Abstracts of Platform and Poster Presentations, Neurology Section, APTA Combined Sections Meeting, February 2007

PLATFORMS: Upper Extremity Control After Stroke Thursday 1:00–2:30 pm

THE PERCEPTUAL THRESHOLD TEST USING ELECTRICAL STIMULATION TO MEASURE UPPER EXTREMITY SENSATION FOLLOWING STROKE: VALIDITY, INTRA-RATER RELIABILITY, AND PRECISION. J. E. Sullivan, L. D. Hedman, A. Atchison, A. Balmat, K. Russell, Department of Physical Therapy and Human Movement Sciences, Northwestern University, Chicago, IL.

Purpose/Hypothesis: Approximately 50% of stroke survivors have sensory impairments which correlate with a poorer functional prognosis. Current clinical sensory tests have not been shown to be valid, reliable, or precise; thus limiting their role in treatment planning. In contrast, the perceptual threshold test (PTT-ES) uses electrical stimulation to provide graded, objective, continuous stimuli to measure sensation. The PTT-ES has previously been used to examine sensation in healthy individuals, as well as those with diabetes, spinal cord injury and stroke. The purposes of this study were to examine the validity and intra-rater reliability of the PTT-ES as well as to compare the precision of the PTT-ES with other clinical sensory measures. **Number of Subjects**: Twenty-nine individuals with chronic stroke participated in the study. Their mean time post stroke was 8.9 years (0.5–24 years). **Materials/Methods**: Each subject participated in 1 session. The PTT-ES was administered to each subject's upper extremities twice. The following measures were administered once: Nottingham Sensory Assessment for Stereognosis (NSA), Fugl-Meyer Sensory Assessment (FMA-S), Stroke Rehabilitation Assessment of Movement, Action Research Arm Test, and the Motor Activity Log-14 (MAL-14). Three examiners administered the tests and were blinded to each other's results. One examiner performed the PTT-ES at the beginning and end of the session; one administered the MAL-14; and the final examiner performed the other clinical measures. **Results**: There was a statistically significant positive correlation between the results of the PTT-ES and NSA ($p=.001$), and between the PTT-ES and MAL-14 amount of use subscale ($p=.036$); but not between PTT-ES and other measures. Intra-rater reliability of PTT-ES was high with ICC values of .896 and .829 for uninvolved and involved hands respectively. Of the 13 subjects who received a full score on the FMA-S for their involved UE; 75% were found to have sensory deficits on the NSA and 50% showed sensory deficits on the PTT-ES. **Conclusions**: The results suggest that PTT-ES is a valid and reliable measure of upper extremity sensation following stroke. These results also suggest that the NSA and PTT-ES may better discriminate sensory dysfunction post-stroke as compared with the FMA-S. Clinical Relevance : The PTT-ES is a clinically feasible test that can provide meaningful information for treatment planning.

MEASURING UPPER EXTREMITY FUNCTION IN THE FIRST FEW MONTHS AFTER STROKE. J. A. Beebe, C. E. Lang, Physical Therapy, Washington University, St. Louis, MO.

Purpose/Hypothesis: When evaluating and managing patients with upper extremity paresis due to stroke, clinicians must choose to use one or more standardized tests of hand function. Results of these tests may be used to select specific treatments or to assess progress. Unfortunately, there is little data available to directly compare a variety of tests from which clinicians might choose. The purpose of this study was to determine how clinical tests of hand function are related to each other in the first weeks and months after stroke and to determine how responsive the tests are to change. **Number of Subjects**: We tested 31 people with hemiparesis due to stroke with a mean age of 56.9 ($\pm$ 10.2) years. **Materials/Methods**: We measured hand function within 1 month (19.0 $\pm$ 5.47 days) after stroke, and at 3 and 6 months. We used 6 clinical tests of hand function: Action Research Arm Test (ARAT), Jebsen-Taylor Hand Function Test (Jebsen), 9-Hole Peg Test (9HPT), Stroke Impact Scale-Hand Subsection (SIS-Hand), grip strength, and pinch strength. We used Pearson product moment correlations to evaluate relationships between the tests. To determine if the tests were responsive to change from 1 to 3 months, and 1 to 6 months, we used the single population effect size method. Effect sizes of > 0.50 were considered responsive to change. **Results**: All 6 clinical tests of hand function were correlated with each other at all three time points ($p<0.05$). Generally, the magnitudes of the correlations between the ARAT and the Jebsen were the strongest. The SIS-Hand had weaker relationships with the other tests at the 1 month time point suggesting that subjects may not be fully aware of their limitations early after stroke. At the 3 and 6 month time points, the relationships between the SIS-Hand and the other tests had increased. When looking at responsiveness, we found that the ARAT, Jebsen, 9HPT, and SIS-Hand were considered responsive to change from 1 to 3 months, but the two force production measures, grip and pinch, were not. From 1 to 6 months, all of the tests were responsive to change with the exception of pinch. **Conclusions**: When measuring hand function in individuals with hemiparesis within the first 6 months after stroke, clinicians should feel confident that administering any of these 6 tests will indicate the person's ability to use their hand. When measuring change over time, the ARAT, Jebsen, 9HPT, and SIS-Hand are appropriate for use in this population, however grip and pinch may be less appropriate for use with individuals in the first 3 months after stroke. At 6 months after stroke, all of the tests except pinch may be appropriate for use in measuring change. **Clinical Relevance**: This information gives physical and occupational therapists data to support their decisions when selecting specific tests for evaluating hand function in people with hemiparesis during the first 6 months of recovery. (Supported by NIH HD047669)

REHABILITATION OF THE UPPER LIMB POST STROKE: RANDOMIZED CONTROLLED PILOT INVESTIGATION OF TWO TYPES OF FEEDBACK. G. T. Thielman, University Of The Sciences in Philadelphia, Philadelphia, PA.

Purpose/Hypothesis: For post-stroke individuals, Task-Related Training (TRT) effects on reaching with the paretic limb were evaluated using 2 separate trunk stabilization techniques. One rehabilitation strategy served as the control (trunk-stabilized TRT), and has very recently received support in the literature (Thielman, Kaminski & Gentile, in press). For the experimental group, sensors

provided bandwidth auditory feedback to encourage maintenance of the trunk against the chair back (auditory signaling once the trunk has moved off of the chair back). Based on prior findings(Thielman, Kaminski & Gentile, in press), trunk-stabilized TRT was predicted to lead to less functional reaching improvement than TRT in which the trunk motion was not forcibly restricted (Thielman, Dean & Gentile, 2004). Of note in the 2004 non-trunk stabilized TRT investigation, the training aim was to increase arm use in any way possible, regardless of trunk movement. **Number of Subjects**: Recruitment pool consisted of 18 post stroke, who were discharged from all rehabilitative services at least 6 months prior and were referred by attending physicians and therapists. Individuals all scored between 20 and 44 on the Upper-Arm subsection of the Fugl-Meyer Scale (FM- Poole & Whitney, 1988) and demonstrated some trunk movement during the pretest reaching performance scale measures (RPS, Levin 2006). **Materials/Methods**: Subjects were randomly assigned to either of the two groups. Rehabilitative sessions lasted between 50 and 65 minutes, 2-3 times a week for 4-6 weeks. Both groups performed TRT activities at varied locations across the workspace, using the paretic upper-limb for reaching and grasping as well as multiple bilateral activities. Feedback was systematically and equally faded throughout the training for both groups. Using a pretest/posttest design, rehabilitative effects were determined using the aforementioned outcome scales, along with shoulder/elbow and grip strength measures. **Results**: A 2 (Training Group) x 2 Pre-/Posttests) ANOVA was used to evaluate this clinical trial. Analysis indicated that both methods improved reaching without trunk use (RPS), but the trunk -stabilized group led to more significant changes ($p<.05$). Training under less restrictive conditions associated with TRT (auditory feedback from trunk sensor) as compared to stabilized TRT, led to improved functional and impairment measure scores (WMFT, FM and shoulder flexion). **Conclusions**: Fading feedback with both training methods, during extended TRT reaching/grasping practice generally led to some improvements. However, as demonstrated by impairment and functional outcome measures, using TRT with an auditory feedback signals is a more effective approach than forcing the stabilization of the trunk during rehabilitation of the upper-limb. **Clinical Relevance**: Training under more realistic conditions associated with TRT (non-forced trunk restraint) resulted in functional reaching improvements and should be encouraged for chronic post-stroke individuals.

KINEMATIC AND EMG CHANGES IN THE HEMIPARETIC ARM FOLLOWING THE ACCELERATED SKILL ACQUISITION PROGRAM (ASAP). N. Brainerd, B. Ritter, L. Haubert, P. Requejo, S. Mulroy, Pathokinesiology Lab, Rancho Los Amigos National Rehabilitation Center, Downey, CA.

Purpose: To determine the effect of ASAP on kinematics and muscle activity during reach and grasp in patients with mild and moderate upper extremity (UE) impairment following stroke. **Case Description**: Number of subjects: Two persons 28-71 days post-stroke resulting in UE hemiparesis with minimal active finger extension of the involved hand and UE Fugl Meyer Score 19-58. One subject was the 'usual and customary care' control (CS); one received the ASAP intervention (IS). Two persons served as non-disabled control (NC). Methods: IS received 30 hours of ASAP training: 2 hoursX3 days/week. Meaningful functional training tasks focused on strength, fine motor control, and bimanual use. Functional assessment measures (FAM) were the UE Fugl-Meyer (FM), TEMPA, WMFT, and NIH SIS. UE kinematics (MiniBirds®) and EMG were recorded (pre and post intervention) while subjects performed a reach and grasp task of a dowel (involved UE) utilizing a pincer grasp. Aperture size (thumb to index finger distance) and wrist angle were determined from the kinematics data. Reach phase, transport phase, and total task times were determined from event triggers. Muscle activity (EMG) from the involved forearm's EDC, ECRL, ECU muscles was recorded with indwelling bipolar 50-um Ni-Cr alloy fine-wire electrodes. EMG intensity during the reach and transport was normalized to maximal voluntary isometric contraction (%MVC), determined for each 1% of the phase, then mean intensity was calculated. **Outcomes**: Results (pre to post): Total time: IS: 8.3 seconds(s) to 6.6s. CS: 4.2s to 5.3s. NC: 2.1s. Peak reach phase wrist extension: IS: 3 degrees (deg) to 46deg. CS: 19deg to 16deg. NC: 25deg. Peak reach phase aperture: IS: 8.8 centimeters (cm) to 9.8cm. CS: 10.0cm to 9.8cm. NC: 12.8cm. Reach EMG: Mean EMG (%MVC) IS: EDC 1.4% to 42.4%MVC, ECRL to 5.7% to 35.0%MVC, ECU 86.0% to 10.7%MVC. CS: EDC 13.3% to 16.5%MVC, ECRL 100.0% to 2.8%MVC, ECU 2.3% to 17.9 %MVC. NC: ECRL 11.4%MVC, EDC 75.8%MVC, ECU 61.0%MVC. Transport EMG: IS: ECRL 2.8% to 31.4%MVC, ECU 105.7% to 33.3%MVC. CS: ECRL 20.5% to 3.7%MVC, ECU 1.1% to 38.4%MVC. NC: ECRL 20.4%MVC, ECU 31.3%MVC. FAM: IS percent improvement: TEMPA 20%, WMFT Functional Ability Scale 8.3%, FM 17.0%, SIS 75.6%. CS improvement: TEMPA 14%, FAS 1.7%, FM 1.7% decrease, SIS 6.1% decrease. **Conclusions**: IS's increase in wrist extension and aperture correspond with increased EDC and ECRL (Reach) activity; post kinematics were closer to NC. CS had decreases in wrist extension and aperture during both tasks. CS's EMG changes demonstrated that ECU activity increased while ECRL activity decreased in both phases, indicating a possible compensation with ECU. IS's movement time decreased while CS's increased. IS had greater improvements than CS in function assessment scores. Clinical Relevance: ASAP intervention for patients with mild to moderate residual impairment of the UE following stroke can be used to improve muscle timing, intersegmental coordination, and speed of movement.

DIFFERENTIAL EFFECTS ON TREATMENT OUTCOMES BASED ON CHRONICITY OF STROKE AND SEVERITY OF UPPER EXTREMITY MOTOR IMPAIRMENT. K. Veeraraghavan, J. M. Wagner, C. Patten, Rehabilitation Research and Development, VAPAHCS, Palo Alto, CA.

Purpose/Hypothesis: To determine whether chronicity of stroke and severity of upper extremity (UE) motor impairment, produce differential effects on treatment outcomes following a combined intervention of UE functional task practice and dynamic, high-intensity resistance training. **Number of Subjects**: Fifteen subjects with subacute (mn 4.8 + 1.1 mos) and 18 subjects with chronic (mn 13.1 + 4.0 mos) post-stroke hemiparesis participated in this study. Subjects in both cohorts were classified as low or high functioning based on initial shoulder/elbow Fugl-Meyer scores. **Materials/Methods**: Both the subacute and chronic cohorts participated in a double blind, randomized controlled trial investigating the therapeutic effects of functional task practice combined with dynamic, high-intensity resistance training on UE function. The sub-acute cohort trained 3x/week x 6 weeks for a total of 18 sessions. The chronic cohort participated in a cross-over design involving two four-week blocks of training 3x/week interspersed with a 4 week washout period. All treatments were individual and 75 minutes in duration. A battery of 7 standardized clinical rating tools (Fugl-Meyer (FM) UE motor score, FM shoulder/elbow score (FM s/e), Ashworth Scale (AS), Wolf Motor Function Test –Time(WMFT-Time), WMFT Functional ability score (WMFT-FAS), Functional Independence Measure (FIM), Barthel Index (BI), European Stroke Scale (ESS) and Stroke Impact Scale (SIS % improvement)) was

administered prior to treatment and immediately following completion of the intervention. The Mann-Whitney-U statistic was used to determine the presence of significant ($p<0.05$) differences in baseline and change scores (post treatment-baseline) between: 1) the sub-acute and chronic cohorts and 2) subjects with low vs. high motor function. **Results**: No significant differences were revealed between the subacute and chronic cohorts in either baseline or change scores. The low motor group had significantly lower ($p<0.05$) baseline FM UE motor, FM s/e, WMFT-FAS, FIM, BI, and ESS scores, higher baseline WMFT-Time scores, but similar ($p>0.05$) SIS% and AS scores, compared to the high motor group. Greater ($p < 0.05$) post-intervention improvements in FM UE motor, FM s/e, WMFT-Time, ESS and BI scores were observed for the low motor group as compared to the high motor group. No significant differences were noted between the low and high motor group for WMFT-FAS, AS, FIM or SIS% change scores. **Conclusions**: Our data revealed a differential effect based on hemiparetic severity, but not chronicity, on treatment outcomes such that subjects with lower UE motor function demonstrated significantly greater improvements than subjects with higher UE motor function, regardless of chronicity of stroke. These findings varied depending upon the outcome measure used to evaluate treatment efficacy. **Clinical Relevance**: Regardless of stroke chronicity, persons with more severe UE impairment appear to demonstrate greater improvements in response to therapeutic intervention than persons with less severe UE impairment.

TRAINING REACH MOVEMENTS IN INDIVIDUALS WITH HEMIPARESIS: EFFECT OF A VIRTUAL ENVIRONMENT. J. C. Stewart[1], H. Yoon[2], S. Yeh[2], S. Chen[1], M. McLaughlin[3], A. Rizzo[4], C. J. Winstein[1], [1]Division of Biokinesiology and Physical Therapy, University of Southern California, Los Angeles, CA, [2]Computer Science, University of Southern California, Los Angeles, CA, [3]Annenburg School for Communication and Integrated Media Systems Center, University of Southern California, Los Angeles, CA, [4]Institute for Creative Technologies, University of Southern California, Los Angeles, CA.

Purpose/Hypothesis: Recent research has shown a benefit of virtual reality (VR) based practice on recovery following stroke. Limited data is available on the impact of VR on reaching movements using detailed kinematics. The purpose of this qualitative study was to perform a post-hoc analysis of reach trajectory data collected during a pilot study investigating the feasibility of VR based practice on skilled upper extremity (UE) movements following stroke. Specifically, we wanted to investigate the strategies employed by individual participants to improve performance on VR tasks. **Number of Subjects**: Three individuals with hemiparesis (mean age 57 years; mean UE Fugl-Meyer motor score 44) and one non-disabled adult (age 81 years). **Materials/Methods**: Participants practiced 4 VR tasks, 2 of which were specifically aimed at improving skill in UE reaching: 'Reaching' and 'Ball Shooting'. All targets were presented in a 3-dimensional virtual environment (VE). Kinematic position data was recorded from an electromagnetic marker on the dorsal surface of the hand during all trials at a variable sampling rate (60-100 Hz). Reach trajectories and resultant velocity profiles were inspected to investigate changes in movement strategy as performance changed. **Results**: All participants improved performance on 'Reaching' over practice (mean decrease in movement time 47% in participants with hemiparesis; decrease of 72% in healthy adult). Outcome on 'Ball Shooting' was stable over practice (80-100% success) but all participants performed the task at increased ball speed (from 2.59 to 4.532 m/sec). Initial trials in 'Reaching' revealed a searching strategy as demonstrated by long and curved reach paths, frequent directional changes and multi-peaked velocity profiles. Over practice, participants demonstrated shorter reach paths and velocity profiles that suggested reaching through targets instead of reaching to targets; target collision frequently coincided with velocities that were still increasing at impact. Trajectory analysis of 'Ball Shooting' trials revealed that for some participants reach trajectories became shorter and less curved over practice while for others reach paths become longer and more curved. Velocity profiles also revealed divergent strategies: delaying movement onset to wait for the ball to come closer versus initiating movement quickly after onset. **Conclusions:** While all participants improved performance on VR based reach tasks, a variety of strategies were used to obtain these improvements. Gains may have been due to changes in movement ability, ability to explore and adapt to a novel environment, or confidence in ability. Further research comparing reach movements in the real-world versus a VE is warranted to better understand the impact of virtual targets on the planning and execution of movement. **Clinical Relevance**: VR is currently under investigation as a tool for stroke rehabilitation. Clarification of the effect of VR on movement is needed to fully understand what skills are being trained in such a practice environment.

PLATFORMS: Balance, Stepping, and Falls
Saturday 8:00–11 am

RAPID RELEASE OF STEP INITIATION BY ACOUSTIC STARTLE IN PEOPLE WITH PARKINSON'S DISEASE. M. Reising[1], R. Kennedy[1], S. S. Palmer[1], M. Pawar[1], C. D. MacKinnon[1], K. M. Martinez[1], T. Simuni[2], Y. Zhang[1], M. W. Rogers[1], [1]Physical Therapy & Human Movement Sciences, Northwestern University, Chicago, IL, [2]Neurology, Northwestern University, Chicago, IL.

Purpose/Hypothesis: Individuals with Parkinson's Disease (PD) have difficulty initiating and executing voluntary movements such as step initiation. It is unknown if this impairment is due to abnormal preparation or execution of the anticipatory postural adjustments (APAs) that precede and accompany the planned movement. Planned APAs are normally progressively prepared prior to a reaction time (RT) "go" cue, and can be rapidly released by an acoustic startle stimulus as a probe of central nervous system excitability. The purpose of this study was to investigate movement preparation prior to step initiation in persons with PD. **Number of Subjects**: Seven subjects (3 females and 4 males, mean age 67.6 years, H & Y Stage I.5–II.5) with a diagnosis of PD were tested off PD medication. **Materials/Methods**: Under simple RT conditions, subjects were pre-cued with a light stimulus instructing them to prepare to step, followed 3.5 seconds later by a "go-cue" light to initiate stepping (45 control trials). In 30 trials, an acoustic startle stimulus (124 dB) was randomly presented prior to the "go-cue" at either -1500, -1000, -500, -250, 100, or 0 ms. Subjects also performed 5 self-initiated steps. Ground reaction forces (GRFs), center of pressure (CoP) changes, and EMG were recorded. The effects of step condition (visual cue vs. self initiated) and stimulus timing on measures of APAs were analyzed using repeated measures ANOVA ($p<0.05$). **Results**: CoP excursions and GRFs during control trials were significantly larger in magnitude and shorter in duration than self-initiated trials ($p<0.014$). Application of an acoustic startle stimulus consistently resulted in the rapid release of appropriate APAs, and often stepping, with EMG, CoP and GRF onset times that were significantly faster (average reduction of 74 ms) than control trials ($p<0.01$). The magnitude and duration of EMG, CoP and GRF changes progressively increased as the startle stimulus approached the "go" and equaled or exceeded control trial values when delivered

at 0 ms. **Conclusions**: These results indicate that people with PD are capable of planning and preparing an APA for step initiation well in advance of an expected sensory cue to initiate gait. This shows that external cues, including acoustic startle, can assist in step initiation in people with PD, and emphasizes the significance of mental preparation and timing of task instruction in improving movement performance. **Clinical Relevance**: These findings highlight clinical strategies for enhancing movement initiation in people with PD including: 1) corroboration that external cues can facilitate movement initiation; 2) that a startle-like stimulus promotes improved timing and magnitude of initiation; and 3) that mental preparation and timing of task instruction improve movement speed and magnitude characteristics.

LATERAL STEPPING FOR POSTURAL CORRECTION IN PARKINSON'S DISEASE. L. A. King, F. B. Horak, Neurosciences Institute, Oregon Health Sciences University, Beaverton, OR

Purpose/Hypothesis: Effective balance rehabilitation requires an understanding of how patients with balance disorders attempt to recover equilibrium in response to external perturbations. This study characterizes, for the first time, the lateral stepping strategies for postural correction in patients with Parkinson's Disease (PD) and the effect of their antiparkinson medication. **Number of Subjects**: Thirteen subjects with idiopathic PD in their ON and OFF levodopa state and 14 healthy age-matched controls. **Materials/Methods**: Subjects were exposed to 7 trials of 12 cm lateral platform translations at 55cm/s ramp velocity. Three postural strategies were observed: lateral step (the limb loaded by the perturbation was unloaded and lateral base widened), cross-over step (the limb unloaded by the perturbation stepped over the front of the other foot) or no step (usually associated with a 'timber' fall). Corrective stepping was characterized by latency to step after perturbation onset, step velocity and step length. Additionally, percentages of trials resulting in falls were identified for each group. **Results**: Whereas elderly control subjects never fell, PD subjects fell in 27% and 36% of trials in the ON and OFF states, respectively. Both PD and control subjects most often used a lateral step strategy; 70% (control), 64% (PD OFF) and 73% (PD ON) of all trials, respectively. PD OFF subjects fell most often when using a cross-over strategy (75% of all cross-over trials) or no-step strategy (100% of all no-step trials). PD OFF subject's lateral stepping strategies were initiated later than controls (370+37 vs. 280+10 ms; $p<.01$), and steps were smaller (254+20 vs. 357+17 cm; $p<.01$) and slower (0.99+0.08 vs.1.2+0.07 cm/sec; $p<.05$). No differences were found between PD OFF versus PD ON in the corrective stepping characteristics. Late steps were associated with falls with a correlation of 0.79, $p>0.01$. Levodopa medication did not significantly affect falls, lateral step latency, velocity or amplitude ($p>.05$). **Conclusions**: PD subjects showed significantly more postural instability and falls than age-matched control subjects when stepping was required for postural correction in response to lateral disequilibrium. Although PD subjects usually chose the same lateral stepping strategy as control subjects in response to lateral translations, bradykinetic characteristics of the stepping responses help explain the greater rate of falls in subjects with PD. Unlike controls, PD subjects were unable to maintain equilibrium when using a cross-over strategy and sometimes failed to take a step at all and fell. Levodopa replacement therapy did not change either strategy selection, stepping characteristics or number of falls, suggesting that levodopa does not improve lateral stepping responses, similar to in-place postural responses. **Clinical Relevance**: Rehabilitation aimed at improving lateral stability in PD should encourage a lateral side-stepping strategy with faster and larger steps to recover equilibrium. Therapists and patients should note that levodopa did not change stepping characteristics or number of falls.

DISEASE SEVERITY DIFFERENCES IN ANTICIPATORY POSTURAL ADJUSTMENTS IN PERSONS WITH PARKINSON'S DISEASE. K. Lasco, K. Foreman, L. Dibble, Physical Therapy, University of Utah, Salt Lake City, UT.

Purpose/Hypothesis: Postural instability associated with Parkinson's Disease (PD) is considered a strong contributor to disability. However, the progression of changes in anticipatory postural adjustments (APA) associated with disease progression is less well understood. The primary goal of this project was to establish a proof-of-concept that measures of APA coordination were valid and sensitive measures of postural instability in persons with PD of varied severity. **Number of Subjects**: This abstract presents the results of the first 7 of a planned sample of 16 individuals with idiopathic PD who consented to participate. **Materials/Methods**: All participants performed a voluntary rise to toes APA task. A VICON motion capture system and an in ground AMTI force plate simultaneously recorded kinematic and kinetic data as each participant attempted to maintain balance on their toes for three seconds. During each trial, each participant was guarded with stand by assist, and instructed to use a safe strategy by discontinuing the task if they felt they would lose their balance or fall. Three trials of the task were completed in a single session. Participants were subdivided into 2 groups based on their PD severity (Mild [Hoehn and Yahr < 2.5] and Moderate/Severe [Hoehn and Yahr > 2.5]). In order to characterize the coordination of each participants' APA, the peak difference in distance from the COP and the projection of the COM sagittal plane position onto the ground (COP-COM difference) and the average variance of the COP –COM difference during the rise to toes task were determined (Frank et al., 2000; Hass et al 2006). The differences between mild and moderate/severe PD groups were calculated for each outcome variable using non-parametric statistics with an alpha level of .05. Standardized effect sizes were also calculated. **Results**: The median age (SD) and Hoehn and Yahr (SD) of the mild PD group ($n=4$) were 61 (7) and 2 (.5), while the median age (SD) and Hoehn and Yahr (SD) of the moderate to severe PD group ($n=3$) was 72 (11) and 3 (1.0). Persons with moderate to severe PD demonstrated significantly less peak COM-COP separation and significantly greater average variance ($p<.05$). The peak COP-COM separation decreased and variability of COM-COP differences increased in magnitude as disease severity worsened. The between group effect sizes ranged from 0.3 to 0.5. **Conclusions**: The initial results with these participants illustrate differences COM-COP differences and variability of COP-COM coordination. These results represent the initial proof-of-concept that measurement of COP-COM coordination during a rise to toes task is sensitive to the alterations in postural control of APA associated with disease progression. **Clinical Relevance**: The long-term goals of this line of research are to utilize APA tasks such as rising to toes to document the natural history of postural instability during PD progression as well as explore variations in APA performance in subtypes of PD and Parkinsonism.

THE EFFICACY OF TARGETED STRENGTH TRAINING ON FUNCTIONAL BALANCE IN PERSONS WITH PARKINSON'S DISEASE. E. A. Read, C. Hearn, N. Lindholm, C. Harro, Grand Valley State University, Grand Rapids, MI.

Purpose/Hypothesis: A decline in postural control mechanisms compounded with weakness leads to high incidence of falls in persons with Parkinson's Disease (PD). There is a lack of research regarding effective interventions for fall prevention in PD. The purpose of this study was to examine the efficacy of a targeted strength training intervention on functional balance in persons with

PD. **Number of Subjects**: Ten subjects (mean Hoehn & Yahr stage 2.4 + 0.46) with idiopathic Parkinson's Disease residing in the West Michigan area. **Materials/Methods**: A one-way repeated measures design was used with two phases: a one-week control phase with no training (T1-T2), and a training phase which consisted of lower extremity strength training three times per week for four weeks (T2-T3) in exercise class format with individualized exercise progression. Dependent measures assessed at baseline, pre-training, and post-training included: Timed Up and Go (TUG), Berg Balance Scale (BBS), Limits of Stability test (LOS), Motor Control Test (MCT), and isokinetic strength measures on Biodex System. Results were analyzed using paired t-tests ($p<0.05$) for balance measures, MANOVA ($p<0.05$) and pairwise comparisons post-hoc analysis for strength measures, and Pearson Product Correlation Coefficient to assess the relationship between balance and strength gains. **Results**: Statistically significant strength gains were found from T2-T3 for average peak torque (APT) of knee extension and time to peak torque (TPT) for knee flexion. Mean TPT gains for knee extension and APT gains for knee flexion also approached statistical significance ($p= 0.052$, 0.061 respectively). Post-training, statistically significant improvements were noted for the BBS, TUG, End Point Excursion (EPE) 4-6 and reduced number of falls on the LOS test. Mean improvements in EPE 1-8 on LOS also approached significance ($p= 0.067$). A trend towards improvement in strength gains was found for APT for hip extension and ankle plantar flexion, as well as TPT for hip extension. Pearson Product Correlation Coefficients found significant, direct relationships between change in BBS scores and strength gains in APT for hip and knee extension, and ankle plantar flexion ($r = .527$ to .752). A moderate direct relationship was found between change in TUG scores and gains in APT for hip and knee extension, knee flexion, and ankle plantar flexion ($r = .537$ to .648). **Conclusions**: Following strength training using closed-chain functional exercises, subjects demonstrated improved dynamic balance function and ability to expand their LOS, especially posterior directional control without falls. The intensity and mode of training may have been key factors influencing positive outcomes. **Clinical Relevance**: Our findings demonstrate that by incorporating a targeted strength training program as an adjunct balance intervention, not only can strength gains be made in a short period of time for persons with PD, but these gains in strength can have a significant direct impact on functional balance for this population.

EFFECTS OF AGE ON ATTENTION DURING STANDING AND STAIR CLIMBING: A DUAL-TASK APPROACH IN THE CLINIC. H. A. Ojha[1], R. W. Kern[2], C. J. Lin[1], C. J. Winstein[1], [1]Division of Biokinesiology and Physical Therapy, University of Southern California, Los Angeles, CA, [2]Kern and Associates Physical Therapy, Santa Monica, CA.

Purpose/Hypothesis: Previous work has focused on the physiological and cognitive factors that predispose older adults to falls. Considerable evidence supports the idea that shrinking attentional resources raises the risk of falls in the older adult. This study tested the hypothesis that the stair climbing task would require more attentional resources for older (65 yrs) compared with younger adults (20-35 yrs). **Number of Subjects**: 20 (10 older and 10 younger adults). **Materials/Methods**: We used a dual task approach to assess the attentional demands of standing, stair ascent and decent. Participants were first screened for specific inclusion criteria (no physical, physiological or cardiovascular conditions that would be contraindicated). Within a single day of testing, each participant performed multiple trials under two task conditions: 1) a simple response time task in which they stood at the foot of the stairs and responded with a verbal 'bah', as quickly as possible to an auditory tone, and 2) a dual task condition with similar measures, but while ascending and descending a set of stairs. Well before the dual task phase, and to assure that performance on the primary tasks were not compromised by the secondary probe response time task; a reliable and repeatable cadence was established for the stair tasks. Group means for demographic and baseline measures were compared using independent student t-tests. A two-factor Group x Task Analysis of Variance (ANOVA) with repeated measures on task (standing, ascending, descending) was performed for voice response time (VRT) to test the hypothesis. Significance was set at $p < .05$ for all analyses. **Results**: Group descriptive results showed that the older adult performance on three baseline measures (Tinetti Assessment score, M=27.5, +/- .7; seconds holding full plank, M=51.9, +/- 52.1; and # of marches in 2 mins, M=90.3, +/- 23.6) was not significantly different from those of the younger adults. Analysis of the experimental data revealed a significant Group x Task Interaction, ($F = 7.119$, $p = .006$). Post hoc analyses showed that VRT was not different between younger (322 +/- 65 ms) and older (306 +/- 22 ms) participants, for the standing task, but was significantly longer for the older during both ascent (493 +/- 113 ms) and descent (470 +/- 127 ms) than for the younger (ascent = 365 +/- 56; descent = 356 +/- 67 ms) participants. **Conclusions**: The study is unique in that it was conducted in the outpatient clinic setting and for its control of specific methodological confounds. These preliminary results suggest that fit older adults require significantly more attentional resources as locomotor task difficulty increases compared to younger adults. As implemented, the dual task paradigm was a sensitive measure of attentional resources in our younger and fit older adult groups. **Clinical Relevance**: Specificity of task assessment and training is important for simulating real-world cognitive demands in the clinic. Implications for the design of proactive falls prevention programs are discussed.

THE RELATIONSHIP BETWEEN FEAR-OF-FALLING AND ACTUAL ABILITIES IN RURAL COMMUNITY-DWELLING OLDER ADULTS. L. K. Allison, Physical Therapy, East Carolina University, Greenville, NC.

Purpose/Hypothesis: Fear-of-falling [FOF] has been correlated with an increased risk for falls, self-restriction of physical activity, & subsequent decrease in quality of life in older adults. The relationship between perceived FOF & balance ability is unclear, as results from prior studies are inconsistent. Few studies have used the Survey of Activities & Fear of Falling in the Elderly [SAFFE] as a standard measure of FOF. No studies have explored the relationship of the SAFFE with tests that predict fall risk. The purpose of this study was to investigate the correlation between FOF as measured by the SAFFE and actual balance abilities in a diverse group of older adults. **Number of Subjects**: Thirty-two rural, community-dwelling older adults (30 female, two male) with a mean age of 76 (range 60-87; SD 10.7) participated in this study. The sample was 49% African-American & 48% Caucasian. FOF was expressed by 38% of subjects. For 26% of participants, fear was significant enough to result in self-restriction of activities. **Materials/Methods**: FOF was assessed using the SAFFE, a self-assessment survey. The SAFFE gathers information about participation in 11 functional activities, as well as the extent to which fear is a source of activity restriction. Balance and functional mobility were measured using the Berg Balance Scale [BBS] and Timed Get Up and Go test [TUG], respectively. Participants were categorized as low (N = 17), moderate (N = 8) or high (N = 7) risk for future falls based on their self-reported past fall history & results on the BBS & TUG. Data

analysis included the Spearman correlation. **Results**: FOF as assessed by the SAFFE was not significantly correlated with balance and functional mobility as measured by the BBS and TUG: SAFFE vs. BBS, r = -0.055, p = 0.776; SAFFE vs. TUG, r = 0.199, p = 0.275. The TUG & the BBS are highly correlated, r = -0.882, p < 0.001. There was no significant difference between any of the three fall-risk groups in FOF (all p > 0.05). **Conclusions**: There is little relationship between subjectively perceived FOF and objectively measured balance abilities. These findings are inconsistent with prior studies that showed a relationship between FOF and physical activity measures. Discrepant results may be explained by differing survey tools, small sample size, skewed BBS scores, and/or problems with interpretation of SAFFE scores. **Clinical Relevance**: Intervention aimed at reduction in FOF may increase activity level but may not directly affect balance abilities or fall-risk. Determination of the relative contribution of FOF vs. actual balance abilities to fall-risk would permit targeting of intervention resources to the most influential risk factors. Older adults whose goals include both reduction in fall-risk and increase in activity level may need combined treatment approaches.

BALANCE CONFIDENCE IN OLDER ADULTS: IMPLICATIONS FOR BALANCE AND PHYSICAL PERFORMANCE. D. W. Klima[1], R. A. Newton[2], [1]Physical Therapy, UMES, Princess Anne, MD, [2]Physical Therapy, Temple University, Philadelphia, PA.

