**DPT Research Day**

Abstracts for Poster and

Platform Presentations

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**Department of Physical Therapy**

**College of Health Professions**

**Class of 2013**

**Friday, July 12, 2013**

**8:30– 2:15 PM**

**Loosemore Auditorium**

**DeVos Campus**

**Grand Rapids, MI**

**Platform Presentations**

**Promoting Self-Exploration AND Function Through an Individualized Mobility Program: A Case Report.** Hannum N, Proctor K, Roberts K, Kenyon LK, Farris J, Ripmaster C, Peck J; Grand Valley State University, Grand Rapids, MI.

**Background And Purpose:** Individuals with severe motor, cognitive, and communication deficits are limited in their ability to use self-initiated movement to explore and learn from the world around them. These individuals are often dismissed as candidates for power wheelchairs and are denied access to power mobility. Our Power Wheelchair Trainer (Trainer) provides an opportunity for these individuals to safely explore power mobility. This case report describes the use of the Trainer to provide an individual with the opportunity to explore the environment while simultaneously addressing prerequisite skills for power mobility. **CASE DESCRIPTION:** The Trainer is a motorized platform that allows a manual wheelchair to be temporarily converted into a power wheelchair, thereby permitting individuals to practice using power mobility while positioned in their own seating system. The control panel on the Trainer interfaces with both a traditional joystick and switches that adapt the power access system to meet the needs of each child. The participant in this case was an 18-year-old female with a diagnosis of cerebral palsy and cortical vision impairment. The participant’s function was classified as a Level V on the Gross Motor Function Classification System, the Manual Ability Classification System, and the Communication Function Classification System. Examination procedures included the Caregiver Priorities & Child Health Index of Life with Disabilities (CPCHILD), the Power Mobility Screen, and assessment of power access options using switches. It was determined that the participant’s only consistent movements were at her head. Therefore, switches were placed on her head rest for right, left, and forward movements. Interventions focused on operating and maneuvering the Trainer included structured repetition of mobility tasks in the Trainer as well as opportunities for self-directed mobility exploration in the Trainer. Intervention sessions of 60-minute durations were scheduled 2 times per week for 12 weeks. **OUTCOMES:** Intervention sessions were initially characterized by accidental switch activation. As the participant became more familiar with the Trainer and the use of the switches, independent purposeful activation of the switches increased; and movement exploration in the Trainer emerged. At the end of the intervention period, the participant was able to inconsistently maneuver the Trainer through doorways and in hallways. Increases in purposeful stops and obstacle avoidance were observed, and improvements on the Power Mobility Screen and the CPCHILD were noted. The participant’s mother reported incidental benefits such as increased contentment, decreased irritability, and increased engagement. **DISCUSSION:** When provided with consistent, repetitive practice in the Trainer, the participant in this case report demonstrated improvements in active exploration of her environment while simultaneously improving her prerequisite skills for power mobility. Future research objectives for the project include the development of user-centered instructional methods and valid assessment instruments to optimize use of the Trainer in promoting self-directed mobility for this unique population.

