulting in a better foot clearance and decreasing the risk of falling. Improvements in kinematics in the more proximal joints and walking performance over a longer duration (6MW) were not observed in this acute study but may manifest after habituation.

(13) FALLS AND ACTIVITY CURTAILMENT IN PEOPLE WITH MULTIPLE SCLEROSIS

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Over half of people with multiple sclerosis (MS) report falling over a 6-month period. In addition to physical injury, a fall may result in activity curtailment and subsequent deconditioning. To date, the evidence in support of the association between falls and activity curtailment in people with MS is based on self-report measures. This investigation examined the association between falls and physical activity using an objective measure of physical activity (ie, accelerometry). We hypothesized that people with MS with a fall history or who are at high risk for falls would demonstrate lower physical activity as indexed by steps per day. To test this hypothesis, 50 people with MS underwent fall-risk screening consisting of the short form of the physiological profile assessment and self-reported fall history in the last year, and wore an ActiGraph accelerometer for 7 consecutive days. Overall, 26 individuals (52% of the sample) reported falling in the last year, with 22 of the 26 falling more than once. People who fell in the last year had a lower number of steps per day than nonfallers (3550 vs. 5290 steps/day; $P < .05$). Fall risk too was significantly correlated with average steps per day ($r = -0.50$; $P < .05$). Importantly, the correlation between average steps and fall risk remained significant when disability (Expanded Disability Status Scale score) was controlled for ($r_p = -0.29$; $P < .05$). Collectively, the findings provide objective evidence in support of the proposal that falls and fall risk result in activity curtailment in people with MS.

(14) QUANTITATIVE BALANCE IMPAIRMENT MEASURES SUBTLE DISABILITY IN MULTIPLE SCLEROSIS

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Objective: Pilot study to detect and quantify balance impairment in people with multiple sclerosis (MS). **Background:** Impaired balance is an important contributor to clinical disability in MS, with disabling consequences such as impaired gait and increased falls risk. Impaired balance is commonly reported by patients even before it can be detected on neurologic examination. In the clinical trial setting, accurate and timely measurement of subtle disability could be invaluable. **Method:** A total of 43 people with MS were classified into three groups based on clinical disability as measured by the Expanded Disability Status Scale (EDSS). Functional systems scores did not differ significantly within groups. Gait

was measured with the GAITrite Analysis System. Balance was measured with Smart Equitest (Neurocom). All patients performed the modified Clinical Test of Sensory Interaction on Balance (static balance), and patients with low-moderate disability also performed the Motor Control Test (dynamic balance). Brain magnetic resonance imaging (MRI) was performed within 4 weeks. Normative values were provided by the manufacturer. **Results:** 1) Static and dynamic balance impairment was detected in all MS patients, including those without overt clinical disability ($EDSS \leq 2$). 2) Regression analysis detected associations between static balance impairment and both EDSS ($P < .01$) and MRI lesion load ($P < .02$). 3) Dynamic balance impairment differentiated between EDSS groups ($P < .005$). A similar trend was seen with MRI lesion load. 4) Across all patients, including those with $EDSS \leq 2$, balance impairment correlated with specific gait parameters, including velocity, double-support time, and step-length variability (absolute correlation coefficient 0.4–0.8). **Conclusion:** Quantitative balance testing elicits abnormalities in people with MS, including those without overt disability. Such subtle disability may nevertheless already affect gait, indicating a potential role for early rehabilitation interventions in MS. The results support the longitudinal exploration of computerized dynamic posturography as a measure of disease progression and correlation with volumetric MRI analysis.

Call for Abstracts



Fourth Cooperative Meeting of the Consortium of Multiple Sclerosis Centers and the Americas Committee for Treatment and Research in Multiple Sclerosis

Hilton San Diego Bayfront, San Diego, California, May 30–June 2, 2012

The submission deadline for abstracts is **January 13, 2012**.

Information on online abstract submission and the meeting can be found at <http://www.cmssc-actrims.org/>.

Presenters at CMSC meetings are given preference in the judging for the Herndon Award for Outstanding IJMSC Article, given annually for the best article published in the *International Journal of MS Care* over the last year. The award carries a \$1000 stipend. Robert M. Herndon was the founding editor of IJMSC and currently serves as Editor Emeritus.