Purpose/Hypothesis: Diminished balance confidence, along with a convergent fear of falling, is a common occurrence in the elderly. Physical therapists must consider its association with physical performance and assistive device variables when screening older adult clients. The purposes of this cross-sectional study were to 1) Examine the relationship between balance confidence and both balance and gait performance measures in older adults during a comprehensive fall screening activity and 2) Analyze balance confidence as a predictor of balance performance on the Multidirectional Reach Test. **Number of Subjects**: Subjects included 107 older adults over the age of 60 (x= 80.2;SD=10.3;range:60-100) living in home residences, assisted living, and senior housing facilities. Eighty-three female and 24 male subjects participated and were independent in ambulation with (cane or walker) or without an assistive device. **Materials/Methods**: During a structured screening session, older adults completed a basic demographic and comorbidity profile, the Activities-specific Balance Confidence (ABC) Scale, and the Multidirectional Reach Test (MRT). Subjects also responded to a single item question dichotomizing (Yes/No) fear of falling presence, and noted if this fear imposed activity limitations. Additional gait batteries included the Timed Up and Go Test (TUG) and negotiation of a timed 8 and 20 foot gait course. Data were analyzed using Pearson product moment correlations for variable relationships, a one-way ANOVA with Tukey post-hoc tests for mean group comparisons, and a multiple linear regression model to predict determinants of balance performance. **Results**: Thirty-two subjects (30%) noted that a fear of falling limited their activities, with a mean ABC score of 69.1+/ 24.3 among all participants. Balance confidence scores were inversely related to gait speed on the timed 8 foot (r=.24;p<0.05), 20 foot (r=-.52;p<0.01), and TUG tests (r=-.55;p<0.01). Elders who walked with no assistive device had significantly higher balance confidence (x=83.0+/-16.1;p<0.05) than those who walked with a cane (x=63.0+/-25.1) or walker (x=51.2+/-21.2). While ABC scores were significantly correlated with all MRT measures, balance confidence was lowest with the backward reach excursion (r=0.54;p<0.01). Multiple linear regression analysis determined that subjects' age and ABC score predicted 51% (p<0.001) of the variance in their forward reach trajectory. **Conclusions**: Data indicate that diminished balance confidence is linked to limits of stability, gait speed, and assistive device use in older adults; moreover, clinicians should fuse both balance confidence and physical performance data to capture a clearer profile of older adults' functional status. **Clinical Relevance**: While age-related norms have been established for gait and balance control, less is known about the concomitant impact of diminished balance confidence on physical performance among older adults. Attention to diminished balance confidence levels will aid in establishing strategic functional mobility interventions.

THE EFFECT OF CONTEXT ON FUNCTIONAL REACH ABILITY IN HEALTHY ADULTS. B. Norris, A. Medley, Texas Woman's University, Dallas, TX.

Purpose/Hypothesis: Research comparing an individual's functional reach ability under various contexts is limited. Since many activities of daily living involve reaching performed under various contexts, it is important to understand how one's reaching ability might vary depending upon the context in which it is performed. Performance data of functional reach ability under varying contexts across age groups would be useful in the examination and treatment of balance disorders. Purposes were to assess functional reach ability across 4 tasks: traditional functional reach (FR); target oriented functional reach (TOFR); functional reach to grasp (FRG) and functional reach on foam (FRF); and to investigate the effect of age on functional reach ability. **Number of Subjects**: 47 healthy subjects, ages 20-39 (n =25; mean age 28); 40-59 (n=22; mean age 50). **Materials/Methods**: Functional reach ability was tested in 4 tasks (FR, TOFR, FRG, FRF), administered in random order in a single session. Subjects completed 3 trials of FR and FRF. Age and gender Functional Reach normative data were used to determine starting distances for TOFR and FRG. Target distance for these tasks was advanced in 1 in. increments until participants were unsuccessful. When an unsuccessful trial occurred, the target was repositioned .5 in. closer and the trial repeated. If this repeated trial was successful, the closer distance was recorded as the maximum TOFR or FRG. If the repeated trial was unsuccessful, the maximum TORF or FRG was the distance of the last successful trial. Subjects rested for 1 minute between each trial and 2 minutes between each task. Intertrial reliability (ICC 2,1) across 3 trials was determined for FR and FRF. Age (young, old) x reaching task (FR, FRF, TOFR, FRG) repeated measures MANOVA was conducted to determine differences between reaching tasks. Post hoc independent t-tests were conducted to determine age differences on each reaching task with a Bonferroni correction (p=.01). Pairwise multiple comparisons were completed to determine differences between reaching tasks. **Results**: ICCs for FR and FRF varied between 0.92-0.95. There was a main effect of reach task (p=.00) and age (p=.00) with no interaction between reach task and age (p=.08). Post hoc independent t-tests revealed that younger subjects reached further for all tasks except the FRF. Pairwise comparisons for the main effect of reach task showed that FR, FRF, TOFR and FRG were all different. **Conclusions**: Reaching ability was greater when subjects were presented with a target to aim toward or to grasp but was decreased when subjects stood on an unstable surface. Additional research is needed to investigate the effects of reaching context in older individuals. **Clinical Relevance**: The results of this study may be useful in the examination and treatment of balance disorders. During examination, reach ability should be assessed under variable conditions, including reaching for objects and on unstable surfaces. During treatment, the utilization of a target to aim toward or to grasp may provide a greater challenge to balance than simply reaching forward.

THE EFFECTS OF USING HANDRAILS ON LEARNING TO WALK ON A NARROW BALANCE BEAM. A. Domingo, D. P. Ferris, Kinesiology, University of Michigan, Ann Arbor, MI.

Purpose/Hypothesis: Although physical assistance is often provided during rehabilitation, it is not clear how it affects motor learning of complex skills. The purpose of our study was to determine how using assistance in the form of handrails affects motor learning of unassisted walking on a narrow balance beam. We chose to study healthy subjects walking on a narrow balance beam to establish basic principles of learning balance with the intent to extend these principles to relevant patient populations in future studies. Physical assistance may impede learning because it changes the sensory environment and removes opportunities for error detection and correction. We hypothesized that using handrails only as needed would improve their ability to walk unassisted on a narrow balance beam more than the not using the handrails at all, and that not using handrails would improve walking more than constantly using handrails. Using the railings only as needed allows learners to explore task dynamics as well as allows for error detection. **Number of Subjects**: 21 healthy subjects **Materials/Methods**: Three groups of 7 subjects were evaluated during 5 minutes of unassisted walking before and after 30 minutes of practice on a narrow treadmill-mounted balance beam (beam-mill) (2.5 cm tall and 2.5 cm wide, speed=0.22 m/s). The first group practiced without assistance (No Rails), the second group practiced with constant assistance by holding handrails throughout training (Constant Rails), and the third group practiced by using the handrails only as much as the subjects felt they needed to learn to walk on the beam unassisted (As Needed Rails). We assessed beam walking performance by calculating the percentage of time the subject was on the beam and recording the medio-lateral movement of the pelvis with a motion capture system. **Results**: The No Rails group had a greater improvement in percent time on the beam (~27%) than both the Constant Rails group (~15%) and the As Needed Rails group (~16%). The No Rails group was on the beam 73.9% of practice time. When subjects used the railings, error was minimized during practice as they were on the beam 99.97% (Constant Rails) and 97.85% (As Needed Rails) of practice time. **Conclusions**: Unassisted practice appears to be more beneficial to learning walking balance than assisted practice in neurologically intact subjects. This was demonstrated by the greater improvements in time walking on the beam-mill for the No Rails group compared to those that used the handrails during practice. Practicing without the handrails was more beneficial for learning because it allowed the subjects to detect and correct movement errors and it was the most task specific practice. **Clinical Relevance**: For everyday motor tasks such as walking, it is unknown how physical assistance affects motor learning, yet clinicians routinely provide physical guidance during gait rehabilitation. Understanding how physical assistance affects learning of walking balance is important in the design of therapeutic interventions and robotic devices used for rehabilitation.

THE EFFECTS OF FATIGUE-INDUCED HIP FLEXOR MUSCLE WEAKNESS ON STEPPING REACTION AND MOVEMENT TIME IN YOUNG ADULTS. A. Goldberg[1], D. Allen[2], M. Cissell[2], S. Schepens[1], S. Talley[2], [1]Department of Health Care Sciences, Program in Physical Therapy, Mobility Research Laboratory, and Institute of Gerontology, Wayne State University, Detroit, MI, [2]Department of Health Care Sciences, Program in Physical Therapy, Mobility Research Laboratory, Wayne State University, Detroit, MI.

Purpose/Hypothesis: The purpose of this study was to determine if reaction time (RT) and movement time (MT) of the lower extremity are affected by fatigue-induced weakness of the hip-flexor musculature in a group of healthy young adults. **Number of Subjects**: Twenty-four. **Materials/Methods**: Stepping RT and MT were evaluated using a repeated measures within subject research design. A sample of 24 healthy young adults, ages 21 to 30 years, participated in this study. Procedures: subjects' RT and MT were tested before and after hip-flexor musculature fatiguing (experimental) and non-fatiguing (control) conditions, separated by one week of rest. Statistical Analysis: descriptive statistics and tests for normal distribution were conducted for RT and MT. A within group, repeated measures analysis of variance was conducted to determine if RT and MT were affected by muscle fatigue. Separate paired t-tests were used to compare maximum voluntary contraction, RT, and MT pre- and post-fatiguing as well as pre- and post-control conditions. Due to multiple comparisons, significance was set at $p<.01$. **Results:** There was a significant decrease in hip-flexor maximum voluntary contraction following the fatiguing protocol ($p<.001$). Repeated measures analysis of variance revealed a significant within subjects effect ($p<.001$) for RT. Post-hoc paired t-tests revealed that fatigue-induced weakness of the hip-flexor musculature significantly increased stepping RT ($p<.001$). Repeated measures analysis of variance did not show a significant within subjects effect ($p=.694$) for MT, indicating that fatigue-induced weakness of the hip-flexor musculature did not affect this outcome measure. **Conclusions**: Stepping RT, but not MT, was adversely affected following fatigue-induced weakness of the hip musculature in a group of healthy young adults. These results are consistent with patterns of delayed recruitment of sufficient motor units to generate the required force to initiate a stepping task but not to complete the movement. **Clinical Relevance**: These results provide insight into the deleterious effects of fatigue-induced muscle weakness. People with neurological disease as well as older adults who are prone to lower extremity muscle fatigue and weakness following exertion during daily activities, may be at increased risk for a fall due to an impaired ability to initiate compensatory stepping responses in a timely fashion. Results of this study may yield insights into understanding factors related to falls in people with neurological disease as well as older adults.

A COMPARISON OF THE EFFECT OF ANKLE PLANTAR FLEXION VERSUS LUMBAR EXTENSOR MUSCLE FATIGUE ON POSTURAL SWAY. S. Samsair[2], A. Zavala[2], S. Schepens[1], S. Talley[2], A. Goldberg[1], [1]Department of Health Care Sciences, Program in Physical Therapy, Mobility Research Laboratory, and Institute of Gerontology, Wayne State University, Detroit, MI, [2]Department of Health Care Sciences, Program in Physical Therapy, Mobility Research Laboratory, Wayne State University, Detroit, MI.

Purpose/Hypothesis: Proper balance is important for optimal performance of activities of daily living. Postural sway, a measure of balance, increases with muscle fatigue. Fatigue of both proximal (lumbar extensors) and distal (plantar flexors [PFs]) muscle groups may occur during daily activity. It is unclear whether fatigue of proximal or distal muscle groups has the greater adverse effect on postural sway. The purpose of this study was to determine which muscle group (PFs versus lumbar extensors), when fatigued, has the greater effect on postural sway. **Number of Subjects**: Seventeen **Materials/Methods**: Postural sway was evaluated using a repeated measures, within subject design. A sample of 17 healthy young adults, ages 21 to 28 years, were included. Procedures: subjects were tested before and after fatiguing protocols of the 1) PFs and 2) lumbar extensors, separated by approximately one week of normal activity. Fatiguing of the lumbar extensors was conducted as fol-

lows: in prone, subjects extended their spine to maximum range, holding the position as long as possible. Muscle fatigue was reached when range of motion dropped at least ten degrees. Fatiguing of the ankle plantar flexors was conducted as follows: subjects stood on their toes for as long as possible while isometrically contracting the plantar flexors. Muscle fatigue was reached when the heel dropped at least 2cm. Statistical Analysis: a within group, repeated measures analysis of variance was conducted to determine if postural sway was affected by muscle fatigue. Post-hoc paired t-tests were used to compare postural sway pre- and post-fatiguing. Alpha level was set at $p \leq .05$. **Results**: Repeated measures analysis of variance revealed a significant within subjects effect ($p < .01$) for postural sway measured under the four conditions (i.e. pre- and post-PF fatigue and pre- and post-lumbar extensor fatigue). Although post-hoc paired t-tests indicated significant sway increases due to fatigue for PFs ($p < .01$) and lumbar extensors ($p < .05$), post-fatigue sway values for the muscle groups were not significantly different from each other ($p > .05$). **Conclusions**: These data validate previous studies showing that fatigue of the PFs and lumbar extensors increases postural sway, thus potentially impairing balance. These data also indicate that fatigue of these muscle groups is associated with similar increases in postural sway, suggesting that addressing fatigue of both the PFs and lumbar extensors is equally important. **Clinical Relevance**: Postural sway in young adults is equally increased as a result of fatiguing both proximal (lumbar extensors) and distal (PFs) muscle groups, thus potentially impairing balance. These results may provide clinicians with insight into some of the factors related to balance impairments in people with neurological disorders and older adults. Fatigued-induced muscle weakness—commonly experienced in these patient populations—can be addressed through physical therapy interventions, thereby potentially improving balance, postural control, and reducing number of falls.

DISCRIMINANT VALIDITY AND DIAGNOSTIC ACCURACY OF FALL RISK ASSESSMENT MEASURES IN ADULTS WITH DIABETES AND PERIPHERAL NEUROPATHY. S. W. Shaffer[1], R. Reynolds[3], A. Nitz[2], A. Harrison[2], [1]Physical Therapy, US Army Baylor University, Fort Sam Houston , TX, [2]Physical Therapy, University of Kentucky, Lexington, KY, [3]Medicine, University of Kentucky, Lexington, KY.

Purpose/Hypothesis: Diabetes and lower extremity neuropathy are both independently associated with an increased risk of falling. Currently there are no clearly established protocols to discriminant fall risk in adults with diabetes and distal peripheral neuropathy (PN). Therefore, the objectives of this study were to assess the discriminant validity and accuracy of various historical and physical fall risk assessment measures in individuals with diabetes and distal lower extremity PN. **Number of Subjects**: Sixty-one (49 males and 12 females; 62.8+9.3yrs) patients with diabetes and confirmed (nerve conduction and quantitative vibration perception testing) distal lower extremity neuropathy were included in this study. **Materials/Methods**: Participants completed questionnaires (adverse event form, Activities Specific Balance Confidence Scale) and a clinical examination which included: historical, patient self-report, sensory, strength, balance and mobility testing items. Participants were tested by an examiner who was unaware of patients past fall history, and one or more falls in the past year served as the reference criteria for fall risk. Discriminant validity of variables was analyzed with independent t-tests, receiver operator characteristic (ROC) curves, Mann Whitney U, and chi-square tests. Sensitivity, specificity, positive likelihood ratios (+LR) and negative likelihood ratios (-LR) were also calculated for all variables with significant ($p < .05$) discriminant validity. **Results**: Over half of the participants ($n = 32$) had a past history of at least one fall in the past year and 16 had experienced an injury secondary to falling. Various historical, self-report, and physical examination measures exhibited significant discriminant validity, and 18 items had meaningful likelihood ratio point estimates above 2 or below 0.50. The items most useful for ruling in fall risk were tandem (+LR=15.4) and one leg stance (+LR=9.5) eyes open. In combination, these two tests resulted in perfect specificity (100%; +LR-infinite). The test items most useful for ruling out a past history of falling included one leg stance eyes closed (-LR=.19) and a report of not having difficulty with walking on unlevel surfaces(-LR=.15). **Conclusions:** Several of the fall risk assessment measures exhibited acceptable levels of discriminant validity and diagnostic accuracy. Measures of static balance (tandem stance, one leg stance eyes open and closed) proved to be the most useful clinical measures for identifying fall risk in community dwelling adults with diabetes and distal lower extremity neuropathy. **Clinical Relevance**: Findings suggest that the combination of three simple measures of static balance were useful for assessing fall risk in patients with diabetes and distal PN. Prospective research in this patient population is required to validate these findings.

PLATFORMS: Spinal Cord Injuries Saturday 1:00–2:30 pm

THE EFFECT OF TASK DEMAND ON PINCH FORCE MAGNITUDE IN SUBJECTS WITH SPINAL CORD INJURY. M. Johanson[1], N. Smaby[1], W. Murray[2], V. Hentz[1], [1]Rehabilitation R&D, VA Palo Alto Heath Care System, Palo Alto, CA, [2]Northwestern University, Chicago, IL.

Purpose/Hypothesis: Individuals with cervical spinal cord injuries (SCI) may have residual muscle function or undergo reconstructive surgery to restore grasp and pinch. Our previous work demonstrated some individuals have sufficient force for tasks requiring lateral pinch strength, but remain unable to perform tasks successfully. The purpose of this study was to determine if the demands of different lateral pinch tasks (i.e., arm position, pinch opening) would have an effect on the resulting lateral pinch force magnitude. **Number of Subjects**: Eight individuals (9 arms) with cervical SCI (C4-7 level) were studied; 2 with incomplete injuries had adequate residual muscle strength to participate, 6 had tendon transfer surgeries to restore hand function. All were male, mean age of 55.3 years, and mean of 15.3 years post surgery. **Materials/Methods**: Pinch force was recorded using a clinical pinch meter and compared with pinch force recorded by force sensors positioned in space to replicate task location and required subjects to match a target pinch force magnitude and center of pressure (COP) of the index finger and thumb. A robotic arm positioned two 6-axis force sensors for recording force produced by the index finger and thumb in the spatial location where selected pinch tasks would be performed; including an ATM card, fork, key, vertical and horizontal zippers, remote, and electrical plug. The position of the sensors was varied by changing their height, orientation, and pinch opening, depending on the task. For each task position, the subject produced their maximum pinch force and in the same position, matched the magnitude of a target force and COP of the force produced by the index finger to that produced by the thumb using visual feedback. Target forces were different for each task. Wilcoxon signed rank tests compared maximum pinch effort from the pinch meter with forces recorded by the robot-mounted sensors in the simulated task position. **Results**: The pinch force recorded by the pinch meter in the subject's chosen position was significantly greater than the pinch force recorded in the simulated task position, except for the electri-

cal plug ($p<.05$). In the simulated task position, pinch force was reduced on average 43% (sd 29%) across tasks, ranging from 19% (sd 21%) decrease for the plug to 70% (sd 17%) decrease for the small zipper. During maximum pinch effort in the simulated task position, the distance between the thumb and index COP ranged from 9.4-13.8 mm apart, but when feedback was provided, subjects could narrow the distance to a range of 5.3-9.0 mm. **Conclusions**: Functional pinch force may be reduced when the arm is positioned to meet the task requirements. The individuals in this study were able to modulate pinch force and position the thumb and index finger so that opposing force is located properly for each task, despite the limited muscles under voluntary control. **Clinical Relevance**: For individuals with SCI, training to maximize residual function or rehabilitation following reconstructive hand surgery should address training in a variety of positions and pinch opening.

ANKLE CLONUS DROP TEST: THE VALIDITY OF A NEW BIOMECHANICAL TEST OF PLANTAR FLEXOR HYPEREXCITABILITY IN SPINAL CORD INJURY. K. J. Manella[1], E. C. Field-Fote[2], [1]The Miami Project to Cure Paralysis, University of Miami, Miami, FL, [2]Department of Physical Therapy, Miller School of Medicine, University of Miami, Miami, FL.

Purpose/Hypothesis: Ankle clonus is one of a constellation of signs associated with spasticity. While it is easy to recognize, it is not easy to quantify. A quantitative assessment of ankle clonus in individuals with spinal cord injury (SCI) is important for evaluating interventions. The objective of this study was to establish validity for a new biomechanical test of ankle clonus in individuals with SCI. **Number of Subjects**: Seven individuals with SCI, with varying degrees of ankle clonus, were included. **Materials/Methods**: The ankle clonus drop test was designed to simulate ankle clonus as it occurs in people with SCI during transfer activities when the bottom of the foot rapidly contacts the wheelchair footrest, floor or other surface. During our biomechanical test, the foot is dropped from a height of 10 centimeters onto a platform and kinematic and kinetic parameters are recorded using an eight camera analysis system; six reflective markers attached to the fifth metatarsal head, lateral heel, lateral malleolus, lateral knee distal to joint line and greater trochanter; and a portable force plate. Each subject underwent a biomechanical test: the ankle clonus drop test; a clinical test: the Spinal Cord Assessment Tool for Spasticity (SCATS); and a neurophysiologic test of reflex hyperexcitability: the Low Frequency Depression (LFD) H-Reflex Test. To analyze the relationship between these outcome measures, Pearson Correlations and a Spearman Rank Correlation were conducted. **Results**: The frequency (beats per second) of clonus, as measured by the drop test, accounted for 98% of the variance in SCATS clonus duration and was highly significant, (Pearson $r = .9755$, $p=.0002$). The drop test clonus frequency accounted for 95% of the variance in SCATS clonus scores and was highly significant, (Spearman $r=.9543$, $p=.0064$). The drop test clonus frequency accounted for 69% of the variance in the H-Reflex depression ratio and showed a trend towards significance, (Pearson $r=.6907$, $p=.0858$). Our results indicate that ankle clonus frequency, as measured with the ankle clonus drop test, was correlated with a clinical tool, SCATS, which has been reported to be a reliable and valid measurement of ankle clonus in the spinal cord population. This suggests that the use of the ankle clonus drop test is a valid measure of ankle clonus in the spinal cord population. The finding of a moderate correlation with a neurophysiologic test of plantar flexor reflex hyperexcitability with a trend towards significance is encouraging and requires further study. **Conclusions**: The ankle clonus drop test, a new biomechanical assessment tool, demonstrated significant correlation with a clinical scale of ankle clonus and appears to produce objective, quantitative, and valid measurements of plantar flexor hyperexcitability in individuals with spinal cord injury. **Clinical Relevance**: Existing measures of plantar flexor spasticity lack validity, reliability and ability to detect change; objective and quantitative measures are needed to better assess ankle clonus.

MODULATION OF HYPERREFLEXIA IN SPINAL CORD INJURY USING PASSIVE EXERCISE. C. C. Yates[1], S. R. Allen[1], N. B. Reese[1], R. D. Skinner[2], E. Garcia-Rill[2], [1]Physical Therapy, University of Central Arkansas, Conway, AR, [2]Neurobiology and Developmental Science, University of Arkansas for Medical Sciences, Little Rock, AR.

Purpose/Hypothesis: We previously demonstrated that the transected (Tx) rat transitions to a hyperreflexive state 714 days after transection and the H-reflex stabilizes in a "chronic" state by 30 days post transection. We also previously demonstrated that motorized bicycle exercise training (MBET) restored low frequency-dependent depression of the H-reflex in Tx rats and in patients with spinal cord injury. We showed that 30 days was the minimum amount of MBET required to achieve normalization of the H-reflex in the rat after complete spinal cord transection if the exercise was initiated in the acute phase of injury. We hypothesized that normalization of the H-reflex with MBET is possible in the Tx rat that has transitioned to the chronic state of injury, although the amount of exercise required will be different than what was required in the acute state. **Number of Subjects**: Groups of rats ($n=8$ per group) were placed in the following groups: control, Tx only 30 days, Tx + MBET 30 days (initiated in the acute phase of injury), Tx + delay (allowing the transition to the chronic state) then MBET 30 days, Tx + delay then MBET 60 days, and Tx +MBET 30 days then cessation of exercise 30 days. **Materials/Methods**: Animals underwent a complete transection at T10 and were provided with daily animal care including bladder expression until reflexive voiding occurred. The H-reflex was measured under anesthesia as previously described (Reese et al. 2005). **Results**: As hypothesized, the Tx + MBET 30 day group (acute exercise) demonstrated a normalization of hyperreflexia and was significantly different from the Tx 30 day group without treatment ($p<.01$), but not significantly different from intact animals. However, the Tx animals that did not begin exercise until they had reached a chronic state (delay 30 days) and then exercised for 30 days, were not significantly different from the Tx 30 day group. The Tx group that delayed exercise (chronic state) and then exercised for 60 days, was significantly different from the Tx 30 day group ($p<0.01$). **Conclusions**: These results suggest that MBET can act to prevent hyperreflexia if it is initiated in the acute stage (before hyperreflexia is evident). However, if passive exercise is initiated in the chronic state, the minimum time required for changes in the H-reflex to occur in the acute model (MBET 30 days), did not normalize the H-reflex. However, the group that exercised for 60 days after initiation of exercise in the chronic state was significantly different from the Tx 30 day group demonstrating that rescue from hyperreflexia is possible. **Clinical Relevance**: These results suggest that MBET is useful for treating hyperreflexia after SCI and could be used to prevent hyperreflexia in the animal model. We have demonstrated that rescue from hyperreflexia is possible if MBET is initiated in the chronic state, in both the animal model and the human patient, although the parameters of exercise required are different in the acute versus the chronic state of hyperreflexia.

PRESERVING BONE HEALTH AFTER ACUTE SPINAL CORD INJURY: DIFFERENTIAL RESPONSES TO A NEUROMUSCULAR ELECTRICAL STIMULATION INTERVENTION. A. Lichy, I. Ljungberg, S. Groah, A. Libin, NRH, Washington, DC.

Purpose/Hypothesis: Determine factors associated with improved response of bone to an intensive neuromuscular electrical stimulation intervention (NMES) after acute spinal cord injury (SCI). **Number of Subjects**: 25 participants have completed the trial (13 exercise, 12 control) **Materials/Methods**: A randomized-controlled trial was conducted at the National Rehabilitation Hospital. Individuals with C4 to T12 ASIA A or B SCI, less than 12 weeks post-injury. The control group received usual care and the exercise group received one hour electrical stimulation 5 days a week for six weeks. Outcome measures were collected at baseline, post-intervention, and 6 months post-injury, and included: DXA, CT, serum osteocalcin, alkaline phosphatase, serum calcium, N-telopeptide, and urine calcium. This study was based on between-subjects research design. Bone density between groups via DXA measure at baseline and 3 month follow up was analyzed using Two-Way ANOVA model. **Results**: 25 participants have completed the trial. Participants under age of 21years who received NMES had a gain in bone density compared to those receiving NMES who were older than 21 (P=.0001). Participants with a body mass index (BMI) less then 18.5 had significantly less BMD at baseline compared to those with higher BMI (p=.001). After intervention, the low BMI group who received NMES demonstrated a gain in bone mass during the period of follow-up (Initial BMD 0.97 vs Post-intervention BMD 1.1). This is in contrast with the low BMI controls who had BMD decreased from 0.9 to .634(p-value=.02). **Conclusions:** Interim data supports that an intensive lower extremity NMES program appears to delay BMD loss after acute motor complete SCI. A larger effect of an acute NMES program in the population under the age of 21 and participants with lower BMI. **Clinical Relevance**: These preliminary results indicate that subpopulations with acute SCI and baseline low BMD may preferentially benefit from an intervention such as this to preserve bone health.

NEUROMUSCULAR ADAPTATIONS FOLLOWING CONTUSION SPINAL CORD INJURY AND LOCOMOTOR TRAINING. A. Jayarman[1], M. Liu[2], D. Howland[3], G. Walter[2], K. Vandenborne[1], [1]Physical Therapy, University of Florida, Gainesville, FL, [2]Physiology and Functional Genomics, University of Florida, Gainesville, FL, [3]Neuroscience, University of Florida, Gainesville, FL.

Purpose: The majority of spinal cord injuries (SCI) sustained currently are clinically incomplete as a result of new developments in the acute management of SCI. Currently; a popular rehabilitation approach in the treatment of individuals with SCI is locomotor training. The purpose of this study was to evaluate the therapeutic influence of early treadmill locomotor training on skeletal muscle and neuromuscular junction (NMJ) activity following contusion SCI in rats. **Description**: Twenty-four adult Sprague Dawley rats (8 controls, 8 treadmill-SCI, and 8 no treadmill-SCI) were studied. Sixteen animals received a moderate T8 spinal cord contusion injury using a standard NYU impactor. Eight of the injured rats received treadmill training starting one week after SCI for five consecutive days, twenty minutes per trial, two trials per day. Lower limb muscles; specifically the soleus, tibialis anterior (TA), extensor digitorum longus (EDL), gastrocnemius (Gas) were analyzed for fiber size, fiber type and markers of muscle regeneration (Pax-7, MyoD, Myf5, Myogenin, Embryonic and Neonatal Myosin) and the expression of muscle specific tyrosine kinase receptor (MuSK a marker of NMJ activity) and acetylcholine receptors (AChR).One week of locomotor training significantly increased muscle fiber size towards normal control values. There was also a significant shift in fiber type in all hind limb muscles towards slower isoforms. The training resulted in a significantly increased expression of the markers of muscle regeneration in all the muscles in comparison to untrained SCI rats, while the control animals showed no expression. Specifically, the soleus showed significant elevations in the expression of regeneration makers after the training in comparison to the other muscles following SCI. One week of treadmill training also upregulated the expression of MuSK and AChR compared to SCI-untrained animals. In addition, MuSK was co-expressed with the markers of muscle regeneration at the NMJ indicating reinnervation combined with regeneration. **Summary of Use**: One week of locomotor training resulted in muscle hypertrophy, fiber type adaptations towards slower isoforms, new fiber formation and also upregulation in the functioning of the NMJ. Importance to Members: This study identifies changes in the peripheral neuromuscular system as a result of SCI. The study is the first to focus on concept of muscle regeneration and NMJ activity after contusion SCI and also to study the positive effects of locomotor treadmill training on the skeletal muscle and the neuromuscular junction.

EXPLORING MEASURES OF WALKING STABILITY IN INCOMPLETE SPINAL CORD INJURY AUTHORS. K. V. Day[1], L. Gill[1], S. A. Kautz[2], A. L. Behrman[2], [1]Physical Therapy, University of Florida, Gainesville, FL, [2]Brain Rehabilitation Research Center, Malcom Randall VA Medical Center, Gainesville, FL.

Purpose/Hypothesis: Persons with spinal cord injury (SCI) classified as American Spinal Injury Association Impairment Scale (AIS) D are predicted to recover the greatest walking ability compared to AIS A, B, and C. However, the heterogeneity of sensory and motor deficits within AIS D injuries may contribute to varying degrees of walking disability. Dynamic stability is a co-requisite of functional ambulation and is often impaired after SCI. Current clinical measures of dynamic stability are limited to ordinal scale assessments, which have not been substantiated in SCI. The purpose of this case series was to explore dynamic walking stability in persons with SCI categorized as AIS D through a comparison of current clinical balance assessments and a quantitative biomechanical measure, margin of stability (MoS). MoS is the shortest perpendicular distance between an individual's center of mass extrapolated in the direction of its velocity and center of pressure during the stance phase of gait. We hypothesized that persons with SCI classified as AIS D would demonstrate a wide variation in dynamic walking stability when assessed by both clinical assessments and MoS. **Number of Subjects**: Six participants with chronic, cervical or thoracic level SCI (45.2 ± 10.8 years; 5 males) and 10 healthy controls (59.5 ± 8.5 years; 2 males) participated in this study. **Materials/Methods**: Individuals with SCI were assessed using the AIS, Berg Balance Scale (BBS), and Dynamic Gait Index (DGI). Persons with SCI also performed 30 second walking trials on a split-belt treadmill instrumented with forceplates. Trials were conducted without assistive devices at self-selected (SS) speeds. Controls walked for 30 seconds at treadmill speeds comparable to the SCI group. MoS were calculated from forceplate and VICON motion analysis data. **Results:** Persons with SCI exhibited a wide MoS range of 0.20 ± 0.12m at SS gait speeds of 0.25 ± 0.07m/s. In contrast, controls demonstrated a more consistent, narrower MoS

range of 0.12 ± 0.03 at 0.3 m/s. BBS scores varied from 21-51/56 and DGI scores ranged from 12-17/24. Neither BBS nor DGI or MoS values consistently agreed with each other regarding the dynamic stability of each participant. **Conclusions:** Despite AIS D classification, MoS revealed a broad range of walking stability deficits and severely compromised walking speeds in individuals with SCI when compared to matched norms. Clinical balance assessment findings were inconsistent with each other and MoS for describing dynamic stability. EMG and accelerometry evaluations during SS and fastest-selected walking may further delineate dynamic stability deficits. **Clinical Relevance**: Ordinal scales of impairment and balance may not sufficiently describe dynamic walking stability in SCI compared to quantitative biomechanical measures. MoS and alternative quantitative measures of dynamic stability may allow discrimination among clinical balance tools and direct clinical decision-making toward appropriate rehabilitation interventions for walking balance recovery. Supported by the VA RR&D B4024-I, NIH R01 HD46820, NIH T32 HD043730

LOCOMOTION AFTER STROKE: Platform and Thematic Poster Session
Saturday 1:00–4:30 pm

PLATFORMS: Locomotion After Stroke
Saturday 1:00–2:30 pm

SYSTEMATIC INCREASES IN WALKING SPEED HAVE VARIED EFECTS ON POST-STROKE WALKING PATTERNS. M. Roos[1], K. Rudolph[2], T. Kesar[1], D. Reisman[2], [1]Biomechanics and Movement Science, University of Delaware, Newark, DE, [2]Department of Physical Therapy, University of Delaware, Newark, DE.

Purpose/Hypothesis: The purpose of this study is to determine the effect of increasing walking speed on inter-and intra-limb gait parameters in individuals post stroke. Increasing the speed of ambulation improves some gait parameters, but this may be at the expense of others. We hypothesize that increases in speed will have differential effects on intra- versus inter-limb walking parameters and that these effects will be influenced by the subject's baseline walking speed. **Number of Subjects**: 9 subjects with chronic post-stroke hemiparesis have been tested to date; data from 5 are presented here. **Materials/Methods**: Subjects walked on a custom-built instrumented split-belt treadmill (AMTI,Watertown, MA) at 6 different speeds: self-selected over ground walking speed (SS), 20% slower than SS (SLOW), their fastest possible speed on the treadmill (FAST) and 3 speeds between SS and FAST. Kinematic data were collected using an 8camera Vicon Motion System (LA, CA) and kinetic data were collected from the custom-built instrumented split-belt treadmill, which contained 2 strain gauge force platforms, one under each belt. Subjects walked for 20 sec per trial, 23 trials at ea speed. **Results**: Intralimb parameters (hemiparetic trailing limb position and peak posterior ground reaction force or push-off force), improved at 2 speeds faster than the subjects' self selected speed ($p<0.008$, $p<0.032$, trailing limb position and push-off force respectively), at 3 speeds faster ($p<0.003$, $p<0.026$), and at their FAST speed ($p<.0001$, $p<.030$) when compared to their SLOW speed. There was no significant difference among speeds for the interlimb parameter (step length symmetry). Subjects who walked at an initial slow speed (<0.8 m/s) showed larger and consistently increasing improvements in trailing limb position and step length with speed compared to subjects with faster baseline speeds (>0.8 m/s). **Conclusions**: The results of this study demonstrate that improvements in intra- and interlimb parameters in individuals with stroke show different patterns of response to increasing walking speed. Since intralimb parameters represent the response of an individual limb and interlimb parameters represent coordination between the limbs, these results suggest that initial increases in treadmill speed may have a greater influence on an individual limb rather than on coordination between the limbs. In addition, the relatively steady and larger improvement seen in this study for subjects with slower baseline walking speeds has mirrored improvements in metabolic energy costs (Reisman et al, 2007) which suggests that individuals post-stroke with the slowest walking speeds may have the most to gain from increasing the speed during treadmill training. **Clinical Relevance**: At present there are no guidelines to determine the most appropriate speed that maximizes improvements in inter- and intralimb gait parameters in individuals post-stroke. This research can assist clinicians in determining the initial optimal treadmill training speed based on the deficits to be targeted and the level of baseline walking impairment.