**ACTIVITY AND PARTICIPATION LEVELS IN 6-12 YEAR OLD CHILDREN WITH CEREBRAL PALSY: A PILOT STUDY.** Fisher S, Fontaine K, Kordick L, Peck J, Kenyon L, Shoemaker M; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Previous research has shown that adolescents with cerebral palsy (CP) are less physically active and often participate in less structured and lower intensity daily activities than their typically developing peers. However, the physical activity levels of 6-12 year old children with CP have not been reported. The purpose of this study was to examine the intensity and nature of functional and recreational activity levels of ambulatory children with CP, as well as their manual dexterity and communication skills, and to relate the findings to typically developing children. **METHODS:** Three male participants with a medical diagnosis of CP, ages 9-11, wore an RT3 tri-axial accelerometer for two school and two weekend days. The child and parent(s) completed an activity log along with the CAPE/PAC participation measure. Each child was classified using the Gross Motor Function Classification System – Expanded & Revised (GMFCS), the Manual Ability Classification System (MACS), and the Communication Function Classification System (CFCS). A qualitative analysis was performed. **RESULTS:** The classification results on GMFCS, MACS and CFCS were: Child One – II, I, I; Child Two – I, I, II; and Child Three – I, II, I. Child 1 and 3 reported high enjoyment for most of their activities, and the majority of their activities were performed with family and at home. All three children reported the highest diversity, intensity, and preference for recreational activities with Child 3 additionally reporting the same for social activities. The three children reported the lowest intensity for physical activities. Child 1 identified highest enjoyment for physical activities, Child 2 identified highest enjoyment for skill-based activities, and Child 3 identified highest enjoyment for both. Child 1 and 3 reported participation in informal activities more frequently than formal activities and with a higher intensity. Child 2 had a lower preference score for communicative activities. Child 1 and 3 had lower preference scores for manual dexterity activities. The three children demonstrated contrasting levels of weekday vs. weekend activity, yet all of them demonstrated higher total activity counts in school than after school. The 4-day total of hard/vigorous activity was 2 minutes for Child 1, 22 minutes for Child 2, and 59 minutes for Child 3. **DISCUSSION:** All three children reported a lower intensity for physical activity in comparison to reported scores for recreation, social, skill-based, and self-improvement activities. This result was not surprising given the physical limitations the children might experience during high-level physical activity. As expected, the child with more impairment (Child 1, GMFCS Level II) demonstrated a lower occurrence of hard/vigorous activity than Child 2 and 3 (GMFCS Level I) who were able to demonstrate more activities with consistent vigorous activity counts. While all three children identified several preferred activities, many barriers prevented the children from actually completing these activities (e.g., season, community availability, feasibility, and cost). Child 1 and 2 experienced higher activity counts during gym class, and Child 3 experienced higher activity counts during a walking field trip. This observation identifies the benefit of scheduled, organized physical activity. **CONCLUSION:** In comparison to typically-developing, age-matched peers, all three children demonstrated a much lower amount of time per day spent in hard or vigorous activity. Additionally, all of them reported comparatively low intensity in the physical activity category. If clinicians were provided with CAPE/PAC results which identified the child’s preferences, home exercise programs that included the child’s preferences might increase the child’s amount and intensity of physical activity.

**THE EFFECTS OF SPEED-DEPENDENT TREADMILL TRAINING AND RYTHMIC AUDITORY-CUED OVERGROUND WALKING ON GAIT FUNCTION, BALANCE FUNCTION, FALL RISK, AND FALL INCIDENCE IN INDIVIDUALS WITH IDIOPATHIC PARKINSON’S DISEASE: A RANDOMIZED CONTROLLED TRIAL.** Karl KL, Tomassi EM, VanHaitsma RJ, Harro CC, Shoemaker MJ; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Externally-cued locomotor training paradigms such as speed-dependent treadmill training (SDTT) and rhythmic auditory-cued (RAC) overground walking have been shown to improve gait deficits in individuals with Parkinson’s Disease (PD), but the effects on balance function and fall risk are inadequately studied. The purpose of this single-blinded, randomized controlled study was to examine and compare the immediate and retention effects of progressive SDTT and RAC training on gait function, balance function, and fall risk in individuals with PD. **METHODS:** Twenty participants (mean age 66.1 years) with idiopathic PD were randomized into either SDTT (n=10) or RAC (n=10) locomotor training. Training consisted of 30-minute sessions, 3x/week for 6 weeks. The SDTT protocol involved progressive-speed, interval-based treadmill training. The RAC protocol involved interval-based auditory-cued overground walking using a progressive beats per minute music playlist. Dependent measures examined immediate and retention effects on gait function [comfortable and fast gait speed (CGS, FGS), Functional Gait Assessment (FGA), and 6-Minute Walk Test (6MWT)] as well as on balance function and fall risk [FGA, Berg Balance Scale (BBS), Rapid Step-Up Test (RST), Activities-Specific Balance Confidence Scale, and NeuroCom Sensory Organization Test (SOT), Motor Control Test (MCT), & Limits of Stability (LOS)]. Fall incidence was assessed prospectively based on six monthly self-report fall calendars. Dependent paired t-tests were used to examine within-group training effects, and independent t-tests examined between-group training effects (alpha level p< .05). **RESULTS:** Findings revealed immediate within-group training effects for gait measures including statistically significant gains in CGS, 6MWT, and FGA for the RAC group and in FGS, 6MWT, and FGA for the SDTT group. All gains were retained for the RAC group, and FGS and FGA gains were retained for the SDTT group. Significant gains in balance measures were observed post-training in BBS, RST, and SOT for the RAC group and in RST, SOT, and LOS for the SDTT group. Gains were retained in all measures for the RAC group, but only RST gains were retained for the SDTT group. No significant differences in training effects on gait and balance function were found between groups from baseline to post-training or from post-training to the 3-month follow-up. No clear trend in reduction in fall frequency or fall classification was evident based on fall report data. **DISCUSSION:** This was the first study to demonstrate both immediate and retention training effects of cued locomotor paradigms on balance, mobility, and fall risk reduction in the PD cohort. **CONCLUSION:** These results provide evidence that an externally-cued locomotor training program with progressive speed challenges, either overground with RAC or on a treadmill, produce significant improvements in walking speed, endurance, and dynamic balance function. These changes are clinically relevant as locomotor training is one critical component in a multi-factorial approach to fall risk reduction in PD. **ACKNOWLEDGMENTS:** To our collaborators at Hauenstein Neuroscience Center, SMHC.