EFFECTS OF VIRTUAL REALITY-ROBOTIC TRAINING COMPARED TO ROBOT TRAINING ALONE ON WALKING INDIVIDUALS WITH POST STROKE HEMIPLEGIA. A. Mirelman[1,2], P. Bonato[2], J. E. Deutsch[1], Rivers Lab-Doctoral Program in Physical Therapy, UMDNJ, Newark, NJ, [2]Spaulding Rehabilitation, Harvard University, Boston, MA.

Purpose/Hypothesis: The purpose of this study was to determine if lower extremity training on virtual reality-robotic device improved walking ability better than training with the robot alone. We hypothesized that gait speed and endurance would be faster and longer respectively, both in a lab setting and community setting. **Number of Subjects**: Eighteen individuals with chronic post-stroke hemiplegia participated. They had active partial anti-gravity dorsiflexion of the affected ankle and were able to walk 50 feet without the assistance of a person. **Materials/Methods**: A single blinded randomized control trial (RCT) with repeated measures at pre-training, post training and three months follow-up was conducted. Walking velocity was measured as the average of five trials during an instrumented gait analysis and walking endurance was measured using the 6 minute walk test (6MWT). Community ambulation was monitored with an activity monitor(PAM) for one week prior to training and one week after training. Subjects trained one hour three times a week for four weeks. Training was controlled for repetitions and feedback. Subjects in the robotic- vr group used a lower extremity robot as input to two virtual environments (VEs). Their task was to navigate a plane or a boat through a series of targets. Targets were manipulated to produce warm up endurance, strengthening and coordination exercises. Knowledge of performance (KP) and results (KR) was provided by the system. Subjects in the robot alone group had the same training protocol. They received KP and KR from the therapist. Data were analyzed using (2 x 3) RM ANOVA for walking velocity and endurance and a (2x2) RM ANOVA for community ambulation. **Results**: Gait speed increased 24% (from .64m/s to .81m/s) for the robot-vr group and only 2% for the robot alone group. Five out of nine subjects had a change in their walking classification by one level (Perry, 1995). Endurance increased 21% (261m to 312m) for the robot-vr group and only .5% for the robot alone group. There were significant within group effects for the robot-vr group for both gait speed ($F=7.09$, $df=2$, $p=0.003$) and endurance ($F=7.09$,$df=2$, $p=0.002$). Subjects in the robot vr group had significant improvements of 17 % in gait speed (from .53-.63m/s) and 141% in walking endurance (from to 1.2 to 2.8 miles) measured in the community. **Conclusions**: Use of task

based virtual environment training improved walking for people post-stroke better than massed lower extremity training on a robot alone. The walking improvements measured in the lab setting were comparable to those measured in the community. **Clinical Relevance**: Walking gains made by individuals post-stroke who trained with a robotic virtual reality system were clinically meaningful and transferred to real world environments.

EFFECTS OF A SINGLE SESSION OF UNILATERAL VERSUS BILATERAL PEDALING ON PROLONGED MUSCLE ACTIVITY DURING PEDALING IN PERSONS WITH POST STROKE HEMIPARESIS. A. Freeman, A. Brantl, C. L. Johnston, L. M. Rogers, D. A. Brown, Physical Therapy & Human Movement Sciences, Feinberg School of Medicine, Northwestern University, Chicago, IL.

Purpose/Hypothesis: In persons post-stroke, inappropriate prolonged muscle activity exists in knee extensors during locomotion, which leads to reduced gait speed and an increased risk for falls. We have studied inappropriate prolonged vastus medialis (VM) muscle activation during the upstroke phase of the pedaling cycle (VM3) and have found that it interferes with net mechanical work in bilateral pedaling post-stroke. However, during paretic one-legged (unilateral) pedaling, VM3 activity is reduced and appears to be less inappropriate. The purpose of this study was to determine if a single session with 30 minutes of unilateral pedaling can result in reduced inappropriate VM3 activity during subsequent bilateral pedaling in persons post-stroke. **Number of Subjects:** Twelve individuals (6 M, 6 F) with chronic hemiplegia (>6 months) with mean age = 61.2 +/- 13.1 years. All subjects had locomotor deficits resulting in gait speed less than 1.0 m/sec. **Materials/Methods**: Each of two sessions began with a pretest of bilateral pedaling to establish baseline conditions. This was followed by either a 30 minute unilateral or 30 minute bilateral pedaling intervention, followed by post-measurements. The procedure was repeated 24-48 hours later using the remaining intervention. EMG activity of the vastus medialis was monitored from both the paretic and nonparetic leg. Repeated measures ANOVA was used to test the hypothesis that a pre-post reduction in VM3 activity after unilateral training was less than after bilateral training. **Results:** Inappropriate EMG activity during the upstroke (VM3) increased in the paretic leg as a result of 30 minutes of bilateral pedaling (baseline 16.9% +/- 9.4% total EMG; post-intervention 18.3% +/- 9.1% total EMG, $p<0.05$), but did not change with 30 mins unilateral pedaling. During the phase that included the initiation of VM EMG activity (VM4), there was a significant increase in VM4 as a result of 30 minutes of bilateral pedaling only (baseline 17.9% +/- 8.4% total EMG: post-intervention 21.9% +/- 9.8% total EMG, $p<0.05$). This increase did not occur after 30 minutes of unilateral pedaling. **Conclusions**: Our initial hypothesis was not supported in that inappropriate VM3 activity did not decrease after a 30 minute trial of unilateral pedaling. However, 30 minutes of bilateral pedaling appeared to increase inappropriate termination and early initiation of VM activity whereas a thirty minute unilateral pedaling intervention did not worsen inappropriate VM activity. **Clinical Relevance**: Clinicians use bilateral pedaling as an exercise post-stroke. However, our findings suggest that 30 minutes of bilateral pedaling may exacerbate inappropriate VM timing in the paretic leg. Unilateral paretic leg pedaling appears to prevent this exacerbation while potentially providing potential benefits for the improved control and strength of the paretic leg. Funding support provided to Brown by a grant from NIH/NINDS R44 NS042560

RELIABLITITY AND VALIDITY OF THE FUNCTIONAL OBSTACLE COURSE AS MEASURED WITH INDIVIDUALS POST-STROKE. M. Beahm, T. Crutcher, K. Krivanec, B. Marshall, A. Nagel, S. Schramer, G. M. Huber, D. Brown, Department of Physical Therapy and Human Movement Sciences, Northwestern University, Chicago, IL.

Purpose/Hypothesis: The Functional Obstacle Course (FOC) is a performance test that simulates daily activities that challenge balance and mobility. The FOC consists of twelve stations, scored on time and quality of movement, and has been previously validated in an older adult population to assess fall risk. The FOC may also be valid as a performance measure in individuals post-stroke. This study examined the reliability and validity of the FOC with individuals with chronic hemiplegia post-stroke. **Number of Subjects**: Thirteen subjects, mean age 59 years old, (M=5, F=8) with chronic hemiplegia post-stroke were recruited from the surrounding community. **Materials/Methods**: Participants completed the 10m walk test (comfortable and fast speed), Berg Balance Scale (BBS), and the FOC, on two separate testing dates. In addition, the Lower Extremity Modified Fugl-Meyer Assessment (FMA), Activities Balance Confidence Test (ABC), and 6-minute walk test data was available for validity analysis. ICC (3,1) was used to assess interrater (between day and within day) reliability of the FOC scores. Validity was assessed using Pearson and Spearman-rho correlations between FOC scores and select comparison scores (BBS, 10m walk, 6 min walk, ABC, and FMA). Significance level is ≤ 0.05. **Results**: Inter-rater reliability for FOC-time scores was high (range for 12 obstacles: ICC (3,1) = 0.99 -1.00). Within day test-retest reliability was high: time scores ICC range for each obstacle was 0.85-0.99; for the total FOC score: 0.97; and for the FOC quality total score: 0.90. Between-day test-retest was also high: FOC-time scores: ICC was 0.65 -.97; FOC total score was 0.99; and FOC-quality scores was 0.95. FOC-time and quality have moderate correlations with BBS with r=-0.52 and r= 0.52 respectively. FOC-time has a significant moderate correlation with 10m-comfortable speed (r=-0.74). Significant, high correlations were found between FOC-time and the 6 minute walk distance (r=-0.82) and the 10m-fast (r=-0.78). FOC-time and quality had low non-significant correlations with ABC (r=0.20 and 0.15 respectively) and FMA (r=0.12 and 0.45 respectively). **Conclusions**: These results suggest the FOC is a relatively highly valid and reliable measure to assess balance and mobility in individuals post stroke. Future studies might investigate the usefulness of this test for measuring relative risk of falls in individuals post-stroke. **Clinical Relevance**: The FOC is a valid and reliable post stroke outcome measure. Funding support provided to Brown by NIDRR Field-Initiated Grant #H133G050132

OUTCOMES FOR FOUR PATIENTS WITH CHRONIC STROKE FOLLOWING LOWER EXTREMITY BOTULINUM TOXIN COMBINED WITH TWO MODES OF GAIT TRAINING. S. A. Combs, E. W. Miller, L. Biggers, J. Barber, L. Bingham, C. Schiel, J. Widick, KSPT, University of Indianapolis, Indianapolis, IN.

Background & Purpose: Botulinum toxin (botox) is often used in the management of spasticity post stroke, however, the effectiveness of combined botox and gait training has not been investigated. The purpose of this multiple case series was to investigate the outcomes of different modes of gait training immediately following lower extremity botox injections in patients with chronic spasticity post-stroke. **Case Description**: Four patients who were at least 6-months post stroke and who received botox injections in their

involved lower extremities were randomly assigned to either body weight support treadmill training (BWSTT) or overground walking. Each participated in their assigned intervention for 20 minutes, 3 times/week for 6 weeks immediately following botox injections. Outcomes were tested pre-botox, 1 week post-botox and gait training, and 3 months post-botox and gait training. Outcome measures included the modified Ashworth scale (MAS), Berg balance scale (BBS), timed up and go test (TUG), 10-meter and 6-minute walk tests and stroke impact scale (SIS). **Outcomes:** Three patients presented with minimally reduced spasticity at immediate post-testing, but MAS scores returned to pre-testing values at post-testing 3 months later. No clinically meaningful changes (6 points) were made by any patients on the BBS, and only the patients trained overground made clinically meaningful changes (23%) on the TUG during post-testing periods. All four patients increased their gait speed, but only two, one trained with BWSTT and one trained overground, made clinically meaningful changes (22%) in the 10-meter walk test during post-testing periods. All patients made clinically meaningful improvements (13%) in the 6-minute walk test during post-testing. Three of the four patients maintained improvements in gait endurance at 3-month post-testing. All patients reported clinically meaningful (10-15 points) increases in perception of stroke recovery on the SIS. **Discussion:** Although reductions in spasticity were short in duration, some patients demonstrated clinically meaningful improvements in mobility and gait following lower extremity botox injections and either mode of gait training. These improvements suggest that botox injections may create a window of opportunity for some patients in which physical therapists can take advantage of reduced spasticity to focus on improving activity-level skill.

THE EFFECTS OF SINGLE LIMB EXERCISE TRAINING ON FEMORAL ARTERY BLOOD FLOW IN CHRONIC STROKE: A CASE STUDY. S. Billinger, P. M. Kluding, B. Y. Tseng, Dept of Physical Therapy and Rehab Sciences, University of Kansas Medical Center, Kansas City, KS.

Purpose/Hypothesis: Physical activity levels may play a primary role in blood flow regulation. For people post-stroke, a decrease in physical activity and a lower demand for leg oxygen consumption may affect blood flow to the hemiparetic lower limb. A reduction in leg blood flow may limit the muscles ability to perform work during functional tasks or exercise. In previous work, we have found significant differences in resting femoral artery blood flow velocity and diameter in the hemiparetic limb when compared to the less affected side. During bilateral exercise, individuals with stroke use their less affected limb more, which reduces the amount of work performed by the hemiparetic limb. Therefore, single limb exercise training may be advantageous to improve blood flow to the hemiparetic limb by stimulating arterial vascular changes. The purpose of this case study was to describe the effect of single limb exercise training on femoral artery diameter and blood flow velocity in the hemiparetic limb post-stroke. **Number of Subjects**: One male adult with chronic stroke (81 years of age, 10.6 years post-stroke) participated in the study. Right lower extremity Fugl-Meyer score was 33/34 and cardiorespiratory fitness was 19.5 ml*kg-1*min-1. Baseline measures for femoral artery blood flow velocity were: 67.5 vs 74.7 cm*sec-1, for the hemiparetic and less affected limb, respectively. Femoral artery diameter was1.03 cm for the hemiparetic limb and 1.05 cm for the less affected limb. **Materials/Methods**: Doppler ultrasound was used for assessing resting femoral artery blood flow velocity and arterial diameter at baseline and post-training. For this case study, the participant performed single limb exercise training 3 times/week for 3 weeks using a Biodex System 3 isokinetic knee flexion/extension exercise protocol with a pace of 150 degrees/sec at 40 repetitions per set. The protocol allowed for progression to 20 sets with 30-second rest breaks in between each set. **Results**: The primary outcome was the change in femoral artery blood flow velocity and arterial diameter between the hemiparetic and less affected limb at baseline and post-exercise training. A 10.7% increase (baseline: 67.5 vs post-training: 74.7 cm*sec-1) in the hemiparetic limb for femoral artery blood flow velocity was observed while only a small percent increase (0.97) was found for arterial diameter. This may be explained by the diminutive difference in baseline measures for femoral arterial diameter between the hemiparetic (1.03 cm) and less affected limb (1.05 cm) in this subject. No increases were observed for blood flow velocity or arterial diameter for the untrained limb. **Conclusions**: This case study is an important step in understanding if vascular adaptations can be altered in the hemiparetic lower extremity following stroke. **Clinical Relevance**: Single limb exercise training using only the hemiparetic limb may be considered an important therapeutic intervention strategy in people post-stroke to increase blood flow and improve muscular endurance during tasks that require increased energy expenditure.

THEMATIC POSTERS: Locomotion After Stroke Saturday 2:30–4:30 pm

VALIDATION OF A SPEED-BASED CLASSIFICATION SYSTEM USING QUANTITATIVE MEASURES OF WALKING PERFORMANCE POST-STROKE. M. G. Bowden[1], C. K. Balasubramanian[2], A. L. Behrman[1], S. A. Kautz[1], [1]Brain Rehabilitation Research Center, Malcom Randall VA Medical Center, Gainesville, FL, [2]Rehabilitation Science Doctoral Program, University of Florida, Gainesville, FL.

Purpose/Hypothesis: Self-selected walking speed has been used to stratify persons with varying degrees of walking impairment and predict functional walking status post-stroke. In fact, speed-based classification has become a mechanism to define clinical meaningfulness for randomized clinical trials and clinical practice. However, this approach was validated primarily using questionnaires. This study examines the relationship between a speed-based classification system and quantitative measures of walking performance. **Number of Subjects**: Fifty-nine individuals with chronic hemiparesis participated in one of two cross-sectional studies (48 male; ages = 61.9 +/- 10.8 (SD) years; time since stroke (yrs) = 4.05 +/- 3.72; affected side: left = 29). **Materials/Methods**: Each participant walked over an instrumented walkway for spatiotemporal assessment and over embedded force platforms to collect ground reaction forces. The following variables were collected for all participants: self-selected walking speed; Fugl-Meyer lower extremity (FM-LE) and synergy (FM-S) portions of the Fugl Meyer Assessment; paretic propulsion (Pp), defined as the percentage of total propulsion generated by the paretic leg; step length ratio (SLR), defined as the percentage of the paretic step length of the total combined step lengths; percentage of the gait cycle in paretic pre-swing (PPS); and the average number of steps/day in the community as counted by a Stepwatch Step Activity Monitor. Participants were stratified by self-selected walking speed (slow: < 0.4 m/s; moderate: 0.4-0.8 m/s; and fast: > 0.8 m/s) and group differences were analyzed using a one-way ANOVA with a LSD post-hoc analysis. **Results**: A significant main effect was seen for FM-LE, FM-S, SLR, PPS, and the number of steps/day ($p<0.05$). All measures with a main effect demonstrated a significant difference between the slow group and

both moderate and fast groups ($p<0.05$). However, only the steps/day illustrated significant differences between all three groups. Furthermore, a linear regression analysis illustrated that 47% of the variance in the number of steps/day is accounted for by self-selected walking speed ($p<0.0001$). No other variables significantly contributed to steps/day. **Conclusions**: Classifying individuals post-stroke by self-selected walking speed predicts community walking behavior as quantified by daily step counts. Other measures demonstrate differences only when compared to the slowest group and may represent varying contributions to mechanisms of increasing walking speed. Thus, the speed classification presents a useful yet simple mechanism to stratify those with post-stroke hemiparesis in a way that is clinically meaningful and predictive of walking ability. **Clinical Relevance**: This study supports the clinical meaningfulness of using walking speed as an outcome measure by demonstrating the relationship with a quantitative measure (steps/day) of community walking performance.

THE COST OF DOING TWO THINGS AT ONCE AFTER STROKE: DEFICITS IN AMBULATION, HAND MOVEMENTS AND SPEECH. P. S. Pohl[1], S. Kemper[2], L. Boyd[3], C. Siengsukon[1], R. E. Herman[2], E. Vidoni[1], [1]Physical Therapy & Rehabilitation Science, University of Kansas Medical Center, Kansas City, KS, [2]Department of Psychology, University of Kansas, Lawrence, KS, [3]University of British Columbia, Vancouver, British Columbia, CANADA.

Purpose/Hypothesis: The challenge of doing two things at once can reveal deficits not detected when only a single task is performed, as is often the case in clinical tests. The purpose of our study was to examine the ability of adults with stroke to perform upper and lower limb motor activities at the same time, and to examine the performance of each of these activities while speaking. We hypothesized that dual task conditions would uncover performance deficits in those with stroke. We anticipated that these stroke-related deficits would relate to the side of the lesion for speaking and handmovements. **Number of Subjects**: Right-hand dominant subjects, 22 with unilateral stroke (mean age of 67.3 + 9.1 years) and 12 controls (mean age of 72.7 + 8.0 years), consented to participate in this study. **Materials/Methods**: Subjects were independent in ambulation and living in the community. Those with stroke were screened for aphasia. Structural brain scans were analyzed for 14 subjects with stroke. After baseline testing in single task conditions, subjects performed pairs of activities simultaneously. Measures of interest included step rate while walking a narrow elliptical pathway, tapping rate for each hand, and the rate and complexity of speech as subjects recalled memorable vacations or historical events. **Results**: Results revealed that although both groups of subjects (control, stroke) reduced walking rates during speaking compared to baseline, deficits in speech were specific to those with stroke. They spent more time not speaking while walking ($p=.035$); and they reduced the complexity of their speech compared to baseline (grammatical complexity-GC and mean number of clauses per utterance-MCU, p's=.000). Baseline tapping rates were not different between groups but group differences were found in dual task conditions. Tapping rates with the affected hand were lower for those with stroke compared to controls while walking ($p=.003$) and while talking ($p=.015$). Those with stroke also decreased the complexity of their speech (GC, $p=.004$; MCU, $p=.0001$) while tapping with the affected hand. Dual task conditions of tapping with the less affected hand revealed group differences only when paired with talking. Subjects with stroke decreased the complexity of their speech (GC, $p=.0001$; MCU, $p=.0001$) and spent more time not speaking ($p=.018$). Post-hoc analyses revealed that those with right-sided lesions had more deficits than those with left-sided lesions regardless of tasks paired. In our sample of those with brain scans, lesion volumes were higher for those with right-sided lesions than for those with left-sided lesions. **Conclusions:** As we expected, performance deficits were revealed for those with stroke under dual task conditions. Dual task deficits after stroke may be related to lesion size more than lesion side, but more work is needed in this area. **Clinical Relevance**: Clinical examinations for clients with stroke should incorporate dual task conditions. Deficits may be revealed in simple hand movements, walking or talking when two of these tasks are performed together.

SYNERGY PATTERNS OF CHRONIC STROKE SUBJECTS WHILE WALKING IN A LOKOMAT ROBOTIC ORTHOSIS. D. NICHOLS[1], N. Neckel[2], J. Hidler[2], [1]Inpatient PT, National Rehabilitation Hospital, Washington, DC, [2]CABRR, National Rehabilitation Hospital, Washington, DC.

Purpose/Hypothesis: To compare the joint moments exhibited by stroke subjects while walking in the Lokomat robotic gait-orthosis with those of healthy age-matched controls. Special consideration was given to patterns consistent with the classic flexion and extension lower limb synergies (CLF/E). Following stroke, some individuals couple joint moments into synergistic patterns inappropriate for the desired task. These synergy patterns are grouped into the extension synergy (hip, knee, and ankle extension and adduction) and the flexion synergy (hip, knee, and ankle flexion and abduction) In a coordinated multi-joint exercise such as walking, the timing and coupling of joint moments is critical throughout the gait cycle. The role of the CLF/E patterns during the gait should be investigated to better understand gait impairments following stroke. **Number of Subjects**: Ten chronic stroke subjects (5M/5F, 5L hemi/5R) and 5 healthy age-matched controls (3F/2M) participated in the study. **Materials/Methods**: Subjects walked within the Lokomat at 2.5 km/h with minimal BWS. The frontal and sagittal ankle, knee, and hip joint moments generated were recorded with the Codamotion system. To identify synergy patterns, the average joint moment profile generated by each subject throughout the gait cycle was first normalized by the subject's maximum joint moment, resulting in subject-specific patterns ranging from 0 to 1 (min to max) for each of the 6 joint moments recorded. Synergies were identified whenever the sum of two joint moment profiles of a subject was greater than 1.6 (i.e. both torques at 80% or one torque at 100% and the second at 60%). The average synergy patterns found in the left leg of healthy subjects was used as a basis to compare the average synergy patterns found in both the involved and uninvolved limb of the stroke subjects. **Results**: Healthy subjects expressed 15 distinct two-joint synergy patterns throughout the gait cycle, 5 of which follow the CLF/E (ankle inv/knee ext and knee valg/hip abd @ mid-stance, ankle ev/hip flx and knee valg/hip flx @ terminal stance, and knee var/hip add @ terminal swing). The uninvolved limb of stroke subjects expressed only 3 normal (i.e. similar to controls) synergy patterns with 1 a classic CLF/E (knee var/hip add @ terminal swing). The involved limb of stroke subjects expressed only 1 normal synergy pattern while none followed the CLF/E. Additionally, stroke subjects generated abnormal synergy patterns in the involved (ankle plant/ankle inv @ terminal stance) and uninvolved (knee flx/hip ext @ initial loading, ankle inv/hip flx @ terminal stance) limbs. Only the abnormal synergy expressed in the involved limb followed the CLF/E. Conclusions : Stroke subjects failed to produce normal synergy patterns, including synergy patterns that are consistent with the CLF/E. **Clinical Relevance**: Despite the symmetric step patterns and BWS provided by the Lokomat, neither the involved nor uninvolved limbs behave like the healthy limb.

USE OF THE SHORT VERSION CONTINUOUS SCALE PHYSICAL FUNCTIONAL PERFORMANCE TEST (CS-PFP10) WITH STROKE SURVIVORS. T. Manns[1], C. Tomzcak[1], A. Jelani[2], E. Cress[3], R. Haennel[1], [1]Physical Therapy, University of Alberta, Edmonton, Alberta, CANADA, [2]Division of Cardiology, University of Alberta, Edmonton, Alberta, CANADA, [3]Exercise Science, University of Georgia, Athens, GA.

Purpose/Hypothesis: To determine CS-PFP10 scores (total and domain scores) and their associations with impairment and peak VO_2 in a group of stroke survivors (SS) and their controls. **Number of Subjects**: Twenty participants volunteered including 10 SS (mean ± SD; age 54 ± 11 years; time since stroke 89 ± 100 months, median 50 months) and 10 age and gender matched controls (age 54 ± 10 years). **Materials/Methods**: The Chedoke McMaster Stroke Assessment was used to characterize impairment with the SS. Scores were reported as combined upper and lower extremity stages of recovery (maximum 14, lower scores indicated greater impairment). The CS-PFP10 was used to measure physical functional capacity in five domains (upper body strength, lower body strength, upper body flexibility, balance and coordination, and endurance). Outcomes recorded were time to complete the task, weight carried during the task, and sometimes both. Example tasks included donning and doffing a jacket, getting up and down off the floor, and carrying a pot. Peak VO_2 was determined during a graded exercise test using a recumbent cycle and indirect calorimetry. A Pearson correlation coefficient was used to determine the strength of associations between CS-PFP10 scores, peak VO_2, and impairment. **Results**: For SS, combined arm/hand, leg/foot stages of recovery (impairment) were 7.1 ± 4.6 and 7.9 ± 3.0, respectively. The total score on the CS-PFP10 was 16.5 ± 8.3 for SS, and 78.8 ± 11.6 for controls. CS-PFP10 domain scores for SS were 20.0 ± 10.4 (upper body strength), 34.6 ± 13.1 (upper body flexibility), 12.8 ± 7.1 (lower body strength), 14.9 ± 8.2 (balance and coordination), and 15.6 ± 8.7 (endurance). Relative (ml/kg/min) peak VO_2 was 43% lower ($p<0.001$) for SS as compared to controls. Greater upper extremity impairment was associated with lower CS-PFP10 domain scores for endurance, balance and upper body flexibility (r0.712, $p<0.048$). Greater lower extremity impairment was not significantly associated with any of the CS-PFP10 domains though the association between lower extremity impairment and the coordination and endurance domains approached significance ($r=0.645$,$p=0.084$; and $r=0.650$, $p=0.081$ respectively). Higher CS-PFP10 total and domain scores were associated with higher peak VO_2 (r0.655, $p>0.036$) in SS. In controls, peak VO_2 was not significantly associated with the domain or total scores on the CS-PFP10 (r values ranged from 0.359 to 0.541), with the exception of the domain of upper body flexibility ($r=0.721$, $p=0.043$). **Conclusions**: Stroke survivors scored lower than healthy controls on all domains of the CS-PFP10. This finding could be anticipated as 6 out of 10 participants had one non-functional upper extremity. Significant correlations with peak VO_2 provide preliminary validation of the use of the CS-PFP10 with the stroke population. **Clinical Relevance**: The CS-PFP10 is a measure of physical performance that is feasible to use with ambulatory individuals with stroke. The test did not require any modifications, and did not demonstrate any floor or ceiling effects.

BODY WEIGHT SUPPORT TREADMILL TRAINING COMPARED WITH OVERHEAD HARNESS TRAINING IN CHRONIC STROKE PATIENTS: A MULTI CASE STUDY INVESTIGATION. P. Altenburger[1], M. Gill[2], C. Hunter[2], M. Kustudia[2], B. Altenburger[2], S. Schuerman[2], [1]Physical Therapy, Indiana University , Indianapolis, IN, [2]Physical Therapy, UNLV, Las Vegas, NV.

Background & Purpose: Body weight support treadmill training (BWSTT) and overhead harness training (OHHT) are two types of task specific interventions that are used to improve functional recovery in patients post stroke. While a good deal of evidence has been conducted on the effectiveness of body weight support for acute and subacute stroke patients, little research has assessed the impact of the device on chronic stroke patients. Furthermore, no evidence to date has shown the effectiveness of overhead harness training on post stroke functional recovery. Similarly, there is a limited amount of published research investigating enhancements in gait parameters such as symmetry. The purpose of this pilot study was to investigate the effects of body weight support treadmill training versus overhead harness training on functional recovery and gait parameters in patients with chronic stroke **Case Description**: A multiple case study design was used to compare BWSTT and OHHT. Four patients were randomized into two groups, BWSTT and OHHT. All subjects had moderate residual deficits determined by the modified Fugl-Meyer Lower Extremity Assessment. The poststroke interval for each subject ranged from 7 to 11 years. Each intervention protocol consisted of 15, 1 hour treatments, completed over a 5 week period. BWSTT participants experienced decreasing support and increased speed to tolerance throughout the intervention period. OHHT participants performed simple, moderate, and complex gait and balance tasks. Outcome measures included the Berg Balance scale (BBS), the Neurocom Balance Master® walk across and step-quick turn tests, Activity Based Confidence (ABC) scale, 10 meter walk test (10MW), and 6 minute walk test (6MinW). Measurements were taken pre-treatment, post treatment, and 1 month following treatment. **Outcomes**: Statistical analysis was not conducted due to the small sample size; however, trends were noted with both BWSTT and OHHT. The BWSTT group showed improvement with the ABC scale, 10MW, 6 MinW, step width, and BBS at the post and 1 month follow up. One subject within the BWSTT group achieved a minimal detectable change (MDC) on the BBS. No change was noted for BWSTT in step length and symmetry. The OHHT group showed improvement with the ABC scale, 10MW, 6 MinW, step length, step symmetry, and BBS at the post and 1month follow up. **Discussion**: A general trend indicated that both training methods improved gait parameters and functional recovery. Subjects in the OHHT group had greater initial deficits in gait parameters consequently; they demonstrated greater overall improvement with gait parameters. BWSTT participants had an average increase in confidence from low to moderate. In addition, BWSTT participants improved their gait speed from limited community ambulation to community ambulation. Both interventions demonstrated improvements in specific tasks related to functional gait recovery. Further exploration of these two devices on chronic stroke recovery is warranted.

BODY WEIGHT SUPPORT TREADMILL TRAINING IMPROVES WALKING IN SUB-ACUTE AND CHRONIC SEVERELY DISABLED STROKE PATIENTS. J. C. Breen[2], B. Baker[1], K. Thibault[1], D. E. Snyder[1], [1]Portsmouth Regional Hospital, Newington, NH, [2]Whittier Rehabilitation Hospital, Haverhill, MA.

Purpose/Hypothesis: Although Body Weight Support Treadmill Training (BWSTT) has been shown to improve walking velocity, balance and functional status in stroke patients treated in research setting, few studies report outcomes of stroke patients treated with BWSTT in community-based programs. **Number of Subjects**: 34 stroke patients (25 infarcts, 9 hemorrhages), with an average age of 59 (range 16-81), received gait training with either Lite Gait or Biodex BWSTT systems between 2/02 and 4/06 as part of a community-based outpatient rehab program. 5 patients were excluded from analysis because of incomplete data measurements.

Materials/Methods: Patients unable to safely ambulate independently on a treadmill received BWSTT 1-3 times per week for an average of 13 weeks (range 3-30). The Six Minute Walk Test (SMWT), the Timed Up and GO (TUG) and the Timed Stand Test (TST) were administered prior to start and upon discontinuation of treatment. Outcomes of 11 patients admitted to the program > 90 days post-stroke (chronic group) were compared to outcomes of all patients. **Results**: Baseline modified rankin score was 4 for 27 and 3 for 2 of the patients. Ten of the chronic stroke patients had baseline modified rankin scores of 4 and 1 had a 3. 28/29 of all and 11/11 chronic patients improved on the SMWT. 28/29 of all and 10/11 chronic patients improved on the TUG, and 28/29 of all and 10/11 chronic patients improved on the TST. The average pre-treatment distance walked on the SMWT was 473 feet (range60-1035) for all and 340 feet (range60-960) for chronic patients; the average post-treatment distance walked was 880 feet (range3701500) for all and 737 feet (range 370 to 1440) for chronic patients; and the average improvement was 191% (range7%1150%) for all and 289% (range26%-1150%) for chronic patients. The average initial time on the TUG was 28 seconds (range9-106) for all and 35 seconds (range1-106) for chronic patients; the average post-treatment time was 14 seconds (range7-36) for all and 18 seconds (range7-36) for chronic patients; and the average improvement was 43% (range-15 to 85%)for all and 36% (range -15 to 85%) for chronic patients. The average initial time to complete the TST was 31 seconds (range13-88) for all and 40 seconds (range13-88) for chronic patients; and the average improvement was 38% (range -4 to 81%) for all and 40% (range 0 to 81%) for chronic patients. 21 of the 29 patients and 7 of the 11 chronic patients achieved independent or supervised treadmill ambulation without body weight support. **Conclusions**: Stroke patients with severe neurologic deficits treated with BWSTT in a community-based program achieved improved walking endurance, balance and functional lower extremity strength. Despite severe deficits, patients who began treatment with BWSTT at > 90 days post stroke had significant improvement in all outcome measures. **Clinical Relevance**: BWSTT is an appropriate treatment intervention, to be used in conjunction with other functional therapeutic activities. BWSTT is appropriate to use with patients who are > 90 days post stroke.

THE EFFECTS OF BODY WEIGHT SUPPORTED TREADMILL TRAINING ON INDIVIDUALS WITH CHRONIC STROKE. J. Mowder-Tinney[1], E. Duval[2], E. Dilag[1], G. Gordon[1], [1]Physical Therapy, Nazareth College, Rochester, NY, [2]CP Rochester, Rochester, NY.

Purpose/Hypothesis: Balance deficits are often seen in individuals with chronic stroke, and may have a negative impact on the ability to perform daily activities. Body weight supported treadmill training (BWSTT) is a form of gait training that may be used to improve balance in individuals with chronic stroke, however, there is limited evidence to support this. The purpose of this study was to determine the effects of BWSTT on balance in individuals with chronic stroke. **Number of Subjects:** Nine subjects between 0.6 and 10 years post stroke were selected from a sample of convenience. **Materials/Methods**: Subjects participated in BWSTT twice a week for 45 minutes over a 10 week training period. The ICF disablement model was used as a frame of reference to select outcome measures at the impairment level, activity level, and participation level. Measures were performed pre and post intervention and included the: 1) modified Clinical Test for Sensory Integration on Balance (mCTSIB), 2) the Berg Balance Scale (BBS), and 3) the Activities Balance Confidence (ABC) Scale. **Results**: SPSS 13.0 was used to perform paired t-tests for the mCTSIB, BBS, and the ABC scales. The p value was set at $p = 0.05$ for the level of significance. This analysis identified statistically significant differences in the average total scores for both the Berg Balance scale and the ABC scale. Specific items in both scales were also found to be significant and appeared to correlate to ambulation activities. No statistical significance was found for any condition in the mCTSIB. **Conclusions**: The results of this study suggest that BWSTT was an effective intervention for improving balance at the levels of activity limitation and participation restriction in individuals with chronic stroke. It was also found that BWSTT may have a task-specific effect on balance tasks and functional activities that are related to gait and ambulation. The findings of this study provide evidence to support a cross-over effect between gait and balance. In addition, the ICF model can serve as a guide for selecting outcome measures for assessing balance deficits on a continuum from the underlying impairments, to the ability to perform activities, and participate in life situations. **Clinical Relevance**: Traditionally, physical therapists have used BWSTT as an intervention for improving gait in individuals with chronic stroke. The findings of this study provide evidence to support that BWSTT was an effective intervention for improving balance in this population.

CAN AEROBIC EXERCISE TRAINING IMPROVE AEROBIC CAPACITY, FUNCTIONAL ABILITIES AND QUALITY OF LIFE IN THE ADULT CLIENT POST STROKE? N. J. Gaertig[1], T. M. Steffen[2], [1]Physical Therapy, Agnesian Healthcare, Fond du Lac, WI, [2]Physical Therapy, Concordia University Wisconsin, Mequon, WI.

Purpose/Hypothesis: Increased energy demands coupled with muscle weakness often leads to poor cardiorespiratory fitness after stroke. Low cardiorespiratory fitness is related to decreased functional performance and an increased risk of secondary stroke and cardiovascular disease. Aerobic exercise has the potential to help clients with stroke increase aerobic capacity, decrease energy demands for functional tasks and increase quality of life. The purpose of this evidence-based systematic literature review was to discover if aerobic exercise training improves aerobic capacity, functional ability and quality of life in the adult client post stroke? Does the type of aerobic program impact outcomes? **Number of Subjects**: Studies ranged from 9-57 subjects. **Materials/Methods**: A search for relevant articles was performed using thirteen online databases and reference pages of review articles. Key search words included stroke, aerobic exercise, and aerobic conditioning. Articles were selected for review if treatments consisted of aerobic training of adults post stroke, excluding body weight supported treadmill training. **Results**: Sixteen studies, eight randomized controlled studies and eight single group pretest/posttest studies were included. Aerobic training involved: 1) aerobic exercise performed on lower extremity ergometers or treadmills, 2) circuit training routines composed of aerobic exercise, strengthening/functional activities, and flexibility, 3) water-based exercise or 4) a home-based exercise program. Significant improvement in Peak VO2 was found in all 12 studies where it was measured. MET level and exercise duration improved in 6 of the 7 studies. Ambulation endurance improved in 5 studies and stair climbing in 3 studies where they were assessed. Gait speed measured in 7 studies improved in 4. Quality of life measured in 8 studies improved in 5. **Conclusions**: Evidence supports the use of aerobic training programs of 3x/wk for 8-24 weeks duration to achieve significant gains in aerobic capacity. No significant differences were found related to the type of exercise equip-

ment used (treadmill, leg cycle ergometer, stepper). Target intensities of the majority of studies were at traditional levels (60-80% heart rate reserve), however, aerobic gains were often seen in clients who were unable to reach these goals. Stronger evidence for gains in balance, gait speed or functional mobility was found in studies with circuit training protocols. Gains in quality of life measures occurred less often than impairment and functional limitations. **Clinical Relevance**: Research demonstrates that therapists can improve impairments, functional limitations (including walking speed and endurance) and possibly quality of life when implementing wellness programming that includes aerobic parameters for adults 1-12 months post stroke. A circuit training protocol should be considered over sole use of treadmill or bike protocols to improve functional mobility as well as aerobic capacity.

GAIT TRAINING FOLLOWING STROKE: A PILOT STUDY COMBINING A GRAVITY-BALANCED ORTHOTIC DEVICE, FUNCTIONAL ELECTRICAL STIMULATION AND VISUAL FEEDBACK. V. Krishnamoorthy[1], W. Hsu[2], J. P. Scholz[2], T. M. Kesar[2], D. L. Benoit[3], R. Perumal[2], S. Binder-Macleod[2], S. K. Banala[4], V. Sangwan[4], S. K. Agrawal[4], [1]Rehabilitation Medicine, Emory University, Atlanta, GA, [2]Physical Therapy, University of Delaware, Newark, DE, [3]Rehabilitation Sciences, University of Ottawa, Ottawa, Ontario, CANADA, [4]Mechanical Engineering, University of Delaware, Newark, DE.

Background & Purpose: Stroke is a leading cause of functional disability among adults in the United States. Residual gait deficits following conventional physical therapy are common in stroke survivors, limiting the individual's independence at home and in the community. It has been suggested recently that chronic stroke survivors benefit from intensive walking practice and combining different training programs. In the reported case study, we describe the application of a novel gait re-training approach to an individual with post-stroke hemiparesis. The program involved the application of motor learning principles, combined with gait assistance using a specially designed gravity-balancing orthosis (GBO) during treadmill walking and functional electrical stimulation (FES) to the ankle muscles. This case study sought to provide a preliminary evaluation of the effectiveness of this multi-disciplinary approach to post-stroke gait rehabilitation. **Case Description**: The participant was a 58 year old male with right hemiparesis who had a stroke more than 3 years prior to the intervention. He received conventional physical therapy immediately following the stroke but was not receiving any therapy at the time of the study. He underwent gait re-training at the Center for Biomedical Engineering Research, University of Delaware, over a 5 week period. Initially, full gravity compensation for the weight of both the patient's leg and the device was provided by the GBO. Continuous visual feedback about walking performance and FES to dorsiflexors and plantarflexors at different times in the gait cycle were provided while performing treadmill walking. The gravity compensation provided by the GBO as well as visual feedback was gradually reduced over training sessions. **Outcomes**: The participant tolerated the intervention well. At the end of 5 weeks, his gait speed increased by 10% during over ground walking; his gait was more symmetric; stride length on the affected side increased (by 10%) as did the joint excursions at the hip and knee (>9%) and weight bearing ability (~38%). Except for gait symmetry, all other improvements were maintained one month post-intervention. There was also an increase in plantar flexor peak twitch force and maximum voluntary isometric contraction post-training. **Discussion**: This study suggests possible advantages of judiciously combining different treatment techniques in improving the gait of chronic stroke survivors. Some specific advantages are that it can be a) economical by providing repetitive training under the supervision of a therapist without the full attention of the therapist, b) efficient and precise as the various training parameters can be computer-controlled and c) accurate data can be recorded from sensors on the GBO, which the therapist can use to monitor progress within and across sessions. Further studies are planned to evaluate the effectiveness of different components of this training in both the sub-acute and chronic stages of stroke recovery.

THE EFFECTS OF BACKWARD TREADMILL WALKING SUPPORT IN PERSONS WITH HEMIPARESIS- A CASE SERIES REPORT. S. E. Saliga, J. Fecek, S. Paraventi, L. Shance, L. Wisniewski, Physical Therapy, Oakland University, Rochester, MI.

Background & Purpose: Many persons with history of stroke experience abnormalities in gait due to muscle weakness or paralysis, loss of coordination, balance or timing of muscle contractions. Present research supports using partial body weight support treadmill training to improve gait and function in individuals with acute or chronic stroke. Recently, the literature has identified backwards over ground walking as a beneficial and effective training technique in obtaining a more symmetrical gait pattern in persons with hemiparesis. There is a gap in the literature investigating the combination of both approaches to address gait deviations in individuals with hemiparesis due to a stroke. The purpose of this study was to determine the effectiveness of backward treadmill walking with partial body weight support on gait speed, endurance, and balance in persons at least six months post-stroke. **Case Description**: Four subjects who were six-months or more post-stroke participated in a backwards walking treadmill program. Twenty percent of each subject's body weight was supported utilizing a body weight support system while the subject walked on a treadmill. Each subject completed twelve twenty-minute treatment sessions on the treadmill over the course of four weeks. During treatment, the subject walked backwards at a self-chosen speed while the researchers provided manual assistance with treadmill ambulation as necessary to insure foot clearance, foot placement and weight shifting. **Outcomes**: Outcome measures included the Berg Balance Scale, the two-minute walk test for endurance, and gait velocity. These outcome measures were assessed on two different occasions pre-intervention and two times post-intervention. Increases in balance were found in all subjects, with improvements of 8%, 17%, 18% and 70% as measured by the Berg Balance Scale. The two standard deviation band method (TSDBM) showed that these improvements were significant. Endurance measures showed two subjects had improvements of 14% and 17% respectively which were deemed significant by the TSDBM. The other two subjects displayed a reduction in gait endurance (8% and 44%). Three subjects displayed improvements in gait velocity (17%, 22% and 27%) which were found to be significant using the TSDBM. One subject demonstrated a slight decrease in velocity (8%). **Discussion**: The results of this study suggest that backward walking treadmill training with body weight support is a promising intervention for treating persons with hemiparesis, most specifically persons with balance deficits. It is recommended that further studies be performed to investigate whether backwards treadmill walking with body weight support has an effect on the quality of gait, or on a person's quality of life.

OVERGROUND GAIT TRAINING FOR LONG-TERM STROKE SURVIVORS WITH MOBILITY DEFICITS: A SYSTEMATIC REVIEW. R. A. States, E. Pappas, Y. Salem, Physical Therapy, Long Island University, Brooklyn, NY.

Purpose/Hypothesis: Mobility deficits in general, and gait abnormalities in particular, are common problems for long-term survivors of stroke. One year after a stroke, half of community-dwelling stroke survivors could not complete a six-minute walk test (6MWT), and those who did walked only 40% of their predicted normal distance (Mayo et al., 1999). Whether long-term stroke survivors would benefit from additional physical therapy gait training services is not clear however. The purpose of this systematic review was to examine whether overground physical therapy gait training (without high technology aids like body-weight supported treadmill training - BWSTT) improves measures of gait in long-term stroke survivors who have mobility deficits. **Number of Subjects**: NA **Materials/Methods**: In collaboration with the Cochrane Collaboration Stroke Review Group, we searched 10 databases in spring and summer 2006 and identified 3627 studies. Of those, 52 were potentially relevant. Eight randomized controlled trials met our inclusion criteria (stroke at least 6 months before; mobility deficit; main intervention was overground gait training; intervention did not include high-technology approach like BWSTT). Two comparisons were tested in this review. For comparison A, 4 studies contrasted gait training to a no treatment control group (314 subjects total). For comparison B, 4 studies contrasted gait training to a placebo control group (165 subjects total). We evaluated effectiveness using functional gait score, gait speed, 6MWT, the Timed Up and Go test (TUG), and quality of life, immediately post-intervention and on follow-up of 2-3 months. **Results**: For comparison A, meta-analyses were only possible for gait function and gait speed at post-test and results were non-significant; at follow-up meta-analysis was only possible for gait speed and that was also non-significant. For comparison B, meta-analyses were possible for gait speed, 6MWT, and TUG at post-test. There were significant benefits of overground gait training for gait speed and the 6MWT but no difference for TUG. At follow-up, no significant differences were found for gait speed or 6MWT, the only variables that could be tested using meta-analysis. **Conclusions**: To summarize, insufficient data were available to determine whether overground gait training benefits long-term survivors of stroke who have mobility deficits. The more targeted interventions used in recent placebo controlled studies are suggestive of potential short-term benefits but these must be replicated with larger numbers of subjects, additional outcome measures, and cost-benefit analyses. **Clinical Relevance**: Future research is needed to determine if overground gait training can increase the number of long-term stroke survivors who can improve their mobility to aid in fully re-integrating into their societal roles.

EFFECTS OF BODY WEIGHT SUPPORTED TREADMILL TRAINING (BWSTT) ON LOCOMOTOR RECOVERY IN CHRONIC STROKE PATIENTS. C. Chau, D. Bajus, D. Barclay, J. Brown, M. Landon, Physical Therapy, Nazareth College, Rochester, NY.

Purpose/Hypothesis: The purpose of the study was to examine the effect and functional implications of body weight-supported treadmill training (BWSTT) on locomotor recovery in patients with chronic stroke. **Number of Subjects**: 9 **Materials/Methods**: Nine subjects with an average time of 3.5 years post stroke were studied. All but one subjects ambulated without an assistive device. All subjects were trained on a treadmill (Biodex ®) for 10 weeks, twice weekly. The average total training time per subject was 288.69 minutes. The subject started at a training speed of 0.5 mph with 30% of their weight supported using the LiteGait® system. Assistance was provided and adjusted over time to ensure upright trunk alignment and weight bearing through the lower limbs. Locomotor performance was recorded using GAITRite® and videotaped before, immediately after, and at three months post-training. Quality of the gait was measured using the Wisconsin gait scale. A subjective questionnaire was completed to ascertain the functional implication of BWSTT. A two tailed T-test analysis using the SPSS was performed to determine the statistical significance of temporal and spatial gait parameter changes before and after training. **Results**: Throughout the training period, all subjects progressively required less percent BWS (50%) and tolerated an increase in treadmill speed (0.5-2.0mph). At post-training, velocity, cadence, step length, and stride length were increased significantly ($p<0.05$) as compared to pre-training values. Velocity and stride length were 120% of the pre-training value. At three months post-training, cadence remained the same, velocity, step length, and single limb support increased and stride length decreased when compared to post-training values. All gait parameters were still above the pre-training values. Temporal symmetry index improved at post-training (4.24%) and continued to improve at three months post-training (11.3%). Wisconsin gait analysis showed a significant improvement at post-training which was maintained at three months post-training. Findings from the subjective questionnaire revealed that subjects felt a difference in their walking, were able to walk longer distances (88%), taking larger steps (75%), could walk faster and had more confidence in their walking (63%). Patient reported an increase in strength, endurance, speed and function following treadmill training. **Conclusions**: Our results suggest that patients with chronic stroke were capable of locomotor recovery with BWSTT and that the gait improvements were maintained even 3 months after cessation of training. Gait improvements included a significant increase in temporal and spatial gait parameters, an increase in gait symmetry and quality of gait. Subjective reports indicated that BWSTT improved locomotor ability which corroborated with the quantitative findings. **Clinical Relevance**: BWSTT can be an effective rehabilitative tool for chronic stroke patients not only for improving the patient's locomotor function but also perceived strength, endurance and confidence in walking.

POSTERS:

USING A COMPUTERIZED BALANCE TRAINING SYSTEM TO IMPROVE STATIC AND DYNAMIC BALANCE IN AN INDIVIDUAL WITH MULTIPLE IMPAIRMENTS: A CASE REPORT. T. Collins, M. Corsetti, A. L'Heureux, E. McGeehan, R. Hakim, PT, University of Scranton, Scranton, PA.

Background & Purpose: To determine the effectiveness of using the NeuroCom Equi Test sequence training to improve balance in an active 53 year old male with multiple system impairments that negatively influence his balance. **Case Description**: The participant volunteered to be in this study and is a 53 year old Caucasian male with a height of 5′6″ and weight of 175 pounds. PMH: TBI in 1992 with damage to the left frontal lobe resulting in right hemiparaesis; relapsing-remitting MS; NIDDM since 2004; 2004/2005 several carciac catheterizations, angioplasty and double bypass surgery. Subject's complaints: fatigue related to MS, balance dysfunction and mild fear of falling. Subject is a high-functioning and actively involved in the community and uses a straight cane for ambulation. Normal ROM in B LEs. Sensory loss at L4 dermatome R LE. All other systems were WNLs. Intervention: 2 one hour sessions a week for 5 weeks using dynamic posturography on the NeuroCom Equi

Test System. **Outcomes** : Subject improved in 13 of the 16 categories on the Activities-specific Balance Confidence Scale. The Berg Balance Scale score increased from 19/56 to 56/56 making the subject no longer a fall risk. Variable improvement in Equi Test Limitis of Stability measures: Sensory Organization score improved from 14 to 63. Left/Right rhythmic weight shifting improved from a composite score of 78 to 83. There was a decline in Front/Back weight shifting, 79 to 71 composite score. Subject exhibited increased weight bearing on L LE during Weight Bearing/Squat testing with only a 10% increase in R LE weight bearing post intervention. **Discussion** : The results show preliminary evidence that using an Equi Test training program can enhance static and dynamic balance in subjects with multiple system impairments. Multiple factors could have influenced the results of this study including: the fluctuating nature of MS, fluctuating cardiac status reported by the subject. The subject had to end the training one week early secondary to cardiac complications, even though he never exhibited symptoms during the training session. Decline in performance on the Equi Test could be due to the subject's increase in confidence and decreased caution with movement. Although training effects may be expected because of the use of the Equi Test System for both testing and training, training activities were notably different than testing procedures and other testing procedures were used, including the Berg Balance Scale, and the Activities Balance Confidence Scale, to display functional carryover. This case study offers an introduction to what dynamic posturography has to offer subjects with balance deficits. Further research is needed to investigate possible training effects and other outcomes that could not be determined by a single subject design. Longer training times and follow up are also needed to establish long term results of an Equi Test training program.

CRITERION-RELATED VALIDITY AND INTERNAL CONSISTENCY OF THE PROGRESSIVE SUPRANUCLEAR PALSY RATING SCALE. R. Di Fabio, F. Jaffer, A. James, J. Koneczny, A. Kroll, Program in Physical Therapy, University of Minnesota, Minneapolis, MN.

Purpose/Hypothesis: The Progressive Supranuclear Palsy (PSP) Rating Scale was introduced approximately 10 years ago as a measure of disability for people with PSP (Golbe et al. 1997). The purpose of this study was to determine the validity and reliability of this assessment. Number of Subjects : Twenty-one subjects with varying severity of PSP (10 females and 11 males, ages 57-83 years) participated in this study. **Materials/Methods**: The Unified Parkinson's Disease Rating Scale motor section score (UPDRSm) was used as the criterion standard. This tool is widely applied in clinical practice to measure the functional status of people with typical or atypical Parkinson's disease, but it is not disease specific to PSP (i.e., it does not address certain clinical features unique to PSP, such as gaze palsy). Higher scores on the UPDRSm and the PSP rating scale indicate greater disability. The degree of association between the UPDRSm and the PSP rating scale score was the measure of criterion-related validity (Pearson's r). Internal consistency of the PSP rating scale was assessed using the standardized Cronbach's alpha. **Results:** There was a direct and statistically significant association between the UPDRSm and PSP rating scale scores ($r = 0.81$, $p=0.000$). The criterion standard accounted for 66% of the variance in the PSP scale. Internal consistency was high (Cronbach's alpha = 0.86). **Conclusions:** These findings indicate that the PSP Rating Scale is a valid and reliable assessment tool for measuring the level of disability in people with PSP. The results support recent findings by Golbe and Ohman-Strickland (Brain 2007) that the PSP rating scale score discriminates among different functional levels in PSP and can be useful as a clinical outcome measure. **Clinical Relevance**: Establishing the validity and internal consistency of this scale provides evidence-based support for use in the clinic. The PSP Rating Scale improves on the UPDRSm by examining disease-specific deficits that are characteristic of PSP, such as ocular motor and bulbar function. This study was supported by grant # H133G030159 from the National Institute on Disability and Rehabilitation Research to Dr Di Fabio.

ARE FOOTLIFT KINEMATICS DEPENDENT ON GAZE CONTROL DURING STAIR STEPPING? R. Di Fabio, J. Kream, E. Kvam, A. Karasik, Program in Physical Therapy, University of Minnesota, Minneapolis, MN.

Purpose/Hypothesis: The control of foot placement during activities of daily living may require a "visual anchor" to guide the next location of footfall as patients move through the environment. The purpose of this study was to determine if impaired gaze control altered the kinematics of footlift during a stair climbing task. To study this topic, we selected a cohort of people with Progressive Supranuclear Palsy (PSP) because this disease affects oculomotor function to varying degrees and because this population of patients experiences recurrent falls. **Number of Subjects:** A total of 15 subjects with PSP participated in the context of a larger study of rehabilitation. For the purpose of this study, subjects with a score of "3" or "4" on the downward saccade sub scale of the PSP rating scale (indicating 50% or less of down gaze from clinical observation) were classified as having severe oculomotor dysfunction ($n=11$; 7 male, 4 female, ages 57-83). Those with ratings of "1" or "2" (more than 50% down gaze range of motion) were classified as having mild oculomotor deficit ($n=4$; 1 male, 3 female, ages 69-78). **Materials/Methods**: The start position of each subject was standardized with the subjects' feet 24 cm from the edge of the first of 2 stairs. Subjects began by looking straight ahead. They were cued with a combined auditory tone and visual stimulus (right or left facing arrow projected at the end of the walkway) to initiate a step onto the platform. This was done to minimize anticipation of the lead foot selected for stepping and encourage gaze shifts toward the feet prior to step initiation. Each step was considered one trial for analysis. Approximately 10 trials were analyzed for each subject. Logistic regression was used to predict footlift symmetry using the classification of mild vs severe oculomotor deficit. **Results**: One hundred and thirty-six trials were entered into the model. The classification of oculomotor function correctly identified the origin of 61% of the trials. People with severe oculomotor dysfunction were 3.08 times more likely to have low lag footlift relative to the lead foot compared to those with a mild oculomotor disturbance (95% CI= 1.45-6.52). **Conclusions**: The current findings demonstrate that gaze control can influence the motor plan for footlift height. These results are similar to previous work with non-impaired older persons living in the community. That work showed vertical footlift asymmetries (e.g., lag foot lower than lead foot) when negotiating obstacles in the walking path (Di Fabio et al JAGS 2004) for elders at the greatest risk of falling. The overall pattern of results suggests that low lag footlift is a key clinical index of fall risk. **Clinical Relevance**: Low lag footlift puts subjects at risk for tripping on obstacles such as stairs or objects in the walking path. The results highlight the importance of considering gaze control as part of the rehabilitation process. This study was supported by grant # H133G030159 from the National Institute on Disability and Rehabilitation Research to Dr Di Fabio.

FUNCTIONAL ELECTRICAL STIMULATION FOLLOWING BOTULINUM TOXIN FOR AN ADULT WITH SEVERE UPPER EXTREMITY IMPAIRMENT AS A RESULT OF CHILDHOOD STROKE. P. Boyne[1], K. Dunning[1], S. Page[2], P. Levine[1], V. Hermann[1], [1]Rehabilitation Sciences, University of Cincinnati, Cincinnati, OH, [2]Department of Physical Medicine and Rehabilitation, University of Cincinnati College of Medicine, Cincinnati, OH.

Background & Purpose: Active, repetitive task practice is key to facilitating motor recovery after stroke but is beyond the capabilities of the severely impaired. Among interventions individually shown to increase upper extremity function for this population are tendon transfer, botulinum toxin (botox) and functional electrical stimulation (FES). The purpose of this case study was to describe the outcomes of a four week FES protocol after botox therapy for an adult who had experienced a childhood stroke and a tendon transfer. **Case Description**: The 22 year old female subject had a hemorrhagic stroke at age 5 resulting in severe right upper extremity hemiparesis. She was discharged from all forms of therapy at age 14 and had tendon transfer surgery at age 18. The subject received botox in the right thenar eminence six weeks prior to starting this study and initially demonstrated flexed right fingers and thumb with no active finger or thumb extension. Wrist strength was: flexion 1+; extension 2+. She demonstrated no active supination. After one week of acclimation to the FES orthosis, the subject received 4 weeks of therapy 5 times per week (3 in the clinic and 2 at home). Each session was 1.5 hours. During these sessions, she used the device in combination with massed, valued task practice and shaping. Outcomes were measured before and after intervention: Fugl-Meyer Scale (Fugl), Action Research Arm Test (ARA), Box and Block Test (B&B) Arm Motor Activity Test (AMAT), Stroke Impact Scale (SIS) and Motor Activity Log (MAL). **Outcomes:** Objective measures of arm function improved: Fugl (36-38); ARA (13-16); B&B (2-3); AMAT (functional ability: 1.71-2.18, quality of movement: 1.64-1.82, time: 9.84-6.77). Self-reported measures (SIS, MAL) showed mixed results. Although the SIS strength subsection decreased, the overall SIS increased especially for affected hand function subsection. While the MAL "amount of use" scale decreased, the "quality of use" scale indicated changes from dependent to independent in three functional activities. **Discussion**: The decrease in some subjective scores may reflect an initially inflated perception of arm function or a lack of measurement sensitivity. The length of time since stroke makes it unlikely that spontaneous recovery was responsible for the improved outcomes. Further research is needed to increase sample size and to determine the clinical significance of functional gains.

CUED STEP-FOOT SELECTION AND GAZE SHIFT ABILITY IN PEOPLE WITH PROGRESSIVE SUPRANUCLEAR PALSY. M. Lueneburg, K. Prenevost, M. Stish, R. Di Fabio, Program in Physical Therapy, University of Minnesota, Minneapolis, MN.

Purpose/Hypothesis: The ability to shift gaze is essential for functional activity. People with progressive supranuclear palsy (PSP) have gaze palsy and experience difficulty shifting their gaze to guide movements. Rehabilitation programs designed to improve gaze control in PSP have not be systematically tested. The purpose of this study was to determine if visual stimuli directing the selection of the foot for step initiation would enhance gaze-shift ability in people with PSP. It was hypothesized that an increase in cognitive demand during forced selection of the lead foot for stepping would improve gaze shift ability. **Number of Subjects**: Four subjects with mild oculomotor deficit ("possible" PSP; 69-78 years, 3 females/1 male) and seven with severe oculomotor deficit ("probable" PSP; 57-78 years, 2 females/5 males) participated as part of a larger study of rehabilitation involving people with PSP. **Materials/Methods**: Subjects stood in front of a platform (17.5 cm high, 57 cm width, 48 cm depth) and looked straight ahead at a projection screen. An arrow and tone were presented simultaneously. Subjects were instructed to use the foot for step initiation directed by the arrow (compatible task) or opposite to the arrow (non-compatible task) depending on the pitch of the auditory tone. Forced selection of the lead foot for stepping has been shown previously to facilitate a gaze shift prior to step initiation. Eye recordings were obtained with infrared oculography and a miniature eye video camera. The primary outcome measure was the gaze fixation score; a measure of eye-head coordination described by Di Fabio et al (Exp Brain Res 2007). The secondary outcome measure was visuospatial ability measured using the Cognitive Linguistic Quick Test. **Results:** There was a significant interaction between diagnostic group and task compatibility. Tukey's post hoc test showed that those with possible PSP had better down-gaze shift in both the compatible and non-compatible tasks compared to those with probable PSP ($F1,9 = 8.79$, $p=0.02$). Task compatibility did not appear to influence the extent of gaze shift in either group. Regardless of diagnostic group, larger improvements in cognitive ability from pre to post test were associated with greater gains in gaze shift ability (r compatible = -0.67, r non-compatible = -0.74; $p<0.05$; lower gaze score equates with better gaze shift ability). **Conclusions**: There appears to be an inter-relationship between gaze-shift and cognitive ability that is independent of task compatibility. Stimulating gaze shifts during platform stepping can be achieved with either compatible or non-compatible stimuli. **Clinical Relevance**: The findings highlight the importance of gaze control as an integral component of functional movement. Physical Therapists should consider interventions that improve gaze control as rehabilitation strategies are developed to treat mobility deficits in people with PSP. This study was supported by grant # H133G030159 from the National Institute on Disability and Rehabilitation Research to Dr Di Fabio.

TEST-RETEST RELIABILITY AND MINIMAL DETECTABLE CHANGE ON BALANCE AND AMBULATION TESTS, SF-36, AND UPDRS IN PEOPLE WITH PARKINSONISM. N. M. Hale, M. Serpas, T. M. Steffen, Physical Therapy, Concordia University, Cedarburg, WI.

Purpose/Hypothesis: In clinical practice, functional tests and quality of life measures are used to document progress towards functional goals. Distinguishing between a clinically significant change and change due to measurement error can be difficult. Minimal detectable change (MDC) scores calculated from test-retest reliability coefficients provide clinicians with a number that can be referenced. Change at or above the MDC can be attributed to success of the intervention while change below the MDC value could be due to error. The purpose of this study was to determine the test-retest reliability and MDC for the Berg Balance Scale (BBS), Forward (FR) and Backwards (BR) Functional Reach, Romberg and Sharpened Romberg Test, Activities-specific Balance Confidence Scale (ABC), Six-Minute Walk Test (6MWT), Comfortable and Fast Gait Speed (CGS, FGS), Timed Up and Go Test (TUG), MOS 36-item short form health survey (SF-36), and Unified Parkinson Disease Rating Scale (UPDRS) in people with Parkinsonism. **Number of Subjects**: Thirty-seven community-dwelling adults (11 female, 26 male) with a diagnosis of Parkinsonism consented to participate in

the study. Mean age of the participants was 71 years. Median for the Hoehn and Yahr (H & Y) was 2 with participants in stages I-IV. **Materials/Methods**: Participants were tested twice by the same rater(s), with one week between testing. For each functional test or quality of life measure, test-retest reliability was calculated using either type 3,1 or 3,2 intraclass correlation coefficients (ICC). The MDC was calculated using MDC = z-score level of confidence x SDbaseline x √(2[1r test-retest]), with a confidence interval (CI) of 95%. **Results**: Test-retest reliability as measured by ICCs over the 2 test periods of 1 week were above .90 for BBS, ABC, SR-EC, 6MWT, CGS, FGS, UPDRS-ADL and total score. The remainder of the ICCs were above a .70 with the exception of BR (.67). MDC95 values for functional tests include: BBS 5; FR 9cm, BR 7cm; Romberg eyes open 10s, eyes closed 19s; Sharpened Romberg eyes open 39s, eyes closed 19s; ABC 13; 6MWT 82m; CGS .18m/s; FGS .25m/s; and TUG 11s. SF-36 subscale MDC95 values as measured by a percentage ranged between 19 and 45. UPDRS subscale MDC95 values were: mentation 2/16, ADL's 4/52, motor examination 11/108, and total score were 13/176. **Conclusions**: This study incorporated people in 4 of the 5 stages of Parkinson Disease and two people with Parkinson's Plus. Of the balance measures investigated, the BBS and ABC had the highest reliability. Gait speed and 6MWT were the most reliable of the mobility measures. The high test-retest and internal consistency of the physical functioning subscale of the SF-36 support the use of it in people with Parkinsonism. The UPDRS motor subscale and UPDRS total score had high test-retest reliability and internal consistency supporting its use clinically. **Clinical Relevance**: MDCs reported are useful to therapists in rehabilitation and wellness programs in determining whether change during or after intervention is clinically significant.

RELIABILITY AND RESPONSIVENESS OF THREE DIMENSIONAL KINEMATIC ANALYSES OF FORWARD REACH TASKS IN ADULTS WITH POST-STROKE HEMIPARESIS. J. A. Rhodes[1], C. Patten[2], J. M. Wagner[2], [1]University of California, San Francisco, San Francisco, CA, [2]Rehabilitation Research and Development Center, VA Palo Alto Health Care System, Palo Alto, CA.

Purpose/Hypothesis: Cross-sectional kinematic studies of reaching in people with post-stroke hemiparesis have yielded important information about impaired control of upper extremity (UE) movement. Recently, longitudinal kinematic studies have been employed to document changes in response to therapeutic interventions. However, the reliability and responsiveness of reaching kinematics in persons with post-stroke hemiparesis have not been established. The purpose of this study was to examine the test-retest reliability and responsiveness of kinematic analyses of a specific reaching paradigm in adults with post-stroke hemiparesis. **Number of Subjects**: Reaching performance was evaluated in 14 subjects with post-stroke hemiparesis (avg. 15.0 ± 6.5 months post-stroke). **Materials/Methods**: Measurements were taken at two baseline time points, four weeks apart. Subjects seated in a straight-back chair were instructed to reach forward toward a target positioned directly in front of the affected shoulder at 110% of arm's length. Tasks varied by target height (low(L)=.51m, high(H)=1.53m) and instructed speed of movement (self-selected(S), fast as possible(F)) yielding four different reaching tasks: LS, LF, HS and HF, with two trials recorded for each. Three dimensional movements were recorded at 120 Hz using a seven camera Qualysis Motion Capture System. Kinematic variables were calculated to characterize speed, efficiency, smoothness, accuracy, inter-joint coordination, angular excursion and reach extent during reaching. Test-retest reliability was established through the calculation of intraclass correlation coefficients (ICC(2,2)). Measurement errors were evaluated by the standard error of measurement (SEM = sx√ [1-Rxx]), and the unit less SEM% ([SEM/mean] x 100). The smallest real difference (SRD = 1.96 x SEM x √2) and the unit less SRD% ([SEM/mean] x 100) were calculated to define the smallest change that indicates a real change for a single individual. **Results**: Relative reliability was good (ICC 0.6-0.7) to excellent (ICC0.75) for most of the kinematic variables, but was low (ICC<0.5) for a few kinematic variables, namely reach path ratio during movements to the low target; and movement time, time to peak wrist velocity, and maximum shoulder abduction ROM for fast movements. Measurement error (SEM%) ranged between 2.5% to 54.8% depending on the variable. Responsiveness (SRD%) ranged between 7.0% to 151.9%. In general, smaller SEM% and SRD% values were calculated for spatial compared to temporal kinematic variables. **Conclusions**: Overall, our data revealed good to excellent relative reliability within the group. However, low absolute reliability yielded poor responsiveness for some kinematic variables. **Clinical Relevance**: Analysis of relative and absolute reliability in combination with responsiveness augments longitudinal intervention studies, including those assessing kinematics of reaching in persons with post-stroke hemiparesis, by revealing the magnitude of change that must occur to exceed measurement error (i.e. real change).

DEVELOPMENT OF THE EMORY CLINICAL VESTIBULAR CHAIR TEST. C. D. Hall[1], K. N. Abbott[2], E. C. Lane[2], K. N. Petrosky[2], J. A. Pilgrim[2], R. J. Tusa[3], S. J. Herdman[2], [1]Rehab R & D Center, Atlanta VAMC, Decatur, GA, [2]Rehabilitation Medicine, Emory University, Atlanta, GA, [3]Neurology, Emory University, Atlanta, GA.

Purpose/Hypothesis: Rotational chair testing is a critical element of the diagnostic battery for identifying vestibular deficits by measuring the vestibulo-ocular reflex. One of the major limitations of the rotational chair test is its expense and availability. Thus, the purpose of this study was to develop a valid, reliable, and simple clinical tool (Emory Clinical Vestibular Chair Test, ECVCT) to identify vestibular hypofunction. **Number of Subjects**: Twenty healthy participants and five participants diagnosed with vestibular hypofunction based on rotary chair and/or caloric tests completed the study. Informed consent was obtained prior to the study in compliance with Emory University IRB. **Materials/Methods**: Each participant completed both the motorized rotational chair test as well as the ECVCT in random order. The motorized rotational chair test was completed by trained technicians according to clinic protocol. For the ECVCT, participants sat in an office chair with eyes closed, head pitched forward 30° and belts placed across the lap for safety. One investigator ("spinner") manually rotated the chair for one minute at 180°/s to the beat of a metronome. The order of the direction of chair rotation (clockwise, CW, and counterclockwise, CCW) was randomized. Once the chair came to a complete stop, eye movements were viewed and recorded using infrared goggles. The duration of post-rotary nystagmus time (PRNT) was measured from videotape using a stopwatch from the instant the chair stopped until the nystagmus subsided with no remaining beats. Three investigators ("timers") measured PRNT independently: one with over 20 years of experience (expert) and two doctor of physical therapy students with minimal experience (novice). The accuracy of the spinner to rotate the chair at 180°/s was calculated based on actual time per revolution from videotape compared to the goal of 2 seconds per revolution. Intraclass correlation coefficients (ICC) were calculated to determine spinner interrater reliability, PRNT test-retest reliability,

and timer intrarater and interrater reliability. Sensitivity and specificity were calculated to assess the validity of the ECVCT to diagnose vestibular hypofunction. **Results**: Spinners had an average accuracy for chair velocity of –5% and interrater reliability r = 0.71. Overall, PRNT test-retest reliability was good (r = 0.88 CW, r = 0.95 CCW). Intrarater reliability, based on the expert timer, was excellent (r = 0.97 CW, r = 0.98 CCW) and interrater reliability was good (r = 0.71 CW, r = 0.91 CCW). Based on the expert timer, sensitivity was 78% and specificity was 92% for identifying vestibular hypofunction. **Conclusions**: The ECVCT is a manual rotation test that is simple and reliable. Future studies are needed to determine validity in a larger sample of participants with vestibular hypofunction. **Clinical Relevance**: Use of a simple clinical test to identify vestibular hypofunction will allow for more effective delivery of appropriate treatment to a greater number of patients.

AN INTENSE MOBILITY INTERVENTION FOR IMPROVING GAIT, BALANCE, AND MOBILITY FOR INDIVIDUALS WITH CHRONIC STROKE: A PILOT STUDY. S. L. Fritz, A. L. Pittman, S. C. Orton, A. C. Robinson, E. D. Rivers, Exercise Science, Physical Therapy Program, University of South Carolina, Columbia, SC.