**Interventions to improve daily activity in individuals with COPD and CHF: a systematic review.** Keenoy B, SlotmanP, Smith B, Shoemaker MJ; Grand Valley State University, Grand Rapids, MI.

Introduction: The purpose of this study was to systematically review the literature regarding interventions to improve daily activity in individuals with chronic obstructive pulmonary disease (COPD) and chronic heart failure (CHF). Methods: Articles found by searching the CINAHL Plus With Full-Text, PubMed, and PsycINFO databases were included in the review if the study examined the effect of exercise- and/or psychosocial-based interventions on daily activity in individuals with COPD or CHF. Article selection, data extraction, and evaluation of methodological rigor and quality were performed by two independent reviewers. Nine articles for COPD and seven articles for CHF met the inclusion criteria and were used in this review. Results: Only 4 of the 9 studies for COPD and 2 of the 7 studies for CHF resulted in improvement in daily activity. Of those studies, all but one included a psychosocial-based intervention. Improvements in daily activity did not occur concurrently with changes in other outcomes such as exercise performance, quality of life, functional status, or depression/anxiety in COPD or CHF. DISCUSSION/Conclusion: Exercise-based interventions serve a limited, if any, role in improving daily activity in individuals with COPD and CHF. Disrupting the cycle of inactivity and de-conditioning requires more than just addressing the de-conditioning aspect of this cycle. Psychosocial-based interventions are a promising, but under-investigated, intervention.

**Clinical Instructors’ Perspectives of an Intermediate Pediatric Clinical Experience: A Pilot STUDY.** Brown J, Hatch J, Reynolds N, Kenyon LK, Ozga K; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Although pediatrics is often considered a specialty area of practice, physical therapist (PT) education programs must prepare students to provide general, basic care within a direct access environment to patients of all ages. Both the didactic and clinical components of the curriculum are necessary to prepare students for such entry-level practice. Depending upon the curricular design of a specific program, though, PT students completing a full-time pediatric clinical education experience may or may not have completed all academic coursework. The purpose of this pilot study was to capture the perspectives of pediatric clinical instructors (CIs) concerning an intermediate pediatric clinical education experience in which students may not have completed all pediatric-specific academic coursework. **METHODS:** Both purposive and snowball sampling techniques were used to recruit 18 pediatric clinicians who had served as CIs for PT students during pediatric clinical education experiences. A Web-based survey was used to gather data related to the participants’ perspectives of an intermediate pediatric clinical education experience. Closed items on the survey assessed inclusion/exclusion criteria and gathered demographic data. Open items on the survey gathered information regarding the participants’ perspectives related to the following topics: (1) the knowledge, skills, and abilities (KSA) that PT students should be able to demonstrate before starting and after completing a full-time intermediate clinical education experience; (2) suggestions for learning experiences in intermediate clinical education experiences; and (3) the potential benefits as well as the potential difficulties of a PT student completing an intermediate pediatric clinical education experience. Responses to closed items were analyzed using percentages of responses. Open items related to KSA were grouped by category and analyzed using frequency counts. Data from the remaining open items were analyzed using thematic content analysis to uncover common themes and subthemes in the participants’ responses. **RESULTS:** The participants provided recommendations pertaining to specific learning experiences for students during intermediate pediatric clinical education experiences and outlined the potential benefits and difficulties of a PT student completing an intermediate pediatric clinical education experience. Specific KSA that PT students should be able to demonstrate before starting and after completing a full-time intermediate clinical education experience were also provided. **DISCUSSION:** The data provide valuable insight into CIs’ perspectives concerning the potential benefits and difficulties of an intermediate pediatric clinical experience. Data related to the pediatric-specific KSA that PT students should be able to demonstrate before starting and after completing a full-time intermediate clinical education experience may be helpful to both pediatric academic faculty and pediatric CIs. Trending themes in the data suggest that hands-on opportunities for students to apply the patient/client management model with pediatric patients must be stressed throughout both the didactic and clinical components of the curriculum. Participants expressed many concerns regarding the potential difficulties of an intermediate pediatric clinical education experience. **CONCLUSION:** The results of this pilot study will guide future research to further investigate intermediate pediatric clinical experiences.

**PRACTICE AREA INTERESTS, JOB SELECTION, AND CONTRIBUTING FACTORS OF FINAL-YEAR PHYSICAL THERAPY STUDENTS.**  Giesel M, Goulet D, Wilson C, Ozga K; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Many diverse physical therapy practice areas exist, but there is limited research on the development of practice area interests of physical therapist students. This study was the third phase of a longitudinal study related to the practice interests and influencing factors of physical therapist students in Michigan. The purposes were to: (1) identify practice area interests of students near completion of their final year of education; (2) determine the extrinsic factors that influenced practice interest; and (3) for those who have chosen a job, identify the practice area, setting type, and factors influencing their job selection. **METHODS:** This study used a mixed-methods design. Twenty-five phase one participants from four DPT programs in Michigan were contacted near the end of their final semester. Initial data collection occurred using an online questionnaire developed by the researchers. Those survey participants who gave consent participated in a follow-up interview to clarify their responses to the initial questions. Twelve participants completed the survey (26.8 years of age, range 24-34; 10 females), and seven of them were interviewed. Quantitative survey data was analyzed using frequency counts and percentages. Qualitative data from the surveys and the interviews were coded and organized individually by three researchers who developed themes and subthemes through a consensus process and through consultation with an expert qualitative researcher. **RESULTS:** Nine of the twelve survey participants ranked orthopedics/musculoskeletal within their three preferences for practice area. Neurology/neuromuscular and sports were ranked by eight participants, and pediatrics was ranked by five participants as a preference for practice area. When the three ranked practice setting preferences were combined, ambulatory care/outpatient was selected by ten participants followed by acute care/hospital (selected by seven), wellness and prevention (selected by six), and rehabilitation hospital/subacute rehabilitation (selected by five). Eight participants chose clinical education and six participants chose type of clientele as one of their three influential factors. Volunteer/work before physical therapy school, volunteer/work since beginning physical therapy school, and clinical instructors were each identified by four participants as influential factors. Qualitative analysis revealed four themes as influential in the development of preferred practice interests: (1) experience, (2) academics, (3) relationships, and (4) perceptions/attitudes. Seven of the eight participants who had accepted a first job selected one with an orthopedics/musculoskeletal component. Location and practice type/setting were the most frequently identified factors influencing job selection. **DISCUSSION:** The most common first-ranked choices for preferred practice area and setting were orthopedics/musculoskeletal and ambulatory care/outpatient. Qualitative analysis identified themes and subthemes that supported and expanded survey findings regarding influential factors. Responses to positive and negative clinical education experiences had a strong impact on practice preferences, and most participants indicated that academic experiences were influential. Experience prior to DPT education and related relationships also remained influential in determining practice preferences. Congruent with the most common practice area preference, most participants selected a first job with an orthopedic/musculoskeletal component. **CONCLUSION:** Both experiences prior to DPT education and experiences within a DPT curriculum impacted student practice preferences. These findings suggest that in the process of program evaluation, educators should consider pre-admittance experience requirements in addition to academic and clinical education components. **ACKNOWLEDGEMENTS:** Cynthia Grapzynski and John Zaugra.