Purpose/Hypothesis: Stroke is the leading cause of disability in the United States. At present, however, there is a paucity of experimental evidence available to indicate what physical therapy techniques are effective for improving mobility in an individual with chronic stroke. The purpose of this study was to determine the feasibility and effect size of an intensive mobility training for people with chronic stroke. **Number of Subjects**: A convenience sample of 8 individuals with chronic stroke. **Materials/Methods**: Participants received an intensive mobility intervention for 3 hours a day for 10 consecutive weekdays. Treatment outcomes were assessed using standardized outcomes of gait, balance and mobility including the GAIT Rite to collect spatial and temporal parameters of gait, the Falls Efficacy Scale, Berg Balance Scale, Dynamic Gait Index, & Timed Up and Go. Data collection was at 4 different time points: baseline, pre, post, and 3 months following intervention. **Results**: The overall effect size of the intervention was 0.72, with changes in balance having much greater effects than changes in gait or mobility. The group demonstrated an average improvement from pre- to post-tests of 12 points on the Berg Balance Scale where a change of 6 is considered a minimal detectable change. **Conclusions:** This intense mobility training was a feasible intervention for this sample and demonstrated large effect sizes for balance outcome measures. **Clinical Relevance**: Future studies incorporating more participants, a standard control, and more emphasis on gait would provide insight into the effectiveness and clinical relevance of this intervention.

THE EXPERIENCE OF DEEP BRAIN STIMULATION FOR INDIVIDUALS WITH PARKINSON'S DISEASE. J. A. McVey, B. Mercado, S. Choy, C. Davidson, Physical Therapy, University Of Puget Sound, Tacoma, WA.

Purpose/Hypothesis: Deep brain stimulation (DBS) has been a popular treatment for advanced Parkinson's disease (PD) for over a decade. Though objective scales might document the effects on motor, cognitive, and affective elements of patient's symptoms, these measures fail to incorporate the personal experience of undergoing the procedure. Objective measures are simple to interpret but may not represent outcomes of greatest significance for patients. Since the nature of psychosocial, cognitive, and emotional functioning has not been clarified in the literature, documenting the range of experiences of people who have received DBS is also important. The purpose of this study was to explore the lived experience of DBS for people with PD and determine how the procedure has changed their lives and perceptions of their condition. **Number of Subjects:** Nine. **Materials/Methods**: Individuals who received DBS were recruited via a purposive sample from the Puget Sound region. Each person participated in two tape-recorded interviews using a semi-structured interview procedure. The interviews were transcribed verbatim and transcripts were subjected to coding and thematic analysis based on recurrent concepts, as per agreement among investigators. **Results**: Four primary themes emerged which characterized the participants' experiences of DBS: no other option except surgery, importance of support, improvements and disappointments in physical functioning, and hope for the future. Conclusions : While the DBS experience was highly individual-specific, support processes from family, friends and health care providers were necessary for all participants to cope with the procedure and its outcomes. Each individual would elect to undergo DBS again despite the associated difficulties, citing the procedure as a major source of hope for the future and fulfillment of social roles. **Clinical Relevance:** Practitioners must be sensitive to clients' personal backgrounds as well as their unique surgical and programming experiences in order to best assist them in working toward their desired social or occupational roles. While DBS may yield dramatic physical and emotional change, clinicians must inform patients that DBS may not relieve all symptoms of PD. Clients may be best served by providers who are knowledgeable of current research regarding PD interventions, understand the range of responses to DBS treatment, and refer to pertinent avenues of support. Consistent with a client-centered approach, treatment should be meaningful to the individual and focus on functional goals while encouraging a positive yet realistic outlook.

USE OF AN EXTERNAL LOCATION OF ATTENTIONAL FOCUS IMPROVES BALANCE. E. T. Cohen, Physical Therapy, University of Medicine and Dentistry of New Jersey and Rutgers, The State University of New Jersey, Stratford, NJ.

Purpose: To synthesize knowledge about the effects of manipulation of location of attentional focus (AF) on balance in healthy adults and people with Parkinson's disease (PD), and to make recommendations for PT examination and intervention for the rehabilitation of balance. **Description**: The manipulation of AF alters performance and retention of balance skills in healthy adults and people with PD. Location of AF can be defined as the body part or position, or target outside of the body, on which a person directs thought during task performance irrespective of visual focus. AF can be divided into two categories: internal attentional focus (IAF) and external attentional focus (EAF). IAF is generated by providing verbal cues (VC) that direct AF to body position or mechanics of movement, while EAF is created by providing VC that direct the AF to the effects of movement. The use of an EAF results in motor control that is less constrained, and thus more automatic. This is evidenced by improvements in performance and retention of balance skill when trained with an EAF regardless of whether attention is focused directly on the postural task (e.g. balanced standing) or on an associated suprapostural task (e.g. balancing an object in the hands). **Summary of Use**: Manipulation of AF should be considered during examination and intervention of balance disorders. The manipulation is based in the VC provided by the clinician. It is common to use explicit directions that guide selective attention to the mechanics of movement rather than its effect. The change is simple: the PT professional should use VC that

focus the individual's attention to the effects of the movement. Two methods are available for use: AF on the postural task or on an associated suprapostural task. A frequently used training method uses variation of the support surface (e.g. pliable or uneven). As an example, a person might be asked to stand upon an inflatable balance disk. Training for static standing balance typically includes VC that guide AF to maintain balance by minimizing body movement (i.e. an IAF on body position). An EAF can be generated by providing directions to minimize movement of the inflatable disc. An even more effective model for improving balance function uses EAF on a supraposturaltask (e.g. minimize movement of an object held in the hand) during postural task performance. Importance to Members: Physical Therapy professionals often use traditional motor teaching methods to ameliorate balance impairments. One component of these methods is the use of explicit directions about performance that guide selective attention to the mechanics of movement. This use of an IAF (i.e. on the mechanics of the movement) has been thought to provide the foundation for motor skill learning and has long been considered best practice in the initial teaching or rehabilitation of motor skills. The evidence indicates that this may not be the case. The use of an EAF during examination and intervention should be considered as a means to more efficiently and effectively restore lost balance function.

CHANGES IN HOME AND COMMUNITY ACTIVITY FOLLOWING A SELF MANAGEMENT APPROACH TO REHABILITATION FOR INDIVIDUALS WITH PARKINSON'S DISEASE. D. K. White[1], R. C. Wagenaar[2], T. D. Ellis[2], L. Tickle-Degnen[3], [1]Clinical Epidemiology and Training Unit, Boston University School of Medicine, Boston, MA, [2]Department of Physical Therapy and Athletic Training, Boston University; Sargent College of Health and Rehabilitation Sciences, Boston, MA, [3]Occupational Therapy Department, Tufts University, Medford, MA.

Purpose/Hypothesis: The present study used an activity monitor to measure changes in specific functional activities, such as sitting, standing, and walking, in the home and community following increasing doses of rehabilitation for the self management (RSM) of health. **Number of Subjects**: 74 **Materials/Methods**: Subjects with mild to moderate Parkinson Disease (PD; mean age 66.7 years, 5.8 years with PD, H&Y 2-3) were randomized into one of three experimental conditions lasting 6 weeks in duration: 1) Medication only (0 hours of RSM), 2) clinic-based RSM and Social Activity sessions (3.0 hours of RSM per week), or 3) clinic-based RSM and Home-Based RSM (4.5 hours of RSM per week). An Activity Monitor (AM) was worn for at least 18 hours in the home and community settings to record the amount of time spent in functional activities. In addition, the Two Minute Walk (TMW) was used to record walking endurance in the clinical setting. Linear contrast analyses were applied to determine if higher doses of RSM resulted in more improvement in functional activities and walking endurance. In addition, interaction effects between baseline activity and experimental conditions were calculated to determine if level of activity at baseline moderated change in AM and TMW measures. **Results**: Although there were no significant linear trends in time spent performing functional activities across experimental conditions, there were significant interaction effects and linear trends found for individuals with low baseline activity for the TMW ($p=0.001$; SES=0.32; 95% CI [-0.48 1.13]), and for individuals with high baseline activity for time spent walking ($p=0.016$; SES=0.81; 95% CI [-0.08 1.71]) and for the number of 10 second walking periods ($p=0.007$; SES=0.94; 95% CI [0.07 1.81]). **Conclusions**: These findings suggest changes in functional activities and walking endurance following RSM are dependent on initial level of activity at baseline in individuals with PD. **Clinical Relevance**: Individuals with PD can improve walking endurance in the clinic and walking in the home and community settings, although change may be dependent on an individual's walking ability at baseline.

BODY WEIGHT SUPPORT TREADMILL TRAINING WITH ONGOING PHYSICAL THERAPY IN A CHILD WITH SEVERE CEREBELLAR ATAXIA. K. Cernak, V. Stevens, R. Price, A. Shumway-Cook, Rehabilitation Medicine, University of Washington, Seattle, WA.

Background & Purpose: Background and Purpose: The purpose of this case study was to examine the effects of body weight support treadmill training (BWSTT) and body weight support (BWS) overground training on mobility in a nonambulatory patient with severe cerebellar ataxia. Research has demonstrated the effectiveness of BWSTT in improving gait in patients with stroke, spinal cord injury and cerebral palsy. To date no studies have examined the efficacy of this intervention in persons with cerebellar ataxia. **Case Description**: Case Description: The study participant was a 13-year-old girl, one year post cerebellar/brainstem infarct. Impairments included weakness, ataxia, dysmetria, spasticity, clonus, balance and sensory/perceptual deficits. While initially nonambulatory, her long term goal was to walk independently in her home with a walker. Intervention: Gait training using a body weight support system both on the treadmill and during overground walking was implemented 5 days a week for 4 weeks in the clinic setting. She continued to receive home physical therapy twice a week for 90 minute sessions. The BWSTT was continued in the home setting five days a week for six months. Training parameters including gait velocity, amount of body weight support, and level of assistance were monitored and progressed weekly. Outcome measures included the Gillette Functional Walking Scale, the Pediatric Functional Independence Measures (WeeFIM), and the number of independent steps taken on the treadmill with BWS but no external assistance. The Gillette and the WeeFIM were tested prior to training, immediately after the four week clinic intervention, and thereafter and at one and six months. The number of independent steps taken during treadmill walking was tested weekly during the four weeks of clinic training, then at one and six months **Outcomes**: Outcome: Gillette Functional Walking Scale score was a 2 (can do some stepping on her own with the help of another person, but does not take full weight on her feet or walk on a regular basis) prior to training. This did not change after 4 weeks of BWSTT, however at six month follow-up she scored a 6 (walks for household distances) on the Gillette. On the WeeFIM, prior to training she scored a 3 (moderate assistance) for all transfers, a 2 (maximal assistance) for walking, and 1 (total assistance) for stairs. At 4 weeks she scored a 4 (minimal assistance) on transfers, all other scores remained the same. At six months, she scored a 6 (modified independence) on transfers, a 5 (supervision) on walking, and 4 on stairs. The number of independent steps taken during treadmill walking was 0 at baseline, 128 at 4 weeks, and 200 at one month follow up. At six month follow-up, all steps were unassisted. **Discussion** : This case study suggest that BWSTT in conjunction with overground mobility training may be an effective way to improve ambulatory function in individuals with severe cerebellar ataxia, but may require a high level of intensity and prolonged duration of training.

DYNAMIC CHANGES IN MOTOR IMAGERY-INDUCED CORTICOSPINAL EXCITABILITY DURING REACTION TIME M. Longenecker, C. O'Rear, Z. Piva, R. Strecker, S. Li, School of Physical Therapy and Rehabilitation Science, University of Montana, Missoula, MT.

Purpose/Hypothesis: Motor imagery leads to movement-specific enhancement of corticospinal excitability (CSE) at subthreshold levels. Likewise, a gradual rise in CSE occurs before electromyographic (EMG) onset during reaction time (RT). It is hypothesized that motor imagery-induced CSE could be dynamically modulated during reaction time. **Number of Subjects**: Nine young and healthy subjects participated in the experiment. **Materials/Methods**: Subjects sat comfortably with the right hand rest on a customized handle. Subjects were explicitly instructed to respond to a visual stimulus on the computer screen by isometrically flexing fingertips again the force sensors as fast as possible (RT task). The visual stimulus was randomly turned on within 3 to 7 s after the beginning of a trail. Meanwhile, subjects were also instructed to perform: 1) rest; 2) imagine maximal isometric finger flexion (ImFlex); 3) imagine maximal isometric finger extension (ImExt). Transcranial magnetic stimulation (TMS) for the right finger flexors were programmed such that stimuli were delivered prior to (t= -120 ms); on (t=0 ms); or after (t=120 ms) the visual stimulus. Each condition had 8 RT trials. Each RT trial lasted 10 seconds. EMG signals from both extrinsic finger flexors (FDS) and extensors (EDC) were recorded. Reaction time (RT) was the interval between the visual stimulus and the EMG onset. Motor evoked potential (MEP) was the peak response from FDS to TMS. **Results**: Baseline FDS and EDC EMGs averaged over 100 ms prior to the visual stimulus onset were not different among different conditions (Rest, ImFlex, and ImExt). Without TMS, RT was significantly longer (332 ms) during ImExt than during ImFlex (294 ms) and at Rest (289 ms). RT was elongated (329 ms) when TMS was delivered at 120 ms prior to the visual stimulus onset, shortened at the 0 ms delivery (237 ms) and the -120 ms delivery (194 ms). No difference in RT among ImFlex, ImExt and Rest during TMS delivered at different time. MEP was first normalized to the peak MEP value measured at the 120 ms delivery during ImFlex, and then averaged across trials and subjects. MEP was dependent upon the time of TMS delivery and imagery status and interactions between delivery time and imagery status. MEP was significantly greater during ImFlex than Rest and ImExt. As compared MEP at the 0 ms delivery, MEP significantly increased at 120 ms, while remained the same at −120 ms during ImExt and Rest. MEP during ImExt remained unchanged when TMS was delivered at −120 ms, 0 ms, and 120 ms, respectively. **Conclusions**: This study provides further evidence of motor imagery-enhanced corticospinal excitability. In addition, the motor imagery-induced changes can interact with early rise in corticospinal excitability during reaction time. **Clinical Relevance**: Motor imagery may be utilized for motor recovery in patients with neurological impairment, e.g., stroke.

HIGH-INTENSITY EXERCISE INDUCES LONG-TERM BRAIN AND BEHAVIORAL CHANGES IN PATIENTS WITH EARLY PARKINSON'S DISEASE. K. T. Winzig[1], J. Yip[1], A. D. Wu[3], G. Salem[1], J. Song[1], G. M. Petzinger[2], J. Lin[1], B. E. Fisher[1], [1]Biokinesiology and Physical Therapy, University of Southern California, Los Angeles, CA, [2]Department of Neurology Keck School of Medicine, University of Southern California, Los Angeles, CA, [3]Department of Neurology David Geffen School of Medicine, University of California Los Angeles, Los Angeles, CA.

Purpose/Hypothesis: We previously investigated the effect of high-intensity (HI) exercise on activity-dependent neuroplasticity and functional improvement in individuals with early Parkinson's disease (PD). Transcranial Magnetic Stimulation (TMS) was used to evaluate cortico-motor excitability (CE). Consistent with the PD literature, pre-exercise cortical silent period duration (CSP) was shortened in all subjects. Immediately post training, all subjects participating in HI exercise demonstrated lengthened or 'normalized' silent period duration. These changes were accompanied by improved gait parameters. No CE or gait related changes were observed in the low intensity (LI) exercise and control groups. To our knowledge this was the first demonstration of exercise-induced changes in TMS values in conjunction with functional improvement in PD. These findings suggest an effect of HI exercise on measures of both brain and behavior in individuals with early PD. However, since PD is a progressive neurodegenerative disorder, any long term benefits of exercise would not be expected. The purpose of this study was to determine if the observed changes would persist beyond the immediate post-exercise period. **Number of Subjects**: Thirty subjects ≤ 3 years diagnosis of PD participated in the study. A subset of these subjects (n = 16) underwent TMS assessment. **Materials/Methods**: All subjects were randomly assigned to: HI, LI, or a non-exercise control group. Subjects exercised 3 times/week for 8 weeks. Data were collected at baseline, immediately and 3 months post exercise. Measures included gait parameters using motion analysis (n = 30) and CE over primary motor cortex with TMS (n = 16). CE was characterized in part by CSP during active contraction of the first dorsal interosseous muscle. **Results**: All measures which showed a significant improvement immediately post HI exercise maintained that significance at 3 months post, including gait velocity, stride and step length and hip joint excursion. Importantly, CSP duration at 3 months showed an additional 10% increase compared to immediately post exercise. Control and LI groups did not show significant changes in any measures at 3 months compared to either baseline or post exercise. **Conclusions**: Our data suggests a long term benefit of HI exercise compared with no and LI exercise on both brain and behavior in individuals with early PD. Although 3 months is an insufficient amount of time to conclude that HI exercise affects PD progression, the fact that the changes observed are contrary to typical decline in PD is promising. Underlying brain changing mechanisms and the relationship between the brain and behavioral changes are unknown. Knowledge of these mechanisms may lead to approaches that directly affect brain recovery and repair in PD. **Clinical Relevance**: Traditionally, individuals with early-stage PD do not receive physical therapy (PT). In addition, for those individuals with more advanced PD, PT has been of relatively low intensity. This study supports early and intensive PT for individuals with PD.

EFFECTS OF WHOLE BODY VIBRATION ON POSTURAL CONTROL. R. Brown[1], L. Bacon[1], H. Gena[1], M. Manning[1], R. Taylor[1], B. Ward[2], [1]Physical Therapy, Belmont University, Nashville, TN, [2]Mathematics and Computer Science, Belmont University, Nashville, TN.

Purpose/Hypothesis: Whole body vibration (WBV)is currently being used by healthy individuals and patient populations to increase flexibility and strength, reduce pain, build muscle, increase bone density, and possibly enhance proprioception. However, few studies have examined the effects of WBV on sensory integration, or motor response to perturbation. The purpose of this study was to examine the effects of WBV on postural sway in healthy young adults under

different sensory conditions using the Smart EquiTest by Neurocom. Motor responses were examined using the Motor Control and Motor Adaptation tests. **Number of Subjects**: Thirty normal, healthy individuals participated and were randomly assigned to the control(n=12) or experimental(n=18) group. Testers were blinded to assignments. **Materials/Methods**: All subjects were tested initially (T1) and 3 days later (T2) on the Smart EquiTest by Neurocom using the Sensory Organization test (SOT), Motor Control test (MCT) and Motor Adaptation test (MAT). The SOT assessed the subjects' postural sway when somatosensory or visual information were altered. The MCT and MAT determined the subjects' response to translational or rotational perturbations. After the second testing, experimental subjects stood on a Pneumax Pro-vibe plate set to a frequency of 35 Hz and high amplitude for four minutes. The control group did not receive vibration. All subjects were re-tested (T3) immediately after intervention and one week later (T4). **Results**: SOT: A two-way crossed MANOVA with fixed factors group (control, vibration) and time-point (T1- T4), and responses conditions (1-6), revealed no significant difference between the control and vibration groups. There was not a significant interaction between the groups and time points; however interaction plots indicated that interaction between groups and time points could exist for some conditions. There was a significant difference between the time points when all 6 conditions were considered. Univariate ANOVAs were performed using the calculated somatosensory, visual, and vestibular scores with no significant differences being found between control and vibration group. Motor Control test: No significant difference was found between the control and vibration group for average composite latency scores on the motor control test. Motor adaptation analysis is ongoing. **Conclusions**: The use of WBV did not appear to affect the use of sensory information for postural control in healthy individuals. The WBV did not change the muscles' ability to respond to a translational perturbation. The lack of significant findings may be due to the small sample size or the high level of initial functioning. Further research is needed to determine the effects of WBV alone or with exercise on postural stability in normal individuals as well as patient populations. **Clinical Relevance**: There was a significant difference across the trials for both the control and vibration groups which may indicate a learning effect, which has been previously shown. This learning effect should be taken into account when interpreting patient improvement across testing sessions.

THE EFFECTS OF BODY WEIGHT SUPPORTED TREADMILL TRAINING ON GAIT, BALANCE, AND ENDURANCE IN A PATIENT WITH CHRONIC STROKE. K. L. Boyd, R. Myers, M. Lucas, Moss Rehab, Elkins Park, PA.

Background & Purpose: Body Weight Supported Treadmill Training (BWSTT) is a form of locomotor training that incorporates central pattern generators and principles of motor learning based on repetition of functional tasks. BWSTT has been proposed to contribute to functional changes in speed and symmetry of gait, endurance and balance scores in patients with acute and chronic stroke. The purpose of this case report was to determine the effect of BWSTT in these areas for a patient with chronic hemiparesis and significant gait dysfunction in an outpatient physical therapy setting. **Case Description**: The patient was a 50 year-old woman who suffered a right hemorrhagic stroke in 2005 with resultant left spastic hemiparesis. Functionally, the patient ambulated community distances using a hemiwalker (HW) or small based quad cane (SBQC) with supervision to minimal assistance and completed transfers with minimal assistance. She was fearful to ambulate without a device. BWSTT was added to her existing plan of care for 4 trials of 3-5 minutes each at speeds of 1.2 to 2.0 mph, 3 days per week for 4 weeks. Outcome measures included the Berg Balance Scale, the lower extremity portion of the Fugl-Meyer assessment, 10-meter walk test, 6-minute walk test, and kinematic gait analysis gathered from a GaitMat II™ system. **Outcomes:** The patient demonstrated a 10% improvement in speed, and 12% improvement in distance with the 6minute walk test. Scores on the Berg Balance Scale and Fugl-Meyer assessment increased by 30% and 25% respectively. Kinematic gait analysis confirmed a 7% increase in gait speed as well as improved symmetry. The patient's family reported improved ability to ambulate without a device at home. She was able to complete all tasks of the Berg Balance Scale at the conclusion of the intervention with less assistance than at baseline. In the 3rd week of BWSTT the patient progressed from tolerating roughly 3 minutes of treadmill walking at 1.2 mph, to 5 minutes at 1.8 to 2.0 mph per trial. At baseline the patient required maximal assistance of 3 therapists for training on the treadmill, by the 3rd and 4th weeks she required minimal assistance of 2 therapists. **Discussion**: A patient with chronic spastic hemiparesis and gait dysfunction can make gains in quality of ambulation, balance, and endurance with 12 sessions of BWSTT as part of an outpatient physical therapy program. Progress made specifically in the last week of BWSTT suggests that task-specific training and repetition may have contributed to this patient's motor learning.

DELAYED-ONSET OF MOVEMENT DISORDER IN AN INDIVIDUAL WITH ANOXIC ENCEPHALOPATHY DUE TO CARDIAC ARREST: A CASE REPORT. S. Z. Trout, R. Myers, T. Watanabe, Moss Rehab, Elkins Park, PA.

Background & Purpose: A rare complication of anoxic injury is delayed onset or worsening of symptoms with a documented occurrence of 0.1-2.8% of all anoxic injuries. While delayed onset of deficits is well researched and documented in anoxic encephalopathy due to carbon monoxide poisoning, this pattern is beginning to be recognized as a result of anoxic injuries of other mechanism, including those from childbirth, drug overdose, respiratory depression, cyanosis, shock, seizures, strangulation, perinatal hypoxia, stroke, encephalitis, and radiation necrosis. This report illustrates a case of anoxic encephalopathy due to cardiac arrest with symptoms consistent with delayed post-hypoxic encephalopathy. **Case Description**: The patient was a 45 year-old male who was admitted following an unwitnessed cardiac arrest. This patient demonstrated consistent progress with functional mobility in physical therapy during weeks one through two. Variability in performance was noted beginning in week three with a maximal decline occurring during week four. This patient who had previously been able to ambulate more than 45 meters with moderate assistance and propel a wheelchair with supervision declined in week four to complete inability to ambulate or participate in wheelchair mobility. In addition, his presentation was significant for emergence of extrapyramidal motor signs, including dyskinetic posturing and athetoid-like movements of bilateral upper extremities, whole-body akathisia, and oral preoccupation. Upon review of the literature, his symptoms and the time frame of decline were consistent with other cases of delayed post-hypoxic encephalopathy. **Outcomes**: Timely observations of functional decline in PT, as well as other disciplines, facilitated referral to neurology and a change in medications. This medication change coincides with resumption of trends toward improvement in functional mobility. Between weeks five and seven, this patient

gained the ability to ambulate over 300 meters with close supervision and required minimal assistance for turns. In addition, he was able to ascend/descend 18 stairs with one handrail and minimal assistance, which far exceeded his optimal performance prior to decline. These improvements in activity limitation represented the difference between long term-care placement and discharge to home. **Discussion**: A thorough search of the literature suggests that delayed-onset post-hypoxic encephalopathy may not be as rare as once believed. Multiple theories of pathomechanism to explain this phenomenon are presented in the literature. Several of these, including no "reflow" phenomenon, demyelination, metabolic toxicity, basal gangliar maturation, and trans-synaptic neuronal degeneration, as well as previously unreported medication interactions, may correlate with this case. Improved knowledge of medication actions and interactions by physical therapists may facilitate timely team communication regarding functional changes for improved overall patient care.

USING THE PHYSICAL PERFORMANCE TEST TO DETECT CHANGES IN PARKINSON'S DISEASE OVER FOUR YEARS. A. J. Threlkeld, K. A. Paschal, S. Kai, D. Hanson, K. Van, Physical Therapy, Creighton University, Omaha, NE.

Purpose/Hypothesis: Measuring functional changes over long time periods in people with slowly progressing neurodegenerative diseases such as Parkinson's Disease (PD) is challenging and has received limited study. We conducted two assessments with two forms of the Physical Performance Test (PPT) 4 years apart. The 7-item form of the Physical Performance Test (PPT) is an objective assessment tool simulating many activities of daily living including walking, turning, and ADL while the 9-item form adds stair climbing. We hypothesized that changes would be highly correlated between the two forms of the PPT (7- and 9-item) and would be correlated to changes measured by two other common clinical measures used in PD: the Modified Hoehn and Yahr Scale (HY) and the Motor Subscale of the United Parkinson's Disease Rating Scale (UPDRS III). **Number of Subjects**: Eight subjects with PD (6M, 2F; mean 62 yrs; range 49-69 yrs, HY range 2-3) from a previous PPT reliability study volunteered for reassessment. **Materials/Methods**: We assessed performance changes in people with PD at 2 time points, 4 years apart using the 7and 9-item versions of the PPT. The HY and UPDRS III scores within +/- three months of the PPT assessments were extracted from the medical record for comparison. Older UPDRS III scores could not be obtained for 2 of the 6 subjects. We compared PPT changes to the HY and UPDRS III by normalizing to percent change and direction of change (better or worse). Spearman Rank Order Correlation was used to statistically compare changes measured by the various tests. **Results**: Correlations between measured % changes were: strong and significant for 7 vs 9-item PPT ($r = 0.95$; $p<0.0001$); negligible to poor, positive and statistically insignificant for PPT vs HY (7-item $r = 0.119$, $p=0.78$; 9-item $r = 0.41$, $p=0.34$), poor to moderate, negative and statistically insignificant for PPT vs UPDRS III (7-item $r = -0.38$, $p=0.4$; 9-item $r = -0.54$, $p=0.3$); negligible and statistically insignificant for HY vs UPDRS III ($r = -0.11$, $p=0.78$). **Conclusions**: We compared changes in the subject's scores as detected by common clinical tests. The change in the 7-item PPT score was predictive of the 9-item PPT score. The correlations between the two forms of the PPT and two other common clinical measures were mostly negligible-to-poor with a moderate negative correlation (-0.54) between the 9-item PPT and the UPDRS III. Although the number of subjects was small, the results provide clear indicators of agreement (or lack of) when measuring change with different tools. **Clinical Relevance:** The two forms of the PPT overlap heavily. Although changes measured by the 7-item are strongly predictive of the 9-item score, there is practical utility in assessing stair climbing with the 9-item for community dwelling subjects. The PPT, HY and UPDRS III all provide useful information about change but are not redundant measures. The PPT focuses on function whereas the UPDRS and HY are weighted toward impairments. The HY has the most coarse measurement scale and seems less sensitive to changes over time.

PRELIMINARY FINDINGS ON MECHANISMS UNDERLYING HEMIPARETIC SHOULDER PAIN. D. D. Hardwick, C. E. Lang, Program in Physical Therapy, Washington University in St. Louis, St. Louis, MO.

Purpose/Hypothesis: Shoulder pain is a common impairment that affects up to 72% of people following stroke. Hemiparetic shoulder pain (HSP) has been associated with reduced quality of life, increased length of hospital stay, and reduced ability to participate in therapy. Despite this, very little is known about the mechanisms that underlie shoulder pain following stroke. It is our hypothesis that shoulder pain following stroke is caused by movement impairments of the scapula and humerus. **Number of Subjects**: We tested 4 people (2 male, 2 female) with hemiparetic shoulder pain. Time since stroke ranged from 3 months to 2 years. We also tested 3 age-matched healthy controls (1 male, 2 female). All subjects were between 48 and 55 years of age. **Materials/Methods**: Shoulder motion and ratings of perceived pain and disability were measured in each subject. We used a 3-dimensional magnetic tracking system to track the positions of the thorax, scapula, and humerus during the performance of shoulder elevation. Pain rating was assessed via the visual analog scale (VAS). Pain and disability was rated via the Shoulder Pain and Disability Index (SPADI). **Results**: We found that shoulder pain in the HSP group increased during movement, from 3.3/10 at baseline to 5.4/10 with movement. Subjects in the HSP group had a composite SPADI score ranging from 35.5% - 76.2% (mean 53.2%). Shoulder elevation range of motion was decreased in the affected arms of the subjects in the HSP group compared to both unaffected extremity and control subjects. In general, scapular upward rotation excursions were decreased in the affected arms of the HSP subjects when compared to unaffected extremity and control subjects. However, start and end positions were highly variable. Some HSP subjects started in increased scapular upward rotation at rest, and ended in a relatively normal amount of upward rotation despite a decreased excursion, other subjects started in relatively neutral positions or downward rotation. Other scapular variables such as tipping and internal/external rotation were highly variable. **Conclusions**: Subjects with HSP demonstrate characteristics that are similar to orthopedic shoulder pathologies. These include pain on movement, decreased shoulder elevation range of motion and decreased excursions into scapular upward rotation. How these patients present clinically is highly variable, so an individual evaluation is vital to discern the nuances of each patient's impairments. **Clinical Relevance**: This information is useful because it shows that there are similarities between shoulder pain following hemiparesis and orthopedic shoulder pathology. It may be advantageous to consider orthopedic shoulder pain evaluation and treatment procedures for patients with HSP.

INTERRATER RELIABILITY OF SENSATION, STRENGTH, BALANCE AND MOBILITY IN ADULTS WITH DIABETIC PERIPHERAL NEUROPATHY. S. W. Shaffer[1], R. English[2], M. Gambrel[3], A. Harrison[2], [1]Physical Therapy, US Army Baylor University, Fort Sam Houston, TX, [2]Physical Therapy, University of Kentucky, Lexington, KY, [3]Physical Therapy, Veterans Administration, Lexington, KY.

Purpose/Hypothesis: Falls and functional decline in adults with diabetic peripheral neuropathy (DPN) are growing areas of concern. Unfortunately, the psychometric properties of assessment measures for this population are limited. Therefore, the objective of this study was to determine the interrater reliability of sensation, strength, balance, and mobility in community-dwelling adults with diabetes and lower extremity peripheral neuropathy. **Number of Subjects**: Twenty-seven (23 males and 4 females) patients (mean+ standard deviation=61.9+10.0 years) with diabetes and confirmed (nerve conduction and quantitative vibration testing) distal lower extremity neuropathy volunteered for testing. Eighteen participants (15 males, 3 female; 61.8+ 10.8 years) underwent two sessions of neurological testing and 19 (17 males, 2 female; 61.8+ 8.3 years) completed repeated testing of balance and mobility items. **Materials/Methods**: Neurological examination of the bilateral lower extremities included light and sharp touch, reflex (knee and ankle), monofilament (MF), quantitative vibration perception threshold (QVPT), and hand-held dynamometry (HHD) strength (hip abduction, knee extension, ankle dorsiflexion) testing. Participants also completed balance (tandem stance, one leg stance, functional reach test, Berg Balance Scale, and four square step test) and mobility (sit to stand 5 times, timed up and go, and comfortable gait speed) items. Measures were repeated on the same day by a second examiner who was unaware of prior test results. Data analysis included descriptive statistics, intraclass correlation coefficients (ICC), minimal detectable change at the 95% confidence level (MDC95), kappa statistics, and Spearman rank correlations(rs). **Results**: Reflex (kappa=.36-.68), light and sharp touch (kappa=.35-.57), and individual sites for MF (kappa=.22-.68) testing exhibited slight to moderate interrater reliability. Agreement on QVPT (ICC=.87-.94; MDC95=4.0-9.0 Volts), collective number of MF sites (kappa=.66-.89; rs=.76-.84), HHD strength (ICC=.76-.96; MDC95=34.5-88.5 Newtons), balance (ICC=.71-.95; MDC95=.9-10.7 seconds; functional reach test MDC95=9.1cm, Berg Balance Scale MDC95=1.6 points,) and mobility (ICC=.87-.91; MDC95=1.7-3.7 seconds, comfortable gait speed MDC95=.23 m/s) testing demonstrated moderate to substantial levels of interrater reliability. In fact, only 2 of the balance measures (single leg stance eyes closed ICC=.72-.73, four square step ICC=.71) and 1 strength (dominant ankle strength ICC=.76; MDC95=53.9 N) variable exhibited ICC values <.80. **Conclusions**: The majority of measures of sensation, strength, balance and mobility were reliable between raters in our group of community dwelling adults with DPN. Further research involving larger and more diverse samples are needed to confirm these results. **Clinical Relevance**: Findings provide evidence to suggest that various sensory, strength, balance, and mobility items can be measured reliably in adults with diabetes and distal peripheral neuropathy.

THE EFFECT OF FIVE-DAY RTMS TREATMENT FOR FOCAL HAND DYSTONIA. M. R. Borich[1], T. Kimberley[2], [1]Rehabilitation Science, University of Minnesota, Minneapolis, MN, [2]Program in Physical Therapy, University of Minnesota, Minneapolis, MN.

Purpose/Hypothesis: Writer's cramp is a type of focal hand dystonia. It is an under-diagnosed disorder associated with specific repetitive hand movements requiring fine motor control and sensorymotor integration. The cause of the disorder is widely debated, and no objective diagnostic criteria or fully successful treatment exists. Recent studies have shown hyperactivity in frontal motor areas and decreased primary motor cortex activation during handwriting tasks, as well as a shortened cortical silent period (CSP), indicating decreased motor cortex inhibition in subjects with writer's cramp. After one-time, low-frequency repetitive transcranial magnetic stimulation (rTMS) application to the premotor cortex (PMC), improvements in handwriting and lengthened CSP have been demonstrated. The purpose of this study is to investigate the effects of five-day rTMS treatment on cortical excitability and handwriting performance in subjects with writer's cramp vs healthy subjects. It is hypothesized that subjects will demonstrate improved handwriting performance as well as decreased cortical excitability after five consecutive days of rTMS treatment. **Number of Subjects**: 15 (5 healthy subjects, 10 subjects with writer's cramp) **Materials/Methods**: A randomized, sham-controlled design was used. Dependent measures for cortical excitability based on TMS responses included: 1) first dorsal interosseus (FDI) motor evoked potential (MEP) amplitude and 2)CSP during voluntary FDI muscle activity. Data collected pre- and post-fifteen minute 1Hz rTMS treatment to the contralateral PMC each of the five days of treatment and at ten-day follow-up. Functional measures, including 1) pen pressure and 2) velocity were collected with a digitized tablet and stylus pen during externally- and self-paced loop tracing and sentence writing tasks. Subjective symptom report was also included. **Results**: Preliminary data show an increase in CSP in subjects with dystonia vs healthy or sham subjects from baseline (Day 1 pretest) to post-test (Day 5), which was maintained at follow-up testing (Day 15). All three groups demonstrated decreased MEP amplitude at follow-up vs baseline. Voluntary FDI activation required to maintain a constant force was increased at follow-up vs. baseline after five-day rTMS treatment but not after sham stimulation in subjects with writer's cramp. Preliminary data suggest that functional measures and subjective symptom report were not significantly different within or between groups after treatment or at follow-up. **Conclusions**: These preliminary findings demonstrate altered cortical excitability after five consecutive days of rTMS application maintained for at least ten days after treatment, corroborating and extending previous research. **Clinical Relevance**: These results will aid in furthering the understanding of the pathophysiology in writer's cramp and potentially aid in the development of effective diagnostic tests and treatment options for patients with focal hand dystonia.