**Changing the culture of the profession for safe patient handling and movement practice: Does education promote future leadership among entry-level students?** Bartold K, Briggs L, Tyler L, Stevenson J, Hinsch C; Grand Valley State University, Grand Rapids, MI**.**

**Introduction:** Practices for patient transfers in the physical therapy profession have begun to shift from traditional manual methods to more evidenced-based, safe patient handling techniques as part of the initiative to promote safer guidelines and techniques among health care providers for patient handling tasks. The purpose of this study was to examine physical therapy students’ attitudes and intentions toward leadership regarding safe patient handling practices for transfers in entry-level practice following their education. **METHODS:** Subjects included in this study were student physical therapists (n= 429) enrolled in CAPTE-accredited programs in the United States who had been educated in patient transfer skills.A pilot form of the survey was used to gain feedback and from second-year physical therapy students, to establish face and content validity. Program directors were sent an e-mail link to a 50-item electronic survey that consisted of four sections of 7-point Likert scale questions pertaining to attitudes and intentions regarding patient handling and transfer education, education and training in their physical therapist education program, and techniques used during their clinical education; a section of forced-choice questions regarding the type of patient handling education they received; and demographic questions. Five hypotheses developed from the theory of reasoned action were tested using bootstrap mediation analysis. **RESULTS:** The participants (n = 291) represented 23% of the CAPTE-accredited programs, 54% of the states in the USA, and Puerto Rico. All five hypotheses were supported indicating that (1) SPHM didactic training impacts SPHM behaviors through the subject’s attitude toward SPHM, (2) SPHM classroom training impacts SPHM leadership expectations through the subject’s attitude toward SPHM, (3) the link between clinical training and SPHM patient handling is mediated by the subject’s attitude toward SPHM, and (4) clinical training impacts a subject’s SPHM leadership expectations through their attitudes toward SPHM. **DISCUSSION/CONCLUSION:** The results reinforce previous findings that the TRA model is applicable in health professions research. Student physical therapists who received didactic SPHM education and training were more likely to express attitudes toward assuming a leadership role in SPHM during clinical practice.

**THE EFFECTIVENESS OF YOGA AS AN INTERVENTION IN THE TREATMENT OF PATIENTS WITH CHRONIC LOW BACK PAIN: A SYSTEMATIC REVIEW.** Dulin C, Mitchell J, Poppaw K, Kinne B; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Low back pain is experienced at least once by 70-85% of all Americans, and the lumbar region is the most likely location of chronic pain resulting in disability claims. Yoga, a type of Complementary and Alternative Medicine (CAM) therapy, has been suggested to be an affordable and effective treatment for chronic low back pain. The purpose of this systematic review was to evaluate the effectiveness of yoga in improving functional ability in patients with chronic low back pain by only examining comprehensive studies with a large number of patients. **METHODS:** The databases that offered the most pertinent data were CINAHL Plus with Full Text, ProQuest Medical Library, and SPORTDiscus with Full Text. The search terms were “pain” AND “yoga” AND “randomized.” This systematic review included the following inclusion criteria: (1) individuals with chronic low back pain; (2) the use of yoga as the intervention under investigation; (3) the use of a functional low back pain rating scale as the outcome measure; and (4) randomized controlled trials. The Oxford Centre for Evidence-Based Medicine 2011 Levels of Evidence tool was the method used to evaluate the evidence level of each of the included studies. The PEDro scale was the method used to evaluate the methodological rigor of each of the included studies. **RESULTS:** Through a database search, a total of 1988 articles were identified. After the removal of duplicates and the screening of records as shown by the PRISMA 2009 flow diagram, all but five studies were eliminated. These five studies were included in the qualitative synthesis. Yoga was better than the control in one of the studies at six weeks, in three of the studies at approximately three months, in four of the studies at approximately six months, and in two of the studies at approximately 12 months. Yoga was better than exercise in one of the studies at seven days and in one of the studies at approximately three months. **DISCUSSION:** This systematic review indicated that the frequency and intensity of yoga treatments may play a role in their effectiveness. For the most part, the yoga group demonstrated greater functional improvements when compared to the control group. In addition, yoga appears to have long-term positive effects on function even after the cessation of treatment. **CONCLUSION:** Yoga should be considered as a viable option to improve function in individuals with chronic low back pain.