PROPRIOCEPTIVE DEFICIT IS RELATED TO MOTOR LEARNING FOLLOWING STROKE. E. D. Vidoni[1], L. A. Boyd[2], [1]Physical Therapy & Rehabilitation Sciences, Univ. of Kansas Med Center, Kansas City, KS, [2]School of Rehabilitation Sciences, University of British Columbia, Vancouver, British Columbia, CANADA.

Purpose/Hypothesis: Research has shown proprioception to be important in the development of internal representations for movement. People post-stroke often experience motor or sensory deficits that impact function. It is unclear if these deficits impact the ability to learn new skills. The focus of the present study was to characterize the relationship between stroke-related sensory deficit, motor impairment and motor learning. **Number of Subjects**: Ten individuals who experienced a stroke in the MCA distribution at least 6 months prior provided informed consent to participate in this study. **Materials/Methods:** Participants practiced a continuous tracking task with the contralesional arm 100 times over 2 days under

conditions of limited visual feedback. Each trial consisted of a repeated sequence and a novel section. Retention testing was conducted on a third day to assess motor learning. Proprioceptive deficit was indexed using a limb-position matching task (LPM). Motor impairment was indexed using the upper extremity section of the Fugl-Meyer Assessment (UEFM). **Results**: As previous work has demonstrated, survivors of stroke learned novel motor sequences. At retention, one-tailed, paired t-testing revealed improvement on the repeated over the novel section ($p=.03$). LPM was moderately related to tracking improvement from the beginning of practice to retention ($r=.55$). UEFM was not closely related to tracking improvement ($r=.14$). **Conclusions**: As suggested by motor control and learning models, proprioceptive sensation may be important for acquiring new movement skills. In some situations, intact proprioceptive sensation may be more important to learning than motor function. **Clinical Relevance**: Clinicians working with clients following stroke should evaluate the integrity of the sensory system including proprioception. Sensory deficits may interfere with the ability of the client to learn new skills.

EFFECT OF OTOLITH DYSFUNCTION ON CLINICAL PRESENTATION OF PATIENTS WITH VESTIBULAR HYPOFUNCTION. S. J. Herdman[1], E. R. Nathan[1], K. D. Richardson[1], C. D. Hall[2], R.J. Tusa[3], [1]Rehabilitation Medicine, Emory University, Atlanta, GA, C.D. Hall, [2]Atlanta VAMC, Decatur, GA, [3]Neurology, Emory University, Atlanta, GA.

Purpose/Hypothesis: To determine if the absence of otolith function affects symptoms and objective measures in patients with vestibular hypofunction. We hypothesized that patients with utricular dysfunction, as measured by subjective visual vertical (SVV) and/or saccular dysfunction, as measured by Vestibular Evoked Myogenic Potential (VEMP) tests, would have different subjective complaints and more imbalance than patients with normal otolith function. **Number of Subjects**: Thirty-one patients diagnosed with vestibular hypofunction (VH) based on rotary chair and/or caloric tests, who also had both SVV and VEMP tests. **Materials/Methods**: Retrospective chart review with full HIPPA waiver. Subjects were assigned to one of four groups based on vestibular function test results. Outcome measures included: self-report of functional limitations (Multidimensional Dizziness Inventory, MDI); specific symptoms either present or absent; depression and anxiety; balance confidence (Activities-specific Balance Confidence scale, ABC), use of sensory cues for balance (Sensory Organization Test (SOT) on dynamic posturography), and fall risk (Dynamic Gait Index). Statistical analyses were performed using SPSS 14.0. Descriptive and correlational statistics were performed. Between groups comparisons of MDI and ABC were conducted using Kruskal Wallace testing. Chi square was used to compare responses on the symptom questionnaire and ANOVAs were used to compare SOT scores across groups. Alpha level was set at .05. **Results**: The four subject groups were VH with: abnormal saccular ($n=6$), abnormal utricular ($n=9$), abnormal saccular and utricular ($n=6$), and normal saccular and utricular ($n=10$) function. There were no differences in age, time from onset, number of prescription medications or number of co-morbidities across the groups nor were there differences in measures of functional limitations, balance confidence or fall risk. The only symptom to differ among groups was lightheadedness, occurring most frequently in the abnormal utricle group. Pearson correlations suggest that patients with abnormal otolith (utricle or saccule or both) function were more likely to report symptoms of depression ($r = .43$) or anxiety ($r = -.52$) than subjects with normal otolith function. Patients with saccular dysfunction had greater sway when standing on condition 2 (eyes closed) on posturography than patients with normal otolith function ($p < 0.002$) and patients with saccular and/or otolith dysfunction had greater sway while standing on condition 6 (novel visual and somatosensory feedback) ($p < 0.006$). **Conclusions**: The results of this preliminary study suggest that symptoms of patients with vestibular hypofunction do not differ greatly based on the presence or absence of otolith function. Patients with otolith dysfunction rely more heavily on visual cues to maintain balance as evidenced by greater sway on conditions 2 and 6 of the SOT. **Clinical Relevance**: Patients with vestibular hypofunction and otolith dysfunction may require a greater emphasis on balance training.

THREE-DIMENSIONAL BONE DENSITOMETRY AFTER SPINAL CORD INJURY; MEASUREMENT SENSITIVITY AT THE DISTAL FEMUR, A COMMON FRACTURE SITE S. Dudley-Javoroski, R. K. Shields, PT & Rehabilitation Science, University of Iowa, Iowa City, IA.

Purpose/Hypothesis: We previously determined that bone mineral density (BMD) errors of 5% result from 3mm errors in slice placement during peripheral quantitative computed tomography (pQCT) of the distal tibia (Shields et al. 2006 Arch Phys Med Rehabil). The distal femur is a more prevalent fracture location in people with spinal cord injury (SCI). The exaggerated contour changes of the femoral condyles (compared to the distal tibia) suggest that trabecular BMD may be highly variable from distal to proximal at this site; perhaps to a greater degree than our previous 5% estimate. This would complicate accurate BMD assessment at this vulnerable anatomic location. The purposes of this study are therefore: 1) To establish the measurement sensitivity of pQCT for determining BMD at the distal femur (12% of femur length), and; 2) To establish non-SCI normative BMD values for the 12% femur site. **Number of Subjects**: Seven men with complete SCI and seven men without SCI participated in the study. **Materials/Methods**: In addition to the "true" 12% femur site, slices were also obtained at intentionally erroneous sites 3mm proximal and 3mm distal to the 12% site. BMD differences between the true and erroneous sites provide an estimate of pQCT measurement sensitivity at this anatomic location. **Results**: Trabecular BMD declined from the distal to the 12% site and from the 12% to the proximal scan site ($p < 0.03$). Mean absolute BMD error was 4.22 mg/cm^3 among slices placed at the specified 3mm intervals (range: 0 – 14.0 mg/cm^3). This corresponds to a mean 3.18% absolute BMD deviation from the "true" 12% site BMD. The "worst-case" absolute BMD error for any subject was 8.85%. **Conclusions**: BMD errors of up to 8.85% may occur due to pQCT slice placement error at the distal femur, exceeding the maximum error previously observed at the distal tibia (5%). **Clinical Relevance**: To be considered effective, interventions designed to attenuate BMD decline after SCI must yield changes in BMD that exceed the measurement error of the densitometric technique. Interventions that yield a BMD difference of more than 8.85% would therefore be desirable at the distal femur site when using pQCT as a measurement tool. This is a more rigorous training criterion than was previously suggested for the distal tibia site (5%).

SLEEP ENHANCES MOTOR SKILL MEMORY CONSOLIDATION IN INDIVIDUALS POST-STROKE. C. Siengsukon[1], L. A. Boyd[2], [1]KU Physical Therapy and Rehabilitation Sciences, The University of Kansas Medical Center, Kansas City, KS, [2]School of Rehabilitation Sciences, University of British Columbia, Vancouver, British Columbia, CANADA.

Purpose/Hypothesis: Evidence supports the role of sleep in motor skill learning in neurologically intact individuals. However, the critical function of sleep for learning new motor skills following stroke remains unclear. Furthermore, explicit motor skill memory consolidation may benefit differently from sleep than implicit motor skill memory consolidation. The purpose of this study was to examine the interaction of sleep and type of instruction (explicit, no explicit instruction) on motor skill learning following stroke. **Number of Subjects**: Twenty-seven individuals with stroke (mean age: 62.4 y.o.) were pseudo-randomly assigned to one of four groups: (1) explicit instruction/sleep, (2) explicit instruction/no-sleep, (3) no explicit instruction (implicit)/sleep, and (4) no explicit instruction (implicit)/no-sleep. **Materials/Methods**: Individuals practiced a continuous tracking task and returned for a retention test either following a period of sleep (sleep condition) or a period of being awake (no-sleep condition). Those in the explicit instruction condition received information regarding the repeating wave sequence embedded in the continuous tracking task while those in the implicit condition did not. **Results**: Results demonstrate that individuals post-stroke benefit from sleep to enhance motor skill memory consolidation. This is supported by a two-way ANOVA [Group(sleep, no-sleep) X Instruction(implicit, explicit)] main effect of sleep ($p=.042$). Furthermore, this enhancement in motor skill memory consolidation occurred regardless of type of instruction provided (ie. motor skill memory was enhanced both following implicit and explicit motor skill learning) as demonstrated by a lack of main effect of instruction ($p=.742$). **Conclusions**: These findings demonstrate that sleep enhances both implicit and explicit motor skill memory consolidation in individuals with stroke. **Clinical Relevance**: Understanding the importance of sleep in memory consolidation and learning following stroke may alter the way therapists teach motor skills to patients who have suffered from neurological injury by placing an emphasis on the need for sleep between therapy sessions. Furthermore, ensuring adequate sleep or addressing underlying conditions affecting sleep following stroke may be needed.

SIMILARITY INDEX OF SURFACE ELECTROMYOGRAPHY MUSCLE ACTIVATION IN POST-STROKE SUBJECTS. A. Reinthal[1], D. C. Lee[2], P. Sung[1], [1]CSU, Cleveland, OH, [2]Center for Neuroscience and Neurological Recovery, Methodist Rehabilitation Center, Jackson, MS.

Purpose/Hypothesis: Trunk muscle activation during gait is essential for individuals that have experienced a stroke. However, there are limited studies comparing normalized lower extremity muscle activation and isolated trunk movements for gait analyses. This preliminary study investigated the use of the Similarity Index (SI) to interpret electromyography (EMG) recordings of trunk and lower-limb muscles during gait in post-stroke and control participants. **Number of Subjects:** The pattern of muscle activation was quantified by SI from seven participants post-stroke (mean age in years = 54.8, SD = 10.1) and five age- and gender-matched control participants (mean age in years = 59.2, SD = 12.9). **Materials/Methods**: Multiple walking trials, each approximately 20 feet in length, were completed at the participant's normal walking speed. Synchronized kinematic and EMG data were recorded and processed by six video cameras capturing three-dimensional full body kinematic motion (Motion Analysis Corporation, Santa Rosa, CA) and using a tethered 8-channel EMG unit (Therapeutics Unlimited, Model 544 EMG System) sampling at 1200 samples/second. To determine significant muscle activity for characterizing the stroke group during gait, trunk and lower-limb muscles were examined using SI computations. **Results**: The SI to individual variance was analyzed by normalizing the stance-to-swing ratio to 60:40. With phase normalization, the SI of the trunk muscles from the stroke group (0.871 ± 0.104) was significantly lower than that of the control group (0.969 ± 0.029), while the SI of the lower-limb muscles demonstrated only a slight difference between the two groups (0.958 ± 0.038 for stroke and 0.970 ± 0.026 for control). **Conclusions**: In comparison to lower extremity musculature, the trunk muscles were more impaired in subjects post-stroke during gait when analyzed using the SI. The SI was objectively assessed using gait EMG for post-stroke subjects, but needs further investigation. **Clinical Relevance**: Clinicians should consider the importance of proper trunk muscle activation patterns when implementing rehabilitation strategies for individuals post-stroke.

AN ALTERNATIVE CLINICAL METHOD TO ANALYZE A COMPLEX MOVEMENT TASK IN THE WOLF MOTOR FUNCTION TEST Y. Chiu[2], S. B. Davis[2], K. E. Light[1], A. L. Behrman[1], O. Teitelbaum[3], P. Teitelbaum[3], [1]Physical Therapy, University of Florida, Gainesville, FL, [2]Brain Rehabilitation Research Center, Malcom Randall North Florida/South Georgia Veterans Affairs Medical Center, Gainesville, FL, [3]Psychology, University of Florida, Gainesville, FL.

Purpose/Hypothesis: Few evaluation methods are clinically available for physical therapists to systematically document change in movement. The Eshkol-Wachman Movement Notation (EWMN) method has been shown to effectively describe various aspects of movement. These include limb position, inter-limb spatial relations, interlimb coordination, sequence and trajectory. Using EWMN, the purposes of this study were 1) to examine the normal movement sequence of a complex task, the "Lift Basket" (LB) task, in the Wolf Motor Function Test (WMFT), 2) to determine the essential movement components of the LB task by systematic movement analyses of the whole body, and 3) to evaluate the normal movement strategy of the "LB" task. **Number of Subjects:** Eight volunteers with no previous neurological disorder were recruited from a local community. (age range: 50-79 years; mean age 70 years ; 4 males and 4 females) **Materials/Methods**: The movement task selected was the LB task of the WMFT. WMFT is a standardized outcome measure in Constraint Induced Movement Therapy. The LB task is regarded as a complex task and one of the more difficult tasks in WMFT, demanding efforts from multiple body systems (e.g. muscle strength, balance). Participants were asked to pick up a basket on a table in front of them, grasping its handle, and moving the basket higher to a side (ipsilateral) table as fast as possible while standing. The progression of movement was videotaped. All eight participants' video tapes were converted to DVD digital format. The movements were then notated by EWMN using still frame-by-frame image analysis (30 frames/second). Movement sequence, components and strategy of the LB task were evaluated and determined by EWMN analyses. **Results**: Using EWMN ten movement components were readily identified in sequence: 1) eye contact with basket handles, 2) initiative synergy (i.e. coupled with opposite movements of arm and forearm), 3) arm fixation movement (i.e. maintaining constant height of forearm in space while arm moves toward the basket, 4) ipsilateral weight shifting, 5) grasping preparation, 6) grasping, 7) eye contact with side tabletop, 8) diagonal arm movement, 9) contralat-

eral weight shifting, and 10) forearm placement. Normal movement strategy is recognized as recruiting proximal to distal body parts. **Conclusions**: This study is the first to reveal the ten essential movement components, as well as the sequence and strategy of a complex task using EWMN's whole body movement analysis. EWMN can provide clinicians with a reliable and economical evaluation tool for documenting movement. **Clinical Relevance:** Clinically, EWMN is economically feasible and can be used to effectively describe and assess movement. EWMN's characteristics of effectiveness and usage readiness make it highly useful to the field of observed motion analysis. EWMN contributes to the therapists' tools for qualitative assessment of movement. The clinical relevance of this study provides future implications for analyzing movement disorders in individuals post stroke.

BALANCE-BASED TORSO-WEIGHTING IS EFFECTIVE IN IMPROVING FUNCTION IN A RANDOMIZED CLINICAL TRIAL OF PEOPLE WITH MULTIPLE SCLEROSIS. G. L. Widener, D. D. Allen, C. Gibson-Horn, Physical Therapy, Samuel Merritt College, Oakland, CA.

Purpose/Hypothesis: Postural control is a common problem that interferes with activities of daily living in people with Multiple Sclerosis (PwMS). Balance-based torso-weighting has shown promise as an evaluation and treatment approach in improving static postural control in PwMS. Therefore, we studied the immediate effects of balance-based torso-weighting (BBTW) in a group of PwMS in a randomized clinical trial (RCT). **Number of Subjects**: There were 36 subjects with MS (relapsing remitting, secondary progressive and primary progressive) who completed the study. **Materials/Methods**: This was a two-phase RCT in which subjects were tested on six dependent variables: Timed up and go (TUG), Sharpened Romberg eyes open and eyes closed (SREO and SREC respectively), 360° turns to left and right, 25-foot timed walk, and computerized platform posturography (CPP) eyes open and eyes closed. In phase 1, subjects were tested then randomly assigned to experimental (n=18) and control (n=18) groups. The experimental group received BBTW that includes a balance assessment followed by placing small amounts of weight in a garment on the torso to counter the identified balance loss. Both groups received a 45-minute rest and were retested. In phase 2, previously assigned control subjects were retested on a second day then randomly split into an experimental group (n=8) that received BBTW and a control group (n=10) that received standard weight placement (SWP) of 1.5% body weight divided in two and placed at waist level at the midaxillary line bilaterally. For phase 1, one tailed t-tests ($\alpha = 0.05$) were used to compare average change scores for the control and experimental groups. For phase 2, two tailed t-tests ($\alpha = 0.025$) were used to compare average change scores for the SWP and BBTW groups. **Results**: The 25-foot timed walk ($p = 0.006$) showed a significant difference between those with and without the BBTW in phase 1. The TUG showed a significant difference ($p = 0.02$) between those with SWP and those with BBTW in phase 2. For all subjects the variability on the SR and CPP scores was very large. BBTW used an average of 1.17 pounds, less than 1.6% of any subject's body weight. **Conclusions**: Phase 1 indicated that BBTW can have immediate advantages over a non-weighted condition for gait velocity. Phase 2 indicated that BBTW can have immediate advantages over a standardized weighted condition in a functional activity, even in subjects who had recently practiced the testing variables. **Clinical Relevance**: BBTW has potential for effecting immediate change in function for PwMS.

BODY-WEIGHT SUPPORT TREADMILL TRAINING TO IMPROVE TRANSFER ABILITY, BALANCE, AND GAIT IN A PATIENT POST BRAINSTEM CVA WITH ATAXIA. S. E. Schuerman, P. Altenburger, E. Altenburger, A. Backlund , L. Mazzini, N. Wetzel, Physical Therapy, UNLV, Las Vegas, NV.

Background & Purpose: Patients with ataxia post stroke may require much assistance from a caregiver for ADL. Interventions to reduce assistance as the patient and caregiver age could allow a patient to stay longer in the home. Little literature exists regarding effective interventions to improve transfer ability and gait in patients with ataxia. The purpose of this case study is to determine whether body-weight support treadmill training could improve transfer ability, balance, and gait on the treadmill in a cognitively intact 63 year old female patient who suffered a CVA resulting in ataxia and mild right sided hemiparesis on 11/10/2001. **Case Description**: Pretests for the subject include the Lower Extremity Fugl-Meyer Test, the Orpington Prognostic Scale (Stroke Recovery), the Berg Balance Scale, and the Duke Mobility Skills Profile. The subject was seen 3 times per week for 12 weeks. Body-weight support treadmill training was provided for 10 weeks followed by overhead harness training for 2 weeks. During treadmill training, the subject was assisted bilaterally in stepping and with weight shift of the trunk from behind. She held onto the front rail of the treadmill for the first 5 weeks of training. Initial speed was 0.3 mph with support of 60 pounds. Initially, she tolerated only 7 to 8 minutes of treadmill walking divided among 3 trials due to fatigue. **Outcomes**: Speed increased to 0.5 mph at the end of 10 weeks. Decreasing support resulted in decreased quality of stepping and weight shift. Time increased to 16-18 minutes over 2 trials by week 7. At that time the patient stopped holding on to the treadmill bar as this stabilization mechanism reduced her weight shift. The resulting increase in subject effort decreased time to fatigue to 11-14 minutes. In week 11, the subject was placed in an overhead harness for transfers, balance, and gait activities. Increased trunk control occurred during transfer, balance, and gait activities ultimately requiring only minimum to stand-by assistance of two investigators. However, fatigue occurred quickly causing loss of trunk control. No measurable gains were observed on the standardized post-tests when performed at the end of week 13. **Discussion**: This subject, largely confined to a wheelchair for 6.5 years, was most limited by her aerobic endurance. Her daily transfers are performed by her caregiver giving her little experience in learning to maintain her COG over her BOS during transfers. Inability to control her weight shift during transfers, balance, and in gait was a second limiting impairment. Body-weight support permitted improved endurance. However, the body-weight support did not allow the subject to experience the trial and error necessary to learn better trunk control in these functional activities. Consistent practice of these functional activities in an overhead harness would allow the subject to engage in motor learning and motor control and would have been a better intervention strategy for this particular subject.

MEASURING WALKING ABILITY AFTER STROKE: A SYSTEMATIC REVIEW OF THE EVIDENCE. G. D. Fulk[1], A. Mirelman[2], C. Josephs[1], J. M. Filler[2], A. Dike[1], J. E. Deutsch[2], [1]Physical Therapy, Clarkson University, Potsdam, NY, [2]Rehabilitation and Movement Science, University of Medicine and Dentistry of New Jersey, Newark, NJ.

Purpose/Hypothesis: It is important for clinicians and researchers to use patient oriented outcome measures with sound psychometric properties when measuring walking ability of people with

stroke. The purpose of this systematic review was to evaluate the reliability and validity of clinically based outcome measures for assessing walking ability after stroke. **Number of Subjects**: N/A **Materials/Methods**: We conducted a search of articles from 1950 to March 2007 in Medline and from 1937 to March 2007 in CINAHL using the key words "walk" or "gait" and "stroke". Articles whose main purpose was to explore validity and reliability were identified and reviewed. References were reviewed for other pertinent articles. Articles were included if they addressed one of four aspects of walking: independence, distance, speed and appearance, and if the outcome measure could be performed in the clinic. **Results**: 151 articles were identified and reviewed. Independence was commonly assessed using the Functional Ambulation Categories (FAC). It demonstrates fair reliability and is strongly related to other measures of gait. Distance was measured using a timed walk and accelerometry. These measures demonstrate strong reliability and are strongly to moderately related to measures of body structure/function and level of activity. Gait speed measured over a 10m walk was the most common method of measuring walking ability in both the acute and chronic stages of recovery. It is sensitive to change and demonstrates strong concurrent, predictive and construct validity in a variety of settings. Based on reported Minimal Detectable Change scores, in the early stages of recovery a change of 0.17m/s is necessary in order to be certain that a true change occurred and in the later stages of recovery a change of 0.29m/s is necessary in order to be certain a true change occurred. Appearance was measured using observational gait assessment (OGA) tools whose reliability and validity varied widely based on the individual OGA. **Conclusions**: The choice of which method of measuring walking ability will depend on the stage of recovery and practice setting. Measures of gait speed and distance have strong reliability and validity. Measuring independence may be useful early after stroke, but demonstrates a ceiling effect and only has fair reliability. Further research is necessary in order to establish the clinical utility of OGA tools. **Clinical Relevance**: Clinical measurements of walking ability of people post-stroke are reliable and valid. Gait speed can be used to assess walking ability at all levels of walking ability and stages of recovery. FAC may characterize walking ability early in recovery and the six minute walk test may be more appropriate later in recovery.

THE EFFECT OF AMBULATORY ASSISTIVE DEVICES ON LOWER EXTREMITY KINEMATICS AND GAIT SPEED
G. D. Fulk[1], A. Strong[2], J. Laskoski[1], J. Carroll[2], [1]Physical Therapy, Clarkson University, Potsdam, NY, [2]Clarkson University, Potsdam, NY.

Purpose/Hypothesis: Locomotor training(LT) utilizing a body weight support(BWS) and treadmill system is an effective intervention for retraining gait after neurological injury. Key components of LT are an upright posture, hip extension at toe off, and training at age normal walking speeds. An important part of locomotor training is overground and community training to facilitate functional carry over. Conventional ambulatory assistive devices(AAD), which are often used during overground and community training may not allow for optimal implementation of LT training principles. We have developed a novel AAD called the natural gait walker(NGW) that may allow gait speeds and LE kinematics that approximate normal values during overground LT. The purpose of this research was to evaluate the effect of different AADs on gait speed and LE kinematics. **Number of Subjects**: 19 healthy adults participated. **Materials/Methods**: Subjects walked in 6 different conditions: no AAD, NGW with arm swing, NGW without arm swing, straight cane(SC), standard walker(SW), and Canadian crutches(CC). Gait patterns with the AADs and height of AADs were standardized and condition order was randomized. LE hip kinematics and gait speed were collected with a VICON motion analysis system. Data were analyzed using a repeated measures ANOVA. If a significant difference among conditions was identified a dependent t-test with a Bonferroni correction factor was used to assess where the difference was. **Results**: There was a significant difference in gait speed between the different conditions. Post hoc analysis revealed that gait speed was significantly faster in the no AAD(1.2m/s) condition compared to the other conditions: NGW no arm swing(0.99m/s), NGW with arm swing(0.88m/s), SC(0.52m/s), CC(0.46m/s), and SW(0.31 m/s). Gait speed in the 2 NGW conditions was significantly faster compared to the other AADs. There was a significant difference in left(L) and right(R) hip extension at toe off between the different conditions. Post hoc analysis revealed that there was no significant difference in right or left hip extension at toe off between the no AAD(R=10.9 degrees, L=10.8 degrees), NGW with arm swing(R=7.7 degrees, L=7.1 degrees) and NGW without arm swing conditions(R=8.7 degrees, L=8.6 degrees). There was significantly less hip extension at toe off on both the right and left during the SC(R=2.4 degrees of flexion), SW(R=15.6 degrees of flexion, L=2.3 degrees), and CC(R=4.2 degrees, L=2.9 degrees) conditions with the exception of left hip extension in the SC(8.1 degrees) condition. **Conclusions**: A new AAD, the NGW, most closely approximated normal gait speed and hip kinematics compared to other commonly used AADs. The NGW may be an effective tool for overground LT. Further research that incorporates the NGW into a LT program with individuals with neurological disorders is necessary. **Clinical Relevance**: Clinicians should consider the potential impact of an AAD on gait kinematics and gait speed during overground gait training. Further research is necessary in order to determine the optimal AAD for gait training.

VESTIBULAR REHABILITATION OF CENTRAL VERTIGO IN A 35-YEAR-OLD FEMALE WITH MULTIPLE SCLEROSIS: A CASE REPORT.
H. Karpatkin, New York Neurorehabilitation Group, New York, NY

Background & Purpose: Vertigo and resulting imbalance are common findings in Multiple Sclerosis (MS), due to involvement of central vestibular structures such as the cerebellum and pons. However, little literature supports the use of vestibular rehabilitation in persons with central vestibular dysfunction. The purpose of this case report is to describe successful use of vestibular rehabilitation in a 35 year-old female with vertigo due to multiple sclerosis. **Case Description**: The patient was diagnosed with relapsing-remitting MS in 1997. Primary impairments were longstanding (5 years) sensations of vertigo and disequilibrium with resulting gait imbalance and activity restrictions. She was referred to physical therapy by her neurologist who found no evidence of recent disease activity or systemic infection. Physical therapy evaluation revealed strength, ROM, and sensation as normal with no evidence of spasticity or incoordination. Her Berg Balance Scale (BBS) score was 52/56, Dynamic Gait Index (DGI) was 19/24 and Dizziness Handicap Inventory (DHI) was 42/100. Hallpike-Dix testing was negative. With head turning, bilateral direction changing horizontal nystagmus was elicited. She complained of vertigo with all head turning activities, as well as when standing or sitting on unstable surfaces. Interventions included daily vestibular-ocular reflex (VORx1) training, initially in sitting, with vertical, horizontal, and diagonal head movements. The patient was shown how to alter the intensity of vertigo these movements produced by changing head speed and range of the motion. As ability to tolerate head movements in-

creased, she progressed to VORx2. When able to perform movements in standing, gait training with vertical and horizontal turns was initiated. **Outcomes**: After eight weeks, BBS improved to 56/56, DGI to 22/24, and DHI to 12/100. She resumed activities she had not attempted in years including dancing and skiing without noting vertigo. **Discussion**: Persons with central vestibulopathy often are considered poor candidates for vestibular rehabilitation despite the fact that no literature has shown this to be necessarily the case. This case describes an excellent response to vestibular rehabilitation in a patient central vestibulopathy due to MS. Given the frequency of vestibular complaints in MS, clinicians should consider the use of vestibular rehabilitation in these patients.

VESTIBULAR REHABILITATION OF PROFESSIONAL ICE HOCKEY PLAYERS WITH POST-CONCUSSION SYNDROME AND DIZZINESS: A CASE SERIES. E. Grace, Physical Medicine and Rehabilitation, University of Pennsylvania Health System, Philadelphia, PA.

Background & Purpose: Concussion, a mild head injury, is a common occurrence in sports. Symptoms can persist for weeks, months and even years in people with post-concussion syndrome (PCS). Although dizziness is among the most commonly reported symptoms of PCS, there is little in the literature discussing appropriate treatment options for this symptom. There is, however, a great deal of research supporting the use of vestibular rehabilitation to treat patients with dizziness from central and/or peripheral vestibular dysfunction. The purpose of this case series is to describe the rehabilitation of two professional hockey players with PCS with complaints of dizziness. **Case Description**: This case series involves two hockey players in the National Hockey League with PCS and dizziness referred for vestibular rehabilitation. Patient 1 had sustained multiple concussions in the past, whereas this was the first recorded concussion for patient 2. When referred for rehabilitation, patients were 8 weeks and 6 weeks post-concussion, respectively. Treatment interventions included vestibulo-ocular reflex retraining, habituation exercises for desensitization of self-initiated body motion and visual motion sensitivity, optokinetic stimulation training, high-level balance retraining, ocular exercises and sport-specific habituation training. The treatment program advanced to also include treatment activities performed on the ice, including sport-specific activities and movements. Patient 1 was treated for 19 weeks and patient 2 for 12 weeks. **Outcomes**: Symptom intensity rating of dizziness, on a 0-10 VAS scale, for Patient 1 improved from a 4/10 on average, 9/10 at worst on evaluation to 0/10 at discharge. Dizziness Handicap Inventory (DHI) score improved from 28/100 on evaluation to 14/100 at discharge. He returned to full contact at team practices, however, continued to experience symptoms of pressure and occasional headaches and was not able to return to participation in games. Patient 2 improved from symptom intensity rating of 3/10 (constant baseline) and 6/10 with head movement on evaluation to 0/10 at discharge. DHI score decreased from 34/100 on evaluation to 0/100 at discharge. He reported no symptoms with any activities, including sport-related movements on the ice and was cleared for full return to sport. **Discussion**: Cumulative effects of multiple concussions and other issues, including dysautonomia, complicated the rehabilitation of patient 1. Both patients, however, had good outcomes and were symptom-free of dizziness at discharge. Most team physicians and trainers do not have extensive knowledge of vestibular disorders and are unclear as to how to address dizziness symptoms in the PCS population. This case series exemplifies the use of vestibular rehabilitation to treat dizziness. Including vestibular specialists in the care of patients following PCS may decrease symptom complaints, improve functional outcomes, and enhance the overall comprehensive care of these patients.

EVALUATION OF MULTI-DIRECTIONAL REACH IN PARKINSON DISEASE. R. Choi[2], J. Funk[1], M. Hackney[1], G. Earhart[1], [1]Program in Physical Therapy, Washington University School of Medicine, St. Louis, MO, [2]Department of Biology, Washington University in St. Louis, St. Louis, MO.

Purpose/Hypothesis: Physical therapists commonly use the forward functional reach to assess balance in Parkinson disease (PD), but the multi-directional reach test has never been examined in PD. The purpose of this study was to evaluate the multi-directional reach in PD. We hypothesized the backward reach would provide important information not provided by the forward reach, as subjects with PD are least stable in the backward direction. We further hypothesized the lateral reach would provide an indication of asymmetry in postural control, as motor symptoms in PD are often asymmetric. We predicted subjects would have more difficulty reaching away from the most affected side**. Number of Subjects**: We tested 55 subjects with PD (Hoehn & Yahr of 2-3, 42 males, 13 females, aged 65.7 +/− 9.7 years (mean +/− SD)). **Materials/Methods**: All subjects performed the multi-directional reach test, Timed Up and Go (TUG), Unified Parkinson Disease Rating Scale Motor Subscale (UPDRS), Activities of Balance Confidence (ABC), Berg Balance Scale, and walking on an instrumented walkway (GAITRite, CIR Systems, Havertown, PA). Reach results were compared to results of the other tests using Pearson or Spearman correlation tests as appropriate ($p = 0.05$). **Results**: The average forward reach was 24.1 +/− 6.7 cm and average backward reach was 18.5 +/− 7.5 cm. The average lateral reaches toward and away from the most affected side were 19.1 +/− 5.2 cm and 18.40 +/− 6.0 cm, respectively. These values were not significantly different and there was no relationship between degree of motor symptom asymmetry and degree of lateral reach asymmetry. As such, results for lateral reach in the two directions were combined for all further analyses. Forward reach was significantly correlated with backward ($r = 0.52$) and lateral ($r = 0.36$) reaches as well as the TUG ($r = -0.32$) and UPDRS ($r = -0.40$). Backward reach, like forward reach, correlated with lateral reach ($r = 0.29$) and TUG ($r = -0.39$). Backward reach also correlated with ABC ($r = 0.27$), gait velocity ($r = 0.42$), and step length ($r = 0.46$), measures not correlated with forward reach. Backward reach did not correlate with the UPDRS. Lateral reach did not correlate with any other tests. **Conclusions:** The lateral reach did not distinguish between the most and least affected sides despite asymmetry of motor symptoms as assessed via UPDRS and did not correlate with any other measures. This suggests the lateral reaches may not provide critical information in this population. The backward reach, however, correlated with measures of balance and gait that were not correlated with forward reach. This suggests the backward reach may measure different and important features of postural control in this group. **Clinical Relevance**: A comprehensive evaluation of postural control in subjects with PD should consider both forward and backward functional reach. Lateral reach may not be a critical component of a balance evaluation.

HIGH INCIDENCE OF CARDIAC MEDICATION PRESCRIPTION IN PATIENTS WITH STROKE: IMPLICATIONS FOR PHYSICAL THERAPY EDUCATION. N. Hellyer, B. Foertsch, K. Wood, B. Wottreng, Program in Physical Therapy, Mayo, Rochester, MN.