**VELOCITY OF SWAY IN SINGLE LIMB STANCE FOLLOWING ACHILLES’ TENDON REPAIR.** Brown J, Pachuta L, Smith R, Goehring M, Liakos P; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Achilles’ tendon rupture is a debilitating injury that may affect ankle proprioceptive mechanisms causing instability. Research indicates velocity of sway (VOS) in single limb stance (SLS) is a valid measure of stability. The purpose of this study was to determine the difference in VOS during SLS on a repaired limb as compared to an unaffected limb in individuals 12 to 24 months post-Achilles’ tendon repair. **METHODS:** The treatment group included 10 subjects with Achilles’ tendon repair performed by a single surgeon. Each subject followed a specific rehabilitation protocol. The control group included 10 individuals without ankle injury. The Neurocom Balance Master® was used to assess VOS in SLS in all subjects. In the control group, VOS in SLS of the dominant vs. non-dominant limbs was assessed to identify normal differences due to limb dominance. The VOS in SLS of the surgically repaired vs. unaffected limb was assessed in the treatment group. **RESULTS:** Multivariate ANOVA results showed a significant difference in VOS during SLS between the dominant and non-dominant limbs in both groups. However, there was no significant difference in VOS during SLS between the control and treatment groups. There was no significant interaction between groups. **DISCUSSION:** The variance in VOS in SLS between the limbs of the treatment group was no different than the variance that existed within the uninjured control group. **CONCLUSION:** This study supports that VOS in SLS may be restored in comparison to the uninjured Achilles’ tendon 12 to 24 months after surgical repair with appropriate rehabilitation.

**EMG ANALYSIS AND SAGITTAL PLANE KINEMATICS OF THE TWO-HANDED AND ONE-HANDED KETTLEBELL SWING: A DESCRIPTIVE STUDY.** Alonzo BA, Briggs DR, VanGelder LH, Hoogenboom B, Hatzel B; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION/CLINICAL RELEVANCE:** Kettlebell swing exercises provide training stresses specific to improving power, strength, and endurance. Kettlebell swings have been proposed as a possible method to assist in neuromuscular re-education during a rehabilitation program. Utilizing a single exercise that demonstrates adequate activation of the hip extensors to meet the criteria of training for strength, endurance, and power may save time as well as promote proper use of hip and spinal biomechanics. The purpose of this study was to provide a descriptive analysis (EMG and sagittal plane kinematics) of two power-based kettlebell exercises. The two kettlebell exercises examined were the two-handed kettlebell swing (THKS) and single-handed (left and right) kettlebell swing (SHKS). In addition, the authors wished to investigate whether hip flexor length could alter the muscular activity or the kinematics of the exercise. **METHODS:** Twenty-three college-aged students (12 females, 11 males; average age 24.04, SD +/- 4.50) participated in this analysis. None of the subjects were formally trained in either the THKS or SHKS prior to their involvement in the study, but they all received formal training at the beginning of the data collection session. Demographic information and hip flexor length via the Thomas test were recorded for each subject. Manual muscle testing positions were utilized to determine each subject’s maximum voluntary isometric contraction (MVIC) of the muscles being tested. Electromyographic activity (EMG) of the bilateral gluteus maximus (GMax), gluteus medius (GMed), and biceps femoris (BF) muscles as well as sagittal plane video analysis were recorded as the subjects performed both the THKS and SHKS in a randomized order. EMG data was filtered and analyzed using AcqKnowledge software version 3.9.1, and sagittal plane kinematics were analyzed using Dartfish ProSuite version 6.0. Muscular activation of the three muscles was calculated from the EMG data and was described as a percentage of the subjects’ MVIC. Regression analyses were utilized to examine correlations between the subjects’ demographic descriptors, static hip extension range of motion, and various kinematic data. **RESULTS, DISCUSSION, AND CONCLUSION:** These sections will be presented on DPT research day. **ACKNOWLEDGEMENTS:** We would like to thank John Gabrosek, PhD for assistance with the study design and statistics.