Purpose/Hypothesis: This study formally describes medication prescription in patients with acute stroke who received inpatient physical therapy services. The analysis provides a basis for pharmacology curricular design in Doctor of Physical Therapy programs

and continuing education courses. **Number of Subjects**: 186 post-stroke (ICD-9-CM code categories 430-435) inpatients who gave informed consent prior to chart review. **Materials/Methods**: This study is a retrospective chart review. Patient data were collected from our institutional UDSMR database for patients who were consecutively discharged from Mayo Clinic Inpatient Rehabilitation Services during a one year period. Medications at discharge were obtained from patients' medical records. **Results**: Overall, cardiac agents were the most prevalently prescribed medications (84%). The most commonly prescribed drug classes were beta blockers (64%), aspirin (58%), and cholesterol-lowering medications (52%). Benzodiazepines were prescribed in 20% of the patients analyzed. **Conclusions:** Cardiac medications are commonly prescribed in stroke patients and should be emphasized in pharmacology curricula. **Clinical Relevance:** Beta blockers, aspirin, cholesterol-lowering medications, and benzodiazepines are associated with fatigue, gastrointestinal bleeding, rhabdomyolysis (muscle breakdown), and delayed motor recovery, respectively. These adverse effects can all impair patient function and recovery and need to be assessed during patient evaluation and treatment. Identifying common drug classes prescribed for patients following stroke will help to guide physical therapy education and enhance patient care.

EXAMINATION OF SENSATION IN PATIENTS POST-SPINAL CORD INJURY WHILE PARTICIPATING IN AN INTENSE REHABILITATION PROGRAM: A CASE SERIES REPORT C. A. Larson[1], K. Dorcey[1], B. Felczak[1], S. R. Hinderer[2], [1]Program in Physical Therapy, Oakland University, Rochester, MI, [2]Center for Spinal Cord Injury Recovery, Rehabilitation Institute of Michigan, Detroit, MI.

Background & Purpose: Spinal cord injury (SCI) causes impaired sensory and motor function below the level of the spinal cord lesion. Sensory impairment is most frequently examined using standardized American Spinal Injury Association (ASIA) testing procedures consisting of light touch and sharp/dull discrimination; therefore, ASIA sensory testing procedures are confined to testing superficial sensation. An algometer measures the presence or absence of deep pressure sensation. The purpose of this study was to determine the sensory level of injury using standard ASIA sensory procedures as compared to algometer testing in individuals with spinal cord injury. **Case Description**: This is a preliminary report for four subjects with SCI (3 males and 1 female) with a mean age of 29 ± 12.5 years and mean time since injury of 4.6 ± 2.9 years. All subjects were participating in an intense rehabilitation program aimed at recovery of sensory and motor function below the level of injury. **Outcomes**: Outcome measures include light touch and sharp/dull discrimination obtained using standard ASIA testing procedures and deep pressure sensation testing using an algometer for the 28 sensory dermatomes. Subject 1 was classified as having a C6 injury based on ASIA sensory testing, but felt deep pressure with algometer testing from C7 to S4-5 (range 0.0-11.7 newtons). Subject 2 was classified as having a C3 injury based on ASIA sensory testing, but felt deep pressure with algometer testing at C4 (0.95 newtons (right), 7.5 newtons (left)) and from T2 to T4 (range 4.6 newtons (right), 3.5-8.2 newtons (left)). Subject 3 was classified as having a T4 injury based on ASIA sensory testing, but felt deep pressure with algometer testing from L1 to L3 (range 4.25-17.45 newtons) and S3-S5 (range 5.21newtons) on the right, T5-T6 (range 5.3-15.5 newtons), T12-L1 (range 10.4-15.2 newtons) and S2-S5 (range 1.52 newtons) on the left. Subject 4 was classified as having a C4 injury based on ASIA sensory testing, but felt deep pressure with algometer testing from C5 to T5 (range 0.0-16.5 newtons) on the right and C5-T3 (range 0.9-5.5 newtons) on the left. **Discussion**: In this preliminary report of four subjects with SCI, the presence of deep sensation obtained by algometry was found in dermatomes that were identified as impaired or absent using standard ASIA procedures (superficial sensation) in subjects with SCI. Therapists should consider adding deep pressure sensory testing using an algometer to their examinations of patients with SCI. Continuation of the study with analysis of 17 subjects with SCI is in progress in order to confirm or refute these findings. In addition, inter-rater reliability of student physical therapists and experienced physical therapists will also be determined.

TESTS FREQUENTLY USED BY EXPERT CLINICIANS WHEN EXAMINING PATIENTS POST-STROKE. B. Andrews[1], S. Folger, L. Clark, S. Norbet, Physical Therapy Education, Elon University, Elon, NC.

Purpose/Hypothesis: The purpose of this study was to determine which tests and measures are used most frequently by expert clinicians in the examination of patients post-stroke. **Number of Subjects**: Four hundred seventy-one physical therapists who had neurologic certification with cerebral vascular accident practice focus and/or geriatric certification with adult hemiplegia practice focus were identified using the American Board of Physical Therapy Specialties website. All of these expert clinicians were sent an e-mail request asking for their participation in the survey if they were actively involved in clinical practice. One hundred twenty-eight completed surveys were returned. **Materials/Methods**: In the web-based survey, demographic information was collected including geographic location, years of experience, average time spent working with patients post-stroke, average number of initial examinations conducted per week, practice setting and academic preparation. Subjects were then asked to rate their familiarity with and clinical use of 294 tests and measures that were derived from and categorized according to the Guide to Physical Therapist Practice. The subjects selected from 5 possible responses which ranged from 'never heard of the test' to 'use the test frequently with patients with stroke.' Each category included an option for the subject to enter additional tests and measurements not found in the list provided. The data were analyzed using descriptive statistics for the demographic information and frequency counts for the tests and measures data. **Results**: Respondents were representative of all geographic regions of the United States. Their average number of years of experience was 16.4 ± 7.1 years. The most common practice location of the survey respondents was an outpatient setting (39.1% of all respondents) followed by inpatient rehabilitation (27.3%). The ten most commonly utilized tests by the expert clinicians when examining patients with stroke were: measurement of ankle clonus (98.4% utilized this test rarely or frequently with patients with stroke), blood pressure measurement (97.7%), Finger-to-Nose Test (97.7%), proprioception test (96.9%), Manual Muscle Test – General (96.9%), Functional Muscle Test - General (95.3%), alert and oriented x 4 (95.3%), ability to follow multi-step commands (94.5%), Berg Balance Scale (93.8%), and goniometry (93.8%). **Conclusions**: The results of this survey show a broad range of tests and measures used by expert clinicians. Ninety tests and measures are utilized by over half of the respondents when examining patients with stroke. While there is variability in the specific tests and measures, there is some consistency in the broad categories of tests frequently utilized by expert clinicians. **Clinical Relevance**: Clinicians who want to emulate the practice of expert clinicians who work with patients with stroke may want to consider the specific tests and measures those expert clinicians utilize. The results of this survey could be helpful

in the establishment of recommended tests and measures for examining patients post-stroke.

REPEATED SINGLE-LIMB HEEL RAISES ARE NOT ASSOCIATED WITH MANUAL MUSCLE TESTING RESULTS OR PEAK PLANTARFLEXION FORCE IN PEOPLE WITH MUSCLE DISEASE. M. Harris-Love[1], J. Shrader[2], T. Davenport[3], G. Rakocevic[4], B. McElroy[4], M. Dalakas[4], [1]Program in Physical Therapy, George Washington University, Washington, DC, [2]Rehabilitation Medicine Department, National Institutes of Health, Bethesda, MD, [3]Division of Biokinesiology and Physical Therapy, University of Southern California, Los Angeles, CA, [4]Neuromuscular Disease Section, National Institute of Neurological Disorders and Stroke, Bethesda, MD.

Purpose/Hypothesis: Repeated heel raises have been proposed as a method of plantarflexor (PF) strength testing that circumvents the limitations of the MMT. The purpose of this study was to examine the relationship among single-limb heel raises, PF peak force, and PF manual muscle test (MMT) in subjects with inflammatory muscle disease (myositis). **Number of Subjects**: Forty-three subjects with myositis obtained through a sample of convenience at a Federal research hospital (age 66.0 ±7.5 years, 13 females). **Materials/Methods**: A prospective, observational clinical trial with a between-groups design was conducted. Group assignment was based on the ability to complete a single limb heel raise (SLHR; Able, n=21; Unable, n=22). Repeated SLHR were performed using a wedge (15 degrees) and metronome (60 bpm) to standardize range of motion and repetition speed, respectively. Isometric peak PF force was obtained in supine with terminal knee extension using a fixed-dynamometer and a force transducer. Averaged force data were recorded in kg and scaled to body weight. MMT was administered using the 10-point scale described by Kendall et al, 2005. Disease duration (years) was obtained through chart review. Spearman's rho (¥ñ) was used to determine the correlation among dependent variables. Mann-Whitney U was used to detect differences between groups (alpha level = .05). **Results**: For the Able and Unable groups, the median values were 10 (interquartile range, IQR, 10; range, 10-10) and 7 (IQR, 7; range, 5-9) for MMT, .27 (IQR, .22-.33) and .16 (IQR, .13-.22) for PF peak force, and 7 years (IQR, 6-12) and 10 years (IQR, 8-14) for disease duration, respectively. In the Able group, there was no association among SLHR performance (median, 13 repetitions; IQR, 8-22), PF peak force, or MMT ($p > .05$). In the Unable group, PF peak force was significantly associated with MMT ($\rho = .70$; $p = .004$). Based on the ability to complete the heel raise task, there were statistically significant group differences in PF peak force ($p < .001$) and disease duration ($p = .037$). **Conclusions**: There are significant differences in PF peak force between people with myositis who can and cannot perform the SLHR. For subjects able to perform the task, the MMT exhibited a ceiling effect because all subjects attained the maximum score. The SLHR test demonstrated a significant floor effect, as 51% of the subjects were unable to perform the task. When subjects were able to complete one or more heel raises, the number of completed repetitions was not correlated with PF peak force. **Clinical Relevance**: MMT may have some utility as an estimate of PF strength in weak subjects unable to complete one SLHR. However, MMT did not provide useful information about the PF strength of the Able group. Repeated SLHR performance cannot be used as a proxy for PF strength in this patient population. Nevertheless, the ability to perform one SLHR provides important clinical distinctions regarding PF peak force and disease duration in subjects with muscle disease.

BILATERAL UPPER LIMB SYNERGIES RESULT FROM BRAINSTEM STIMULATION. W. J. Herbert[1], J. A. Buford[1], A. G. Davidson[2], [1]Physical Therapy, Ohio State University, Columbus, OH, [2]A.G. Davidson, Neurobiology and Anatomy, University of Rochester Medical Center, Rochester, NY.

Purpose/Hypothesis: This study describes motor outputs from the reticulospinal system (RST) to both upper limbs of the monkey and compares results from two stimulation methods. Stimulus triggered averaging (StTA) uses single pulses at low frequency to reveal specific outputs, biased towards monosynaptic connections. However, data collection is time consuming and muscle contractions are imperceptible. Stimulus trains (StimTrains) use a short series of pulses at high frequency, and the results are obtained quickly and muscle contractions are evident. However, this method may recruit motor pools through polysynaptic connections, potentially making results less specific and harder to interpret. In this study, we compared results from both methods in single animals to determine whether StimTrains can be used in lieu of StTA. Our hypothesis was that StimTrains would evoke responses in more muscles, but overall, the two methods would reveal similar RST output patterns. **Number of Subjects**: Two adult male M. fascicularis monkeys. **Materials/Methods**: As animals reached to targets with either arm, chronically implanted EMG electrodes recorded activity from flexor and extensor muscles of scapulothoracic, shoulder, elbow, and wrist joints bilaterally. With StTA, up to 4000 single pulses were delivered at 10 Hz while the subject performed. For StimTrains, bursts of 12 pulses were delivered at 333Hz. Approximately 10 StimTrains were tested at each site with both arms at rest. **Results**: Responses were prevalent bilaterally for both methods, especially for proximal muscles. StTA produced more widespread results than StimTrains. This unexpected result suggests the acceptance criteria for StimTrains were stringent. Stimulation during rest may also have reduced the comparative effectiveness of StimTrains. Of the 1611 StTA responses analyzed, 58% were suppression (SPR) and 42% were facilitation (FAC). In comparison, of the 1093 StimTrains responses analyzed, 26.5% were SPR and 73.5% were FAC. A higher percentage of FAC for StimTrains was expected given the low baseline EMG during stimulation at rest, making SPR harder to detect. For StTA, the most common responses were ipsilateral flexor and contralateral extensor FAC. In cases where StTA and StimTrains both produced a result, there was 96-97% agreement. The next most common responses were ipsilateral extensor and contralateral flexor SPR, with 68-75% agreement. Ipsilateral extensor FAC and contralateral extensor SPR were also prevalent with 66-86% agreement. Contralateral flexor FAC and ipsilateral flexor SPR were rare responses, but even these responses had 87-100% agreement. **Conclusions**: Overall, muscle by muscle comparison showed strong agreement (72%-100%) between the two methods. StimTrains can be an efficient means to reveal facilitatory outputs, but may underestimate suppression. **Clinical Relevance**: RST motor output patterns of ipsilateral flexor and contralateral extensor facilitation mimic stereotypic synergistic movement patterns exhibited by humans after brain injury. This suggests that the RST plays an important role in motor control of reaching.

ZERO G: DYNAMIC OVER-GROUND BODY-WEIGHT SUPPORT SYSTEM. K. Brady, I. Black, D. Brennan, J. Hidler, Research, National Rehabilitation Hospital, Washington, DC.

Purpose/Hypothesis: To test and evaluate a revolutionary dynamic body-weight support system that allows individuals with

varying levels of walking ability to safely practice over-ground gait training, including practicing obstacles such as stairs and uneven terrain. Providing intensive gait training in individuals with serious walking deficits following stroke, spinal cord injury, and other neurological disorders presents significant challenges to even the most skilled physical therapist. Due to lower extremity impairments such as weakness and lack of coordination (Hidler et al., 2003), these individuals are often unstable and are susceptible to falls. Since providing intensive gait training early after neurological injuries is critical to the recovery of lower extremity function (DeJong et al., 2005), technologies are necessary to train individuals with serious lower extremity impairments in a safe, controlled environment. The novel body-weight support system described in this study allows subjects with gait disorders to safely practice over-ground walking, including over obstacles such as uneven terrain and over steps, in the acute stages of injuries **Number of Subjects:** Significant bench top testing has taken place in order to test the system for performance and safety, while a small group of healthy volunteers have tested the system's performance during over-ground gait. **Materials/Methods**: In order to determine the range of walking speeds and vertical excursions of the subject's center of mass in which the system can maintain constant body-weight support, the system was connected to a linear motor, which simulated the subject's up and down movement during walking at speeds ranging from 0.1 to 2.5 m/s. Healthy subjects also walked in the system to evaluate fall prevention algorithms, maximum walking speeds in which the system could track the subject, and the system's behavior over obstacles (e.g. stairs). **Results**: The system can statically lift individuals who weigh up to 300 lbs, with enough travel to raise a person from a sitting position or even lower them to the floor. The unloading system can maintain up to 150 lbs of constant unloading force over a frequency range 4 times greater than those occurring in gait. The overhead trolley that carries the unloading system is active, where a sensor monitors the subject's forward progression and then automatically maintains the trolley above the subject. The trolley can track subjects up to 1.5 m/s, a range more than adequate for individuals with gait impairments. Sensors on the system record distance walked, average speed, unloading forces, falls prevented and rest breaks. **Conclusions**: The system described in this study allows individuals with serious gait impairments to safely practice intensive walking in the acute stages of their injuries. **Clinical Relevance**: We believe training with this system will result in higher returns in functional walking ability compared to subjects trained using conventional methods.

CORTICAL ACTIVATION DURING FINGER TRACKING VS. ANKLE TRACKING. S. M. Kveno, M. L. Konkol, J. A. Klein, K. LaPointe, J. R. Carey, Program in Physical Therapy, University of Minnesota, Minneapolis, MN.

Purpose/Hypothesis: Much research exists connecting cortical activity with hand function but little exists with ankle function, despite the ankle control needed for walking. The purpose of this study was to compare the cortical activation associated with both hand and ankle motor control. **Number of Subjects**: Twenty healthy subjects (13 females, 7 males) with a mean (±SD) age of 23.9 (±2.59) years participated. **Materials/Methods**: All subjects performed both a finger and an ankle tracking task simultaneous with functional magnetic resonance imaging (fMRI) inside a 3-Tesla magnet. Electrogoniometers were applied to the right index finger and right ankle. A 0.4 Hz sine wave with variable amplitude served as the tracking target. The subject viewed this target through a mirror and tracked with either extension/flexion movements of the finger or dorsiflexion/plantarflexion movements of the ankle. The uppermost and lowermost peaks of the sine wave were standardized as percentages of the maximum active motion at each joint. The fMRI task involved three alternating conditions: rest, finger tracking, and ankle tracking. Three 30-s trials of each tracking condition occurred. Tracking accuracy for all trials combined and for trial 1 and trial 3 were computed by normalizing the root-mean-square error to each person's range of motion. Cortical activation was analyzed in the following regions of interest using Brain Voyager software: primary motor area (M1), primary somatosensory area (S1), supplementary motor area (SMA), and premotor cortex (PMC). This software computed the volume and intensity of active voxels during specified statistical contrasts of the blood-oxygen-level-dependent (BOLD) signal intensity. Paired t tests compared the tracking accuracy of the two joints and the mean intensity values of active voxels between the finger and ankle conditions. Alpha was set at $p<0.05$. **Results**: Tracking accuracy was significantly higher for finger compared to ankle and both joints improved significantly from trial 1 to 3. The volume of active voxels was greater for the finger condition in left M1, S1, and PMC; whereas, it was greater for the ankle condition in right M1, and right and left SMA. The intensity of left M1 during finger tracking was significantly greater than left M1 during ankle tracking; whereas, the intensity of right SMA during ankle tracking was significantly greater than right SMA during finger tracking. Regarding the change from trial 1 to 3, the signal intensity decreased significantly in right M1 and S1 for the ankle compared to the finger. **Conclusions**: We conclude that the ankle involves a greater component of ipsilateral activation than the finger. **Clinical Relevance**: Our observation of greater ipsilateral involvement in the less-skilled joint is conspicuous and may relate to the documented observation that ipsilateral activation in stroke generally is associated with poorer recovery. This invites further study into the process of interhemispheric inhibition and how it influences the laterality of cortical activation and skillful performance in healthy subjects and in subjects with stroke.

EFFICACY OF RILUZOLE IN MANAGING SPINAL CORD INJURY INDUCED SPASTICITY IN THE RAT. P. Kitzman, T. Uhl, Rehabilitation Science, University of Kentucky, Lexington, KY.

Purpose/Hypothesis: Spasticity poses a major detrimental impact on the quality of life in a significant number of patients with spinal cord injury (SCI). Currently, gaps exist in our knowledge of the pathophysiology involved in SCI-induced spasticity. Recent observations in our laboratory, using a sacral spinal (S2) transection spasticity model, suggest a significant increase in glutamatergic input to sacrocaudal motoneurons arising from spinal segmental sources. We recently demonstrated that suppression of presynaptic glutamate release from voltage-gated calcium channels significantly decreased the manifestation of spasticity in the tail musculature. Voltage-gated sodium channels are also involved with glutamate release. The purpose of the present study was to examine the efficacy of blocking voltage-gated sodium channels in managing spasticity within the tail musculature. **Number of Subjects**: Nine Sprague-Dawley Rats **Materials/Methods**: In this blinded, cross-over study, animals with S2 spinal transection were tested behaviorally for the progression of spasticity in the tail musculature, using our established system. When the animals demonstrated a significant level of spastic behavior (at least 4 weeks post-injury) they received either riluzole (8 mg/kg i.p.) or saline and assessed behaviorally and with surface electromyography (EMG) at 1, 3, 6, and 12 post-injection. The antiepileptic agent riluzole effects glutamate transmission by multiple mechanisms. However, inactivation of voltage-gated sodium channels

is thought to be a predominant mechanism. Following a 2 week wash-out period, animals were injected with whichever solution they had not previously received and tested behaviorally and with EMG at 1, 3, 6, and 12 hours post-injection. **Results**: Riluzole at a dosage of 8 mg/kg (i.p.) produced a modest decrease in the behavioral manifestations of spasticity at 1 and 3 hours post-injection when compared with baseline (pre-injection) activity and the activity level following administration of saline. In addition, a modest decrease in EMG activity was observed following administration of riluzole when compare to saline. **Conclusions**: Inhibition of voltage-gated sodium channels appears to diminish SCI-induced spasticity, in the tail musculature. **Clinical Relevance**: Further studies are required to determine whether pharmacologic agents that target this class of ion channel (e.g. riluzole) can provide an effective adjunct treatment for the management of SCI-induced spasticity.

RELIABILITY OF SENSATION TESTING OF OLDER ADULTS WITH DIABETES. R. Mawdsley, J. Nagel, B. Zoltowski, N. Smith, J. Ofcharsky, M. Gilbert, S. Barker, Physical Therapy, College Misericordia, Dallas, PA.

Purpose/Hypothesis: The purpose of this study was to determine intratester and intertester reliability of measurements when testing sensation with Semmes-Weinstein monofilaments as presented in the six-piece foot kit in a sample of older adults with diabetes mellitus. **Number of Subjects**: The sample consisted of 24 females and 16 males with a diagnosis of diabetes mellitus. Their ages varied from 50 to 93 years (mean 76.30, standard deviation 11.13). Exclusion criteria were as follows: younger than 50 years old, not able to understand English, and open sores on the right foot. **Materials/Methods**: Prior to collecting data the 5 testers practiced using two six-piece foot kits of Semmes-Weinstein monofilaments. After having been familiarized with a filament, each subject was tested with the same kit three times during one session. Two sites on the dorsal surface and seven sites on the plantar surface of the right foot were tested by pressing the filament against the subject's skin until the filament buckled. For each site the testing procedure began with the smallest filament and, as necessary, was repeated with the next size filament until a filament was felt or the trials were completed. Each subject was allowed five trials to feel the filament at each site. The testing procedure was performed by one tester, followed by a different tester, and then repeated by the original tester. For each of the three testing situations each subject received a score for each site that represented the number of the largest filament that was felt. If no filament was felt, anesthesia was noted for the site. Because of the ordinal level of measurement, Spearman rank correlation coefficients were used to determine intratester and intertester reliability. The level of significance was .05. In order to evaluate the coefficients, the following guidelines were used: below .50, poor reliability; .50 to .75, moderate reliability; and above .75, good reliability. **Results**: The coefficients for intratester reliability varied from .39 to .75, and the coefficients for intertester reliability varied from .40 to .80. All coefficients were significant. **Conclusions**: The majority of the coefficients represented moderate reliability. Since only one coefficient represented good reliability, the measurements overall did not demonstrate an adequate level of intratester or intertester reliability. **Clinical Relevance**: Older adults who have diabetes mellitus may have diminished or no sensation of their feet that may lead to serious injuries. It, therefore, is important to have a reliable test when determining if sensation to touch is normal, diminished, or absent. In a sample of older adults with diabetes mellitus, reliability of sensation testing was not acceptable when testers used the six-piece foot kit of Semmes Weinstein monofilaments.

CORTICAL ACTIVATION ASSOCIATED WITH VISUAL MOTOR PROCESSING OF FEEDBACK IN SUBJECTS WITH STROKE. T. J. Kimberley, S. L. Hall, B. N. Darst Rice, P. A. Slivnik, C. M. Strand, Physical Medicine and Rehabilitation, University of Minnesota, Minneapolis, MN

Purpose/Hypothesis: A critical component to rehabilitation is the appropriate type and amount of feedback to facilitate learning but not provide excessive competition for cognitive resources in an impaired population. Previous research concerning how cognitive load affects motor performance in subjects with stroke is inconclusive. The purpose of this study is to examine brain [(primary motor (M1), primary sensory (S1) and premotor area (PMC)] activation and motor performance during changes in cognitive load during a continuous motor task in subjects with stroke. **Number of Subjects**: Nine right-handed individuals (five males, four females) with left hemiparesis secondary to a single CVA participated. **Materials/Methods**: The task performed was a joystick drawing task during functional MRI. Subjects were presented with an image of a square which they attempted to accurately and continuously draw with their less-affected hand (right) under 3 conditions of varying feedback. Condition 1. drawing from memory. This condition required subjects to hold the image of the presented square in working memory and create a motor plan to reproduce it. They did not see the results of their performance. Condition 2. copying without feedback. This condition provided the template, but subjects did not receive results of performance. Condition 3. copying with feedback. This condition provided the template and the feedback of performance. **Results**: There was a significant decline in contralateral M1 activation between the 1. drawing and 2. copying without feedback conditions ($p<0.01$) and the 1. drawing and 3. copying with feedback conditions ($p<0.05$). In the ipsilateral M1, a significant decline in activation was found between the 1. drawing and 3. copying with feedback conditions ($p<0.05$). Bilaterally, the PMC showed a significant decrease in activation between the 1. drawing and 2. copying without feedback conditions ($p<0.01$) and an increase in activation between the 2. copying without feedback and 3. copying with feedback conditions ($p<.01$). Despite these changes in activation, the accuracy of performance was maintained across the three conditions. **Conclusions**: In subjects with stroke, varying levels of cognitive load were reflected in changes in cortical activation. The changes in cognitive load did not result in performance changes. These data suggest that the amount of feedback provided was manageable to the subjects. **Clinical Relevance**: The key to effective rehabilitation is customizing interventions to fit not only the patient's physical diagnosis, but also their cognitive ability. Therapists should consider the role of working memory and amount of feedback to provide when designing treatment for patients with stroke.

CLASSIFICATION OF PHYSICAL THERAPY INTERVENTION FOR INPATIENT STROKE REHABILITATION. J. R. Karges[1], S. Smallfield[2], C. Marek[1], N. Squier[1], D. Flint[1], [1]Department of Physical Therapy, The University of South Dakota, Vermillion, SD, [2]Department of Occupational Therapy, The University of South Dakota, Vermillion, SD.

Purpose/Hypothesis: The purpose of this study was to investigate and classify the specific types of PT intervention for inpatient stroke rehabilitation based on the Guide to Physical Therapy Practice. **Number of Subjects**: A total of 207 medical charts were reviewed of which 80 met inclusion and exclusion criteria. Charts selected for review were of clients with an ICD-9 code for stroke who completed inpatient rehabilitation at a midwestern U.S. hospital from January 2003 to June 2004. **Materials/Methods**: The design of this study was a non-experimental retrospective chart review. This

study was approved by a local IRB. The investigators analyzed PT intervention notes to collect data regarding the type of interventions based on the Guide to Physical Therapy Practice. Three co-investigators initially reviewed each chart and recorded the data. Subsequently, all charts were reviewed a second time by the principle investigator to reduce the likelihood of error. SPSS 15.0 was used to analyze the data. **Results**: Of the 80 charts reviewed, there were 41 males and 39 females. The mean age of the subjects was 70.28 years ±11.35 and all were Caucasian. The mean length of stay was 15.19 days ±11.69. The FIM scores were 71.90 ±21.47 at admission and 92.23 ±24.43 at discharge which was statistically significant (t=-12.163; p=.000). The subjects participated in 1759 total physical therapy sessions during their stay in the inpatient rehabilitation unit. Of the 1759 sessions, 1714 (97.44%) included physical therapy intervention, 40 (2.27%) were evaluation only sessions, and 5 (0.25%) were either home evaluation or co-treat sessions. The most frequently used interventions of the 1714 sessions were gait training (90.78%), functional training activities (85.94%) and therapeutic exercise activities (60.79%). Of the functional training activities, transfers, sit to stand and bed mobility were the utilized the most. Balance/coordination, strength/power and aerobic/endurance were the most frequently used therapeutic exercise activities. The most frequently used ambulatory aides were the front wheeled walker (43.8%) and the straight cane (20.0%). The most frequently used training equipment included the NuStep (87.5%), steps (83.3%), and the floor ladder (48.8%). **Conclusions**: There were several limitations to the current study. First, the research design was retrospective and descriptive in nature; therefore no causal relationships could be inferred. Second, all subject data were collected from one facility in the midwestern U.S. which limited the ability to generalize the results of the study to other settings. Finally, because the study was a retrospective chart review, the results were limited to what was documented by the treating clinicians. **Clinical Relevance**: These results demonstrate the need for additional prospective research to classify PT intervention related to stroke and to determine the most effective and efficient interventions based on discharge FIM scores. The relationship of NIH scores to FIM outcomes also needs to be explored in greater depth.

LOCOMOTION THERAPY IN INDIVIDUALS WITH MOTOR COMPLETE SPINAL CORD INJURY: EFFECTS ON HEALTH AND WELL-BEING. C. R. Hosler-Smythe[1], K. Brady[1], J. Hidler[2], [1]Inpatient physical therapy, National Rehabilitation Hospital, Washington, DC, [2]Center for Applied Biomechanics and Rehabilitation Research, National Rehabilitation Hospital and Catholic University of America, Washington, DC.

Background & Purpose: Individuals sustaining SCI that result in a complete loss of motor function often experience spasticity, loss in bone density, and other secondary complications. Recent studies have found that these individuals may benefit from long-term intensive lower limb training. Nash et al. (2003) demonstrated that during robot-assisted gait training, a person with chronic motor complete tetraplegia (ASIA B, C3-4) experienced elevations in heart rate, minute ventilation, and oxygen consumption, suggesting a possible cardiovascular benefit associated with this intervention. McDonald et al. (2002) reported significant improvements in function, sensation, and other health metrics in a person with motor complete SCI following long-term cycling with FES. These recent studies suggest that persons with motor complete SCI may experience improvements in health and well-being following intensive lower limb therapy. The purpose of this study was to determine whether long-term robotic-assisted locomotion therapy in individuals with motor complete SCI leads to improvements in sensory and motor function, as well as decreases in secondary complications. **Case Description**: Three individuals with chronic SCI (greater than 18 months) classified as either ASIA A or B were enrolled in the study. Subjects were excluded if they had pressure ulcers, severe contractures or heterotopic ossification in the lower extremities, or a bone density t-score of less than -2.5 as measured by DEXAscan. Each subject was trained 3 days per week for 6 months. Each session consisted of 45 minutes of BWS treadmill training on the Lokomat robotic-gait orthosis, with progressively decreasing BWS and increasing walking speed from session to session. Outcome measures included motor function and sensation (ASIA exam), cardiovascular fitness, spasticity, bone density, muscle mass, range of motion, and quality of life questionnaires. Measures were assessed prior to and following training. **Outcomes**: None of the subjects trained in the study experienced changes in sensation, function, spasticity, or bone density. Furthermore, no changes were found in lower extremity muscle mass or pain. Two subjects did experience significant improvements in hip and ankle range of motion, improving nearly 25 degrees at the hip and 10 degrees at the ankle respectively. Two of the subjects also experienced reductions in overall cholesterol and low-density cholesterol levels, as well as significant decreases in triglyceride levels. No changes were observed in cardiovascular fitness levels. **Discussion**: Despite receiving long-term intensive locomotor training on the Lokomat, individuals with motor complete SCI demonstrated few health benefits from the intervention. While reductions in cholesterol and improvements in lower extremity range of motion were observed, it appears that BWS locomotion therapy is only minimally beneficial to individuals with motor complete SCI.

LIVE VERSUS AUDIO-TAPED MENTAL PRACTICE FACILITATION: BOTH SUPPORT MOTOR LEARNING. N. Fell, C. L. Alexander, C. H. Jones, R. Webster, Physical Therapy, University of Tennessee at Chattanooga, Chattanooga, TN.

Purpose/Hypothesis: Mental practice (MP) involves task repetition through motor imagery, which is cognitively producing a motor act without physically performing it, to ultimately improve motor performance. This study compared change in skill performance and retention between the 2 most commonly used MP facilitation methods found in the literature, live (a therapist verbally guiding the subject in their MP in real time) and audio-taped (subject's use of a prerecorded audio-tape in MP guidance), to determine if a superior method exists to promote the acquisition and retention of a motor task. This study used juggling 3 balls as its motor task. **Number of Subjects**: A convenience sample of 28 adults (22 female, 6 male) ages 20 to 29 (mean 23.5 years) participated in the study. **Materials/Methods**: Following informed consent, subjects completed a Movement Imagery Questionnaire (MIQ) and were randomized to 1 of 3 groups: Live MP (LIVE), Audio-Taped MP (TAPE), or relaxation (Control). All subjects received an initial 10-minute task orientation and 20-minutes of physical juggling practice. Each subject met with an instructor 1x/week for 10-minutes of physical practice and an additional 3x/week for either LIVE, TAPE or Control intervention. Juggling skill was assessed by an independent blinded assessor using the Juggling Assessment Tool (JAT), counting successful toss-catch juggling sequences using 1, 2 and 3 balls (α=0.93; ICC=0.89). Measurements were taken immediately following orientation (pre-test), immediate post-intervention (post-test), and 13 days post-intervention (retention). No practice occurred between post-test and retention tests. A mixed model statistical design (Kruskall-Wallis, repeated measures, and one-way ANOVA with

post-hoc Bonferroni) was used to study the interactions between the 3 groups and the 3 time intervals. **Results**: Subject homogeneity between groups was established with no statistically significant differences found for MIQ or pre-test JAT. All 3 groups demonstrated significant improvement in JAT scores across time ($F=120.38$, $p=0.00$). Tests for between subjects effects revealed significant differences in JAT scores based on group assignment ($F=4.75$, $p=0.02$). The Control showed significant improvement from pre-test to post-test ($p=0.00$), but no significant change from post-test to retention ($p=0.16$). Both MP groups had significant improvement from pre- to post-test ($p=0.01$ LIVE; $p=0.00$ TAPE) and post-test to retention ($p=0.00$ LIVE & TAPE). Post-hoc Bonferroni results demonstrated that at post-test, only TAPE and Control groups were significantly different from each other. At retention, the LIVE and TAPE groups were both significantly different from the Control. **Conclusions**: Our data suggest that MP via audio-taped facilitation may be slightly superior in improving immediate performance, but live and audio-taped facilitation are equal in effect for retention. **Clinical Relevance**: This study suggests that MP facilitated with audio-tape is a viable clinical tool to increase practice time for motor learning.

A LONGITUDINAL STUDY OF THE H-REFLEX AFTER SPINAL CORD INJURY. C. C. Yates[1], N. B. Reese[1], A. Arfaj[1], R. D. Skinner[2], E. GarciaRill[2], [1]Physical Therapy, University of Central Arkansas, Conway, AR, [2]Neurobiology and Developmental Sciences, University of Arkansas for Medical Sciences, Little Rock, AR.

Purpose/Hypothesis: Spinal cord injury (SCI) results in hyperreflexia, partially due to decrease of presynaptic and other inhibition, over a period of time. Previously, we demonstrated that adult female SD rats transected at T10 transitioned to a hyperreflexive state at 7-14 days post injury, measured by a loss of frequency-dependent habituation of the H-reflex. This study used rats at different time points ($n=8$ in each group for Tx + 7,14, and 30 days post-injury) and measured the H-reflex invasively cuffing the tibial nerve resulting in a terminal experiment. Additional experiments in our lab have demonstrated that the transition to hyperreflexia could be prevented by use of a motorized bicycle exerciser trainer (MBET) that passively exercised the hind limbs by eliciting stretch reflexes during cyclic movements if the exercise was initiated in the acute phase of injury (within 7 days post-injury). **Number of Subjects**: In this study, the frequency-dependent depression of the H-reflex of four adult female SD rats was tested prior to surgery and following transection at days 7, 14, 30, 45, 60 and 90. **Materials/Methods**: The H-reflex was tested prior to surgery using surface electrodes while the animal was placed in a cast of the caudal half of the body. After surgical transection of the spinal cord at T10, the H-reflex was tested at designated time points in the same animals (longitudinal) while they were held in a sling. All reflex testing was done while animals were awake. The H-reflex was measured at 0.2, 1, 5, and 10 Hz at each time point. Results : The amplitude of the H-reflex first was significantly different at 14 days after injury at 5 Hz compared to control (presurgical) measurements ($p<0.05$). By 45 days after injury, amplitudes of the H-reflex were different from control values at 1 Hz ($p<0.05$, 5 Hz ($p<0.01$), and 10 Hz ($p<0.05$), and by 90 days all were different from control values at $p<0.01$. The technique using surface electrodes and a half-body cast for control measurements allowed H-reflex measurements to be made before and after SCI in the same animals. **Conclusions**: These results from awake animals were comparable to those obtained using different groups of anesthetized animals at each testing time point. **Clinical Relevance**: The longitudinal method of measuring frequency-dependent depression of the H-reflex confirms the time frame of the transition to a state of hyperreflexia following injury in the rat. This longitudinal method of testing the H-reflex can now be used in additional studies examining the mechanism of hyperreflexia and interventions, such as MBET, to determine if rescue from hyperreflexia is possible after a chronic state of hyperreflexia is manifested.

OUTCOMES OF A PATIENT POST STROKE FOLLOWING A SHORT BURST OF INTENSIVE GAIT TRAINING. S. A. Combs, E. W. Miller, S. Hitchcock, S. Hoffman, B. Laudenschlager, J. Munday, H. Murray, B. Love, J. Opitz, M. Redshaw, KSPT, University of Indianapolis, Indianapolis, IN.

Purpose/Hypothesis: The purpose of this single-subject experiment was to investigate the effects of a short burst intense gait training program aimed at improving balance, endurance and functional outcomes for a participant with chronic deficits secondary to stroke. **Number of Subjects:** A single-subject experimental (AB) design with immediate and delayed retention phases was used. The participant was a 66-year-old woman one-year status post left CVA. **Materials/Methods**: Single-subject baseline performance was established during two weeks of testing with the following measurement tools: Berg Balance Scale, Timed-Up-and-Go (TUG), comfortable 10-meter walk test and 6minute walk test. Also during baseline, the Stroke Impact Scale (SIS) was measured one time. Baseline was followed by two weeks of daily gait training for 30 minutes using body weight supported treadmill training (BWSTT). Following intervention, an immediate retention phase was conducted and 3 months later, a delayed retention test. During the retention phases, all measures were re-assessed in same fashion as baseline. **Results:** The participant improved in mobility and gait outcomes as demonstrated by statistically significant improvements in scores on the TUG, 10-meter walk test, and 6-minute walk test that were evident immediately and 3months following intervention. Minimal clinically relevant changes were also seen on all measures as well as the SIS, however, normal values for mobility and walking status were not reached. **Conclusions**: Although the participant remained at an increased risk for falls, she did improve and maintain her functional walking ability for at least 3 months. **Clinical Relevance**: A two-week burst of intense gait training program was feasible and effective in improving mobility and gait in a participant with chronic deficits after stroke.

COMPARING GAIT OUTCOME MEASURES: THE ROLE OF THE GAITRITE® WALKWAY SYSTEM IN ASSESSING FUNCTIONAL AMBULATORS WITH SPINAL CORD INJURY. R. Abbott[1], D. Atkinson[1], K. Atkinson[1], L. Hyde[1], M. Kern[1], M. Marquart[1], J. Seale[1], C. White[1], D. E. Graves[1], J. Latorre[2], [1]Memorial Herman - TIRR, Houston, TX, [2]University of Texas Medical School, Houston, TX.

Background & Purpose: The Christopher and Dana Reeve Foundation (CDRF) NeuroRecovery Network (NRN) Locomotor Training Clinic (LTC) provides activity based therapy for persons with incomplete (ASIA C and D) spinal cord injuries (SCI). All participants undergo a 2 day evaluation in which several outcome measures are collected, including but not limited to: 1.Walking Index for Spinal Cord Injury (WISCI-II) which assesses walking on a 21 point scale and integrates the patient's need for assistive devices, orthoses, and/or physical assistance. 2. Spinal Cord Injury Functional Ambulation Inventory (SCI-FAI) which is an observational gait assessment tool with 3 components: gait parameter quality, assistive device usage, and typical walking practice. 3.

GAITRite® Walkway System which measures temporal and spatial gait parameters via an electronic walkway. The purpose of this retrospective case series is to highlight the role of the GAITRite® system in objectively assessing specific improvements in gait quality in high functioning ambulators following spinal cord injury. **Case Description**: The 3 participants in this study were admitted to the NeuroRecovery Network (NRN) Locomotor Training clinic for body weight support treadmill training and overground gait training as primary physical therapy interventions. All subjects had ASIA D spinal cord injuries with positive signs of upper motor neuron lesions and were ambulating as their primary means of mobility. Subjects participated in 2 days of evaluation and the outcome measures utilized included: WISCI-II,SCI-FAI, 10-meter walk, 6-minute walk, GAITRite®, Tinetti balance and gait, Berg balance scales. These measures were repeated every 30 days or 20 sessions and at discharge. For this study, WISCI-II, SCI-FAI and GAITRite® measures were reviewed to compare change in documented gait parameters over time as the subjects continued to progress. **Outcomes**: All 3 participants scored high on the WISCI-II and SCI-FAI, 13-20/20 and 27-39/39 respectively at admission, indicating little room to improve. However, the admission GAITRite® data reflected significant abnormalities in such specific measures as base of support, step length, step time, and phase duration. At subsequent re-evaluations, the subjects demonstrated improvements in the above GAITRite® parameters in spite of little or no change in WISCI-II and SCI-FAI scores. GAITRite® assessments indicated that phase duration for both swing and stance improved toward normal and became more symmetrical for all 3 subjects, and that base of support, step length differential, and step time differential all improved, demonstrating improved gait symmetry overall. **Discussion**: Examination of these outcome measures suggests a ceiling effect for the WISCI-II and SCI-FAI scales in subjects that are functional ambulators. However, use of gait analysis tools such as the GAITRite® allows clinicians to more objectively identify gait parameter abnormalities or improvements that other scales fail to reflect.

USE OF AN ELECTROTACTILE VESTIBULAR SUBSTITUTION SYSTEM TO FACILITATE BALANCE AND GAIT OF AN INDIVIDUAL WITH GENTAMICIN-INDUCED BILATERAL VESTIBULAR DYSFUNCTION AND BILATERAL TRANS-TIBIAL AMPUTATION. B. S. Robinson[1], J. L. Cook[1], C. McCormick Richburg[2], S. Price[3], [1]Missouri State University, Springfield, MO, [2]Special Education and Clinical Services, Indiana University of Pennsylvania, Indiana, PA, S. Price, [3]Hearing and Balance Centers at the Elks, Boise, ID.

Purpose/Hypothesis: The purpose of this case study was to assess the effects of an electrotactile vestibular substitution system (ETVSS) on balance and gait of an individual with bilateral vestibular dysfunction (BVD) and bilateral trans-tibial amputation (TTA). **Number of Subjects**: A 69 year old male with BVD and bilateral TTA participated in a vestibular rehabilitation program using an ETVSS. **Materials/Methods**: The ETVSS transmits head position and orientation information through electrotactile stimulation of the tongue. An accelerometer mounted on an intra-oral device detects head position and movement causing the stimulus to move in a corresponding manner on the tongue. Feedback from this stimulus is used to facilitate balance. Intervention with the ETVSS was carried out over 1 year. Prior to treatment and at various intervals the following tests were completed: Sensory Organization Test (SOT), Activities-specific Balance Confidence Scale (ABC), Dizziness Handicap Inventory (DHI), Dynamic Gait Index (DGI), and 6-minute walk test. During clinical training, two 90 minute training sessions were completed daily for two weeks. During the in-home training phase, the subject completed two 20 minute training sessions daily. Retesting was completed after 1 week, 2 weeks, 1 month, 2 months, 3 months, 6 months, and 1 year. **Results**: Intervention with an ETVSS was effective in improving this subject's balance and gait. Standing balance with eyes closed improved from less than 2 seconds to over 20 minutes. SOT composite scores improved from 23 to 48 during the first two months of treatment. The number of falls recorded during the SOT decreased from 12 of 18 to 6 of 18 trials. DGI scores increased from 11/24 to 21/24 and distance walked in 6 minutes increased from 135 meters to 363 meters. Increased subject confidence in balance resulted in higher ABC scores (49% to 62%). Lower perception of handicap was indicated by decreased DHI scores (80 to 64). The subject reported improved quality of life and ability to function independently at home and in social settings. Decreased symptoms of oscillopsia, improved gaze stability and visual tracking, and decreased symptoms of headache and nausea were reported. **Conclusions**: Intervention with the ETVSS improved test results beyond those achieved with vestibular rehabilitation therapy (VRT). The exact physiologic mechanism is unknown; however, may be partially attributed to the tendency of the nervous system toward plasticity when exposed to appropriate sensory activation. Use of an ETVSS may provide a means to improve balance and gait for patients who have not achieved desired goals after intervention with VRT. **Clinical Relevance:** BVD decreases the ability to detect head and body orientation. In the presence of bilateral TTA, BVD had a devastating impact on this subject's balance, gait, and quality of life. About 20% of the population is affected by vestibular impairments. An ETVSS may enhance rehabilitation outcomes for these individuals.

RELIABILITY OF FMRI IN SUBJECTS WITH STROKE. T. J. Kimberley, G. Khandekar, Physical Medicine and Rehabilitation, University of Minnesota, Minneapolis, MN.

Purpose/Hypothesis: Functional MRI (fMRI) has become one of the most commonly used neuroimaging tools to investigate the cortical effects associated with rehabilitation, learning, or disease progression in an impaired population. Despite this, there has been no systematic study of the reliability of the fMR signal in subjects with neurologic impairment. The purpose of this study was to examine the within and between session reliability of fMRI in cortical and cerebellar structures in subjects with stroke during a complex, continuous visual motor task. **Number of Subjects:** Nine subjects with stroke underwent four testing trials during two testing sessions separated by three weeks. **Materials/Methods**: Subjects performed a drawing task using an MRI compatible joystick while in the MRI. Methods of analysis evaluated included an evaluation of percent signal intensity change and active voxel count within and between testing sessions. Reliability was determined with ICCs to quantify the degree of variability between trials and sessions. **Results**: Results indicate that intensity change is superior to voxel count and that within session reliability was higher than between session, as indicated by higher ICC values. Additionally, the second trial of both sets had higher reliability than first trials, demonstrating a stabilization effect. Overall, when comparing inter session results (trial 2 vs. trial 4), good to excellent reliability was obtained (ICC: M1: 0.52, S1: 0.80, SMA: 0.78, PMC: 0.94, medial cerebellum: 0.86, and lateral cerebellum: 0.59). **Conclusions**: These results show higher reliability in stroke subjects than has been reported in healthy subjects performing the same task. This is possibly due to higher intersubject variability and complexity of the task. **Clinical Relevance**: These findings give confidence for interpreting fMRI test/retest research in subjects with stroke.

DOUBLET STIMULATION: A SAFER TECHNIQUE FOR TESTING PARALYZED QUADRICEPS FORCE AND CONTRACTILE SPEED. M. Iguchi, S. Dudley-Javoroski, A. E. Littmann, R. K. Shields, Graduate Program in Physical Therapy and Rehabilitation Science, The University of Iowa, Iowa City, IA.

Purpose/Hypothesis: After spinal cord injury (SCI), rapid bone mineral loss precipitates osteoporosis in paralyzed limbs. Restoration of osteogenic loads may be possible via electrical stimulation of paralyzed muscle. The force-generating capacity and speed properties of paralyzed muscle are important determinants of the quality of loads delivered to bone. These physiologic parameters must be accurately determined to provide an estimate of loading dose during longitudinal electrical stimulation protocols. Quadriceps physiologic properties are usually assessed with the knee in flexion, which places the muscle near its optimal force-length orientation. However, femur shear forces in this position can be substantial during electrical activation. At least one fracture has been reported during this type of testing (Hartkopp et al. 1998 Arch Phys Med Rehabil). Doublet stimulation may allow quadriceps physiological measurements to be obtained without the development of excessive shear forces. The purpose of this study is to determine whether doublet stimulation is sufficiently sensitive to muscle force parameters to ensure its usefulness in quadriceps muscle physiology studies. **Number of Subjects**: 6 men with complete SCI participated in the study. 4 additional individuals without SCI served as a control cohort. **Materials/Methods**: Subjects underwent quadriceps stimulation with the knee positioned in 90 degrees of flexion. Twitches and trains were given to delineate the twitch, tetanus, and potentiation properties of the muscle. A series of doublets (5-10, 15, 20, 30 Hz) were given to establish the doublet force-frequency relationship. Finally, twitches were again given to determine whether the doublet testing protocol induced fatigue or further potentiation. Within- and between-day variability for the protocol were assessed. **Results**: Mean within-day absolute error was 5.17% and between-day error was 5.18%. The doublet force-frequency relationship varied considerably between the two subject groups. Non-SCI subjects demonstrated significantly lower percentages of maximum force than SCI subjects for single twitches and for doublet frequencies at and below 15 Hz. Potentiation of twitch force occurred for the SCI subjects but not the control subjects. **Conclusions**: The doublet testing strategy had sufficient sensitivity to reveal differences between subjects with and without SCI, to characterize the quadriceps force-frequency relationship, and to reveal post-tetanic potentiation of quadriceps force. The protocol had sufficient repeatability to be a useful measurement strategy in studies of quadriceps adaptation to electrical stimulation training. **Clinical Relevance**: Muscle adaptations to electrical stimulation training will almost certainly outstrip bone adaptations; such mismatches may expose participants to an elevated risk for fracture. When testing is performed with the knee in 90 degrees of flexion, doublet stimulation should be considered as an alternative to tetanic stimulation.

MOTOR EVOKED POTENTIAL ABNORMALITIES IN ACUTELY CONCUSSED COLLEGIATE ATHLETES. S. C. Livingston[1], E. N. Saliba[2], J. N. Hertel[2], H. P. Goodkin[3], J. T. Barth[4], C. D. Ingersoll[3], [1]Physical Therapy, George Washington University, Washington, DC, [2]Kinesiology, University of Virginia, Charlottesville, VA, [3]Neurology, University of Virginia, Charlottesville, VA, [4]Neuropsychology, University of Virginia, Charlottesville, VA.

Purpose/Hypothesis: The assessment of motor evoked potentials (MEPs) using transcranial magnetic stimulation (TMS) in the evaluation of moderate to severe TBI has been described, but there is insufficient evidence that TMS techniques can detect MEP changes in individuals with mild TBI. The purpose of this study was to determine if MEPs are significantly different between acutely concussed and non-concussed subjects. We hypothesized that MEP thresholds would be increased, MEP latencies prolonged, MEP amplitudes reduced, and central motor conduction time (CMCT) prolonged. **Number of Subjects**: 18 collegiate athletes (6 females, 12 males, age 20.4±1.3 years) participated. **Materials/Methods**: Nine subjects who sustained a sport-related concussion were enrolled in the study 24.6±12.2 hours post-injury; they were matched to 9 controls based on sport, position played, and prior concussion history. TMS was applied over the primary motor cortex of bilateral cerebral hemispheres with evoked responses recorded from the upper extremities using surface EMG electrodes. MEP thresholds (%), latencies (msec), and amplitudes (μV) were assessed. CMCT (msec) was estimated from the latencies of the MEP, M responses and F waves of the median and ulnar nerves. **Results**: Lower thresholds were greater higher among concussed athletes (36.8 ±7.3%) compared to controls (35.7 ±5.5%) for the left cerebral hemisphere (P=.02). MEP amplitudes were significantly reduced (concussed=0.2±0.1 μV, non-concussed=0.4±0.2 μV, P=.03). MEP latencies and CMCT were not significantly different between the groups (p>.05). MEP responses were absent in 1 concussed subject 4 hours post-injury. Variability of MEP shape was noted in 44% of the concussed subjects. **Conclusions**: When evaluated 24 hours post-injury, concussed athletes demonstrate significant differences in MEP threshold and amplitude in comparison to matched controls. These findings may provide evidence for the theoretical state of hypoexcitability of the cerebral cortex following mild TBI. **Clinical Relevance**: Changes in MEPs in an acutely concussed athletic population have not been previously reported. These results provide insight into the pathophysiology of concussive injuries and in the future may be helpful in the prevention and management of mild TBI in sports.

COMPARISON BETWEEN THE GAITRITE AND A NEW, PORTABLE KINEMATIC SYSTEM ON DETECTING GAIT ALTERATIONS IN EARLY PARKINSON'S DISEASE. C. Zampieri[1], A. Salarian[2], K. Aminian[2], P. Carlson-Kutha[1], J. G. Nutt[3], F. B. Horak[1], [1]Neurological Sciences Institute, Oregon Health & Science University, Beaverton, OR, [2]A. Salarian, K. Aminian, Lab. of Movement Analysis and Measurements (LMAM), Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, SWITZERLAND, [3]Department of Neurology, Oregon Health & Science University, Portland, OR.

Purpose/Hypothesis: Gait alterations in very early Parkinson's Disease (PD) are clinically difficult to detect through visual observation. Gait analysis systems have assisted clinical practice with more sensitive and quantitative measures. However, such systems usually focus on the assessment of lower body gait parameters. The goal of this study was to compare gait assessment with two different systems: the GAITRite electronic walkway system versus a portable kinematic system, which provides information on upper body in addition to spatiotemporal foot parameters. **Number of Subjects**: Eight subjects with early PD (4M, 4F, age 61 ± 9.1 y) and 8 age-matched healthy subjects were studied. Patients were mildly affected (UPDRS Motor = 20.8 ± 9.3) and were not taking PD medication. **Materials/Methods**: Spatiotemporal gait parameters were measured with GAITRite® (electronic walkway) and Physilog® which consists of 5 sensors placed on the body: a 2D gyroscope on each forearm, a 1D gyroscope on each shank and a 3D accelerometer plus a 2D gyroscope on the chest. Subjects were asked to walk 3 times, at their preferred speed on the 20 ft electronic

walkway while wearing the portable kinematic system. UPDRS scores were divided into 2 categories (upper extremity versus posture and lower extremity scores) to determine what symptoms were more prominent in very early PD. Independent t-tests were used for the statistical analysis. **Results**: Both systems detected significant differences between groups in cadence (Physilog: healthy 121.6 ± 5.5 vs PD 112.7 ± 7.7 steps/min., p=0.01; GAITRite: healthy 121.81 ± 6.76 vs PD 112.01 ± 6.78 steps/min., p= 0.01) and cycle time (Physilog: healthy 1.001 ± 0.061 vs PD 1.105 ± 0.063, p=0.009; GAITRite: healthy 0.98 ± 0.056 vs PD 1.070 ± 0.067, p=0.01). In addition, Physilog detected a decreased arm swing in yaw (healthy 41.79 ± 15.21 vs PD 25.27 ± 7.68°, p=0.02), a decreased peak arm speed (healthy 182.797 ± 64.75 vs PD 116.68 ± 28.53°/sec, p=0.01) and a trend to increased arm speed asymmetry (healthy 20.09 ± 8.107 vs PD 38.17 ± 19.27 % or difference between the two sides divided by better side, p=0.07) for PD. UPDRS scores showed more prominent symptoms in the upper body. Upper extremity scores accounted for 59.28 % of the total score whereas posture and lower extremity scores accounted for only 25.15 % of the total UPDRS Motor score. **Conclusions**: Both systems detected parkinsonian gait alterations in lower extremity on cadence and cycle time. Physilog detected additional parkinsonian alterations in arm swing during gait. **Clinical Relevance**: Since upper extremity symptoms are more prominent early in the disease, it is important that they be taken into account when assessing gait. Therefore, a portable kinematic system, which can also quantify upper extremity motion during gait, as well as during postural transitions, such as turning and sit-to-stand, is advantageous in quantifying movement disorders in early PD. This project was supported by the Kinetics Foundation and the NIH AG006457.

THE EFFECTS OF LOCOMOTOR TRAINING ON THE RECOVERY OF BALANCE AND GAIT IN AN INDIVIDUAL WITH AN INCOMPLETE LOWER MOTOR NEURON LESION- A CASE REPORT. E. Ardolino, E. Watson, J. T. Green, Locomotor Training Clinic, Magee Rehabilitation Hospital, Philadelphia, PA.

Background & Purpose: Traditionally, rehabilitation for patients with cauda equina lesions of the spinal cord has focused on teaching compensatory ambulation techniques with the use of bracing and assistive devices. Recently, rehabilitation strategies have changed with the implementation of locomotor training (LT). While the effects of LT on patients with incomplete spinal cord injuries have been studied extensively, most studies have primarily been conducted on patients with upper motor neuron lesions. The purpose of this report is to describe the utilization of LT in the treatment of a person with an incomplete lower motor neuron (iLMN) lesion. **Case Description**: MM was a 33-year-old male diagnosed with an iLMN lesion at the L2 level of the spinal cord secondary to a motor vehicle accident. The patient initiated LT 4 months after initial injury, and completed 76 outpatient LT sessions over a 6-month period. Each session was 90 minutes in length, consisting of 45 to 60 minutes of training on the body weight support treadmill (BWST) system, and another 30 to 45 minutes of overground and community training. The BWST training consisted of 10 to 20 minutes of step retraining, which is defined as kinematically correct ambulation at normal walking speed with decreased BWS and increased manual facilitation. The BWST training also included an additional 5 to 15 minutes of step adaptability, defined as treadmill walking at slower speeds used to promote independence. Overground training consisted of balance and gait training without the use of UE support or assistive devices. Community mobility training focused on teaching MM activities to perform outside of the therapy setting, including gait training with assistive devices and strengthening exercises. **Outcomes**: At initial evaluation, MM was a primary manual wheelchair user. He required maximal assistance of two people to maintain a standing position and maximal assistance of three to ambulate 20 feet without an assistive device. At discharge, MM was ambulating independently with bilateral single point canes and negotiating steps in a reciprocal pattern with bilateral rails. Step retraining parameters improved from requiring 50% BWS to ambulate at 2.0 mph with maximal assistance to ambulating with 10% BWS at 2.5 mph independently. Berg Balance Scale improved from 4 to 45/56, WISCI score increased from 0 to 19 and MM ambulated 987 feet using bilateral single point canes in the 6 minute walk test. **Discussion**: It is clear that this individual regained the ability to perform functional mobility with minimal compensation. However, given that this is a single case report, and that MM was treated during a period of time in which spontaneous recovery may occur, we cannot conclude that the use of LT was the primary means of his recovery. This case report does offer evidence that further research is warranted in the use of LT with individuals with LMN lesions.

EFFECTS OF INTENSIVE MOBILITY TRAINING ON AN INDIVIDUAL WITH PARKINSON'S DISEASE. J. Sweet, E. Rivers, S. Fritz, Exercise Science, University of SC, Columbia, SC.

Background & Purpose: Individuals with Parkinson's disease (PD) face deterioration in their ability to ambulate secondary to an increase in symptoms and a decline in postural stability. These individuals experience decreased balance, resulting in an increased risk of falling, and decreased ability to perform ADLs. As a result, individuals experience decreased functional status, leading to loss of independence and reduced quality of life (QOL). Studies have found that physical therapy (PT) leads to improvements in mobility, functional status, and QOL of individuals with PD, but the most effective intensity and duration of PT treatment is unknown. Therefore, this study employed an Intensive Mobility Training (IMT) program to treat individuals with PD, focusing on improving gait, balance, and mobility through intense, massed practice training. IMT is a new therapeutic intervention that combines two successful interventions, Constraint-Induced Movement Therapy and Locomotor Training. The purpose of this study was to examine the feasibility of IMT for an individual with PD. Specifically, this study determined if IMT resulted in improvements in gait, balance, and mobility. **Case Description**: IMT sessions involved 3 hours of training per day for 10 consecutive weekdays, which focused on encouraging the participant to perform massed practice lower-extremity functional activities, including body weight supported treadmill training (BWSTT), over-ground gait training, and balance, strengthening, coordination, and ROM activities. Various outcome measures were used to assess the participant's functional status prior to the initiation of and following treatment. The participant is a 53 year old male, who was diagnosed with PD in October of 1995. He reported no other medical conditions. Based on observation during baseline testing, the participant is believed to be at approximately stage 3 on the Hoehn-Yahr PD scale. The exact stage must be determined by a neurologist; however, stage 3 presents with bilateral extremity involvement, pronounced gait disturbances, mild to moderate disability, and decreased postural and righting reactions, which are symptoms observed in the participant of this study. **Outcomes**: The results of this study indicated that the participant made improvements on all outcome assessments. The results of this study indicate that IMT was a feasible intervention for this individual with PD. IMT provided a safe and effective way to improve overground gait,

balance, and mobility, which allowed the participant to perform ADLs with more independence and ease. The combination of these improvements led to the participant having increased functional independence and an improved QOL. **Discussion**: IMT may have the potential to effectively reduce impairments and disabilities resulting from PD, leading to functional improvements with shorter, more intense therapy than conventional PT. Therefore, this study demonstrates the potential benefits of IMT and provides valuable information for future research on IMT in individuals with PD.

INTENSIVE MOBILITY TRAINING FOR AN INDIVIDUAL WITH INCOMPLETE SPINAL CORD INJURY: A CASE STUDY. S. L. Fritz[1], A. R. Merlo[1], E. D. Rivers, Exercise Science, University of South Carolina, Columbia, SC.

Background & Purpose: Evidence supports various interventions following neurological injury. Two interventions that have received a great deal of recent attention among rehabilitation specialists are Locomotor Training (LT) and Constraint-Induced Movement Therapy (CIMT). The aim of this case study is to translate the success of LT and upper-extremity based CIMT, supported by the principles and theories of massed practice, learned non-use and neuroplasticity, to determine the feasibility of a massed practice intervention for an individual with incomplete spinal cord injury (ISCI), named Intensive Mobility Training (IMT). Specifically, this study determined if IMT resulted in improvements in gait, balance, and mobility in an individual with ISCI. **Case Description**: The participant was a 65 year old male, 4 years status-post ISCI at the C3-4 level, classified as ASIA C with a motor score of 65. IMT was performed 3 hours per day for 10 consecutive weekdays, for a total of 30 hours. Although many effective ISCI rehabilitation studies have used longer training periods of approximately 12 weeks, majority only offer between 20 to 34 hours of therapeutic intervention. This is consistent with the principle of massed practice, where a therapeutic intervention is offered in a concentrated and often condensed manner, with shorter rest breaks between sessions. The sessions focused on encouraging the participant to use their lower-extremities in a massed practice setting. The participant repeatedly perform activities such as body-weight supported treadmill stepping (1 hour of each session), overground walking with assistive device, sit-to-stand, balance activities, range of motion, stretching activities, strengthening activities, coordination tasks, and motor reeducation (2 hours of each session). **Outcomes**: The following outcome measures were used to assess the participant's functional status prior to the initiation of treatment, immediately following treatment, and at a 6 month follow-up: Dynamic Gait Index (DGI), Timed Up and Go (TUG), Timed Movement Battery (TMB), Barthel Index (BI), Spinal Cord Injury Functional Ambulation Inventory (SCI-FAI), 6-minute walk, and GAITRite. The results of this study indicated that the participant made improvements on DGI, TMB, TUG, 6-minute walk, and GAITRite parameters. No changes were seen for the BI or the SCI-FAI. The DGI revealed an improvement in severity of gait impairments while ambulating at various speeds, as well as ambulation with head movements; the TMB displayed improvements in the 6-meter forward walk and the figure-eight walk; the TUG was reduced by 83%; and 6-minute walk distance was increased from 17 feet to 111 feet. In addition, GAITRite parameters revealed increased gait velocity, increased step length bilaterally, as well as a more symmetrical gait pattern. **Discussion**: The results of this study indicate that IMT was a feasible intervention for this individual with ISCI. IMT provided a safe and effective way to improve overground gait, balance, and mobility.

ENERGY COST OF ABNORMAL WALKING FOR INDIVIDUALS WITH MILD TO MODERATE PARKINSON'S DISEASE. D. A. Josbeno, S. Pradhan, A. Delitto, J. VanSwearingen, Physical Therapy, University of Pittsburgh, Pittsburgh, PA.

Purpose/Hypothesis: Minimal hip extension, greater trunk flexion and less heel first foot contact are common abnormalities of gait of individuals with mobility disability. To understand the physiological burden of abnormal walking in individuals with Parkinson's Disease, the energy cost of walking, physical function and physical activity was examined by gait abnormalities. **Number of Subjects**: Individuals with Parkinson's Disease, Hoehn&Yahr 2-3, mean age (SD), 65.2 (6.53), 53-81 years, participated, n=18. **Materials/Methods**: Postural abnormalities were determined from videotape review of the subjects walking, using the modified Gait Abnormality Rating Scale criterion-based item scores, levels 0-3, for hip extension, trunk flexion and foot contact (item reliability, generalized Kappa, .676), consolidated to 2 levels, mild (0,1) or moderate (2,3). Using the MedGraphics VO2000® metabolic measurement system to analyze expired gases, mean oxygen rate was determined for 3 minutes of treadmill walking at self-selected gait speed and physiological steady state. The energy cost of walking was calculated as: mean oxygen rate/walking speed, ml/kg-m. Physical function measures included the Six Minute Walk Test (6MWT), the 7-item Physical Performance Test (PPT), and mean steps per day average over 7 consecutive days, determined from pedometer records of usual daily physical activity. Mean comparisons of energy cost, physical function and activity across levels of postural abnormality were performed. **Results**: Energy cost (ml/kg-m) was greater with a greater reduction in hip extension, .20 vs .26 and greater trunk flexion, .21 vs .26; and with greater abnormal foot contact, .20 vs .22. A similar impact of gait abnormality was observed for physical function and activity. Mild vs moderate abnormality of hip associated with: 6MWT, 1407 vs 1339; PPT, 22 vs 20; mean steps/day, 4138 vs 3250; trunk flexion associated with: 6MWT, 1396 vs 1275; PPT, 23.5 vs 18.5; mean steps/day, 4073 vs 3990; foot contact associated with: 6MWT, 1408 vs 1310; PPT, 23 vs 20; mean steps/day, 4199 vs 3153. **Conclusions**: The high energy cost of abnormal walking may restrict physical function and physical activity individuals with mild to moderate Parkinson's Disease. **Clinical Relevance**: Promoting physical activity and preventing decline of physical function may require attention to the biomechanics of walking.

CASE REPORT: A COMPUTERIZED BALANCE TRAINING PROGRAM TO REDUCE FALL RISK IN A COMMUNITY DWELLING OLDER ADULT WITH CHRONIC STROKE. R. M. Hakim, L. Davies, K. Jaworski, N. Tufano, A. Unterstein, Physical Therapy, University of Scranton, Scranton, PA.

Background & Purpose: Stroke has been identified as the most prevalent diagnosis among adults who fall with 73% of those living in the community experiencing a fall within 6 months after discharge (Geiger et al., 2001). Currently, there is minimal research utilizing a computerized force plate system, independent of traditional therapeutic interventions, for individuals with chronic stroke and it is unclear whether or not gains made while on the system will transfer to overground improvement as well (Holbein-Jenny et al., 2005; Nichols, 1997). The purpose of this case report was to conduct a computerized balance training program to improve balance and thereby reduce fall risk and improve overground function in a patient with a diagnosis of chronic stroke. **Case Description**: A 61 y/o female 8 years post stroke and deemed at risk for falls (i.e., history of falls, use of assistive device, and balance scores below norms) was recruited to participate. Examination of balance-related

performance was conducted before, after, and at 1 month following the intervention. Outcome measures included: 1) Computerized balance testing with the Sensory Organization Test (SOT) and Limits of Stability (LOS) test on the NeuroCom EquiTest system, 2) Clinical balance testing with the Berg Balance Scale (BBS), Timed Up and Go (TUG), and Activities-specific Balance Confidence (ABC) scale, and 3) impairment level testing with the 30-second Chair Stand and range of motion/goniometry of the ankle joint. She participated in 1 hour of computerized balance training, 3 times a week over a period of 8 weeks. The balance activities were chosen based on the patient's specific problem areas such as: squatting, weight-shifting while standing on foam or rocker-board, marching in place, step-ups, and tracking targets. Activities were progressed with timing/duration, target location, and movement of the support surface and/or the visual surround. **Outcomes**: Upon posttesting, she improved in sensory integration abilities on the SOT for conditions 4, 5, and 6 and maximum excursion abilities improved by a range of 23%-103% in all directions on the LOS test. Scores on the BBS increased from 37/56 to 47/56 which indicated reduced fall risk, balance confidence increased from 50% to 75% on the ABC scale, and TUG score improved by 2.1 seconds. Ankle ROM improved bilaterally by 6 to 8 degrees. At 1 month follow-up all, all scores improved or remained unchanged. **Discussion**: After an 8-week computer-based intervention, the patient's balance abilities generally improved with subsequent decreased fall risk and improved overground function as indicated by most outcome measures. This type of program shows promise as an effective, systematic and objective treatment method for improving overall balance abilities in patients with hemiparesis secondary to chronic stroke. Further research regarding the duration and intensity of treatment with a larger patient population and fall incidence tracking is suggested.

DIFFERENCES IN ANTICIPATORY POSTURAL ADJUSTMENTS BETWEEN FALLERS AND NON-FALLERS IN PERSONS WITH MULTIPLE SCLEROSIS. A. Mehler, T. Hale, K. Foreman, H. Hayes, P. LaStayo, L. Dibble, Physical Therapy, University of Utah, Salt Lake City, UT.

Purpose/Hypothesis: Persons diagnosed with Multiple Sclerosis (MS) experience falls, however the biomechanical coordination of anticipatory postural adjustments (APA) in persons with MS are not well understood. The goal of this pilot project was to examine the coordination of APA in persons with MS with and without a history of falls. We hypothesized that persons with MS and a history of falling would demonstrate more impaired center of pressure (COP) and center of mass (COM) coordination than persons with MS and no history of falls. **Number of Subjects**: Six females with MS were recruited. The participants reported on here represent the preliminary results of a larger project designed to characterize APA differences in persons with varied MS presentations. **Materials/Methods**: Each participant completed a detailed questionnaire about their fall history in the past year. Based on these results, participants were categorized into faller ($\geq$2 falls) or non-faller ($<$2 falls) groups . All participants performed 3 trials of a voluntary rise to toes APA task while a VICON motion capture system and an AMTI force plate simultaneously recorded kinematic and kinetic data. Each participant attempted to maintain balance on their toes for three seconds and instructed to use a safe strategy by discontinuing the task if they felt they would lose their balance or fall. In order to characterize the coordination of participants' APA, the average variance of the COPCOM difference during the rise to toes task was determined. (Frank et al., 2000; Hass et al., 2006) In addition, two clinical balance tests (Berg, Functional Reach) were gathered for each participant. The difference between faller and non-faller groups was calculated using non-parametric statistics with an alpha level of 0.05. Standardized effect sizes were also calculated. **Results**: As a whole, the mean age (SD) of the sample was 48 (12.30) years, while the mean disease duration (SD) = 13 (7.06) years. Persons with MS categorized as fallers (n=3; predominate symptoms: LE weakness, sensory loss, ataxia) demonstrated significantly greater average variability in the sagittal plane ($p=.03$), compared with those in the non-faller group (n=3; predominate symptoms: LE weakness, fatigue). Fallers and non-fallers were not different on clinical balance tests ($p>.30$). **Conclusions**: Those individuals with MS and a history of falls demonstrated poorer coordination of their COP and COM relative to those without a history of falls. In this small sample, clinical balance tests were not sensitive to these differences. **Clinical Relevance**: The biomechanical characterization of this impaired control may be a sensitive measure for the documentation of the natural history of postural instability during MS progression. Additional participants with MS with heterogeneous neurologic symptoms are needed to confirm these observations