**Poster Presentations**

**THE ROLE OF THE CORE DURING KNEE FRONTAL PLANE MOTION DURING A LATERAL STEP-DOWN ACTIVITY.** Cates TG, Kuipers CW, Post AA, Hoogenboom B; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION/CLINICAL RELEVANCE:** Several authors have come to the conclusion that excessive frontal plane motion and valgus positioning of the knee can contribute to an increase in knee injuries, especially anterior cruciate ligament (ACL) injuries. Dynamic knee valgus can be described as medial deviation of the knee that occurs during a functional activity, characterized by internal rotation and adduction of the femur as well as external rotation of the tibia. In previous research, several authors posited that excessive frontal plane motion was due to muscle weakness at the hip and knee. More recently, it has been suggested that weakness at the hip and knee may not be the only cause contributing to the excessive frontal plane motion and that the lack of neuromuscular recruitment of the hip muscles may be of more significance. Despite mounting evidence in the literature that “core stability” has an impact upon lower extremity function and prevalence of injury, very few studies have examined the relationship between core activation and dynamic knee valgus during a functional task. Therefore, the purpose of this study was to examine hip and knee kinematics as well as muscle activation in females during a single-limb lateral step-down with and without volitional core engagement. Two-dimensional video analysis and surface electromyography were utilized with the goal of gaining a better understanding of the influence that core activation has on knee frontal plane motion. **METHODS:** Asymptomatic, healthy females with no previous history of knee injury were recruited for participation in this study. Prior to the data collection, an assessment of core stability was performed utilizing three tests from the Functional Movement ScreenTM (overhead deep squat, trunk stability push-up, and rotary stability) in order to determine the subjects’ ability to utilize the core during fundamental movements. This assessment was followed by two trials of the lateral step-down, a movement similar to a single leg squat. During the first trial, the subject was asked to perform five repetitions of the exercise with cueing provided only on form. During the second trial, the subject was instructed to volitionally engage her core while performing the movement for an additional five repetitions. During the movement, frontal and sagittal plane video data was recorded and later analyzed in order to evaluate the knee frontal plane projection angle and the knee flexion angle. In addition, surface electromyographic data was collected from the external oblique, vastus lateralis, biceps femoris, gluteus maximus, and gluteus medius ipsilateral to the leg performing the task. All of this data was collected from the third repetition of each trial. **RESULTS, DISCUSSION, AND CONCLUSION:** These sections will be presented on DPT research day. **ACKNOWLEDGEMENTS:** Barbara Hoogenboom, EdD, PT, SCS, ATC, Laurie Stickler, PT, MSPT, OCS, Heather Gulgin, PhD, ATC, Meri Goehring, PT, PhD, GCS, and Gordon Alderink, PT, PhD.

**ARE PROBLEMS WITH CURVE REVERSAL WHEN TRANSITIONING FROM SIT TO STAND RELATED TO THE SUB-CLASSIFICATIONS OF THE DERANGEMENT SYNDROME? A RETROSPECTIVE STUDY.** Heiss A, Stuart S, Terry S, Vaughn D, Merkx-Quinn L; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Robin McKenzie developed The McKenzie Method, also known as Mechanical Diagnosis and Therapy (MDT). It is a comprehensive approach to examination and treatment of patients with mechanical low back pain. The MDT model classifies a patient into one of three subgroups or ‘syndromes’: postural, dysfunction, or derangement. Approximately 70% of patients with low back pain are classified within the derangement sub-classification. Within this sub-classification, a directional preference for extension-biased exercises is the most common presentation. According to McKenzie and May, patients with an extension directional preference demonstrate a unique complaint of pain that occurs with reversal of the lumbar lordosis following prolonged periods of sitting or bending. However, there is a lack of evidence to support this premise. The purpose of this study was to determine the frequency at which patients with an established derangement have difficulty with this postural transition. Secondarily, the authors sought to determine which sub-classification of the derangement syndrome reflects this characteristic most frequently. In addition, the authors evaluated whether the duration of a patient’s symptoms is significantly related to problems with curve reversal. **METHODS:** A cohort composed of 231 patients (mean age 42.2 years, range 18-60 years old) diagnosed with a derangement syndrome by a physical therapist using the MDT system were included in this retrospective study. The chi-squared test of independence was utilized to identify significant associations among the cohorts, and an odds ratio was obtained to assess the strength of the correlation between the characteristics of interest. **RESULTS:** One hundred thirteen subjects (48.6%) reported increased pain when rising from prolonged sitting. Of these 113 patients, 93 (82.3%) had an extension directional preference, 7 (6.2%) had a flexion directional preference, and 13 (11.5%) had a lateral flexion directional preference. The presence of pain when rising from prolonged sitting was significantly associated with a directional preference (p=0.046). A significant relationship was not found between symptom duration and the presence of pain when rising from prolonged sitting (p=0.321). The presence of an extension directional preference was significantly associated with having difficulty with curve reversal during the transition from sit to stand (p=0.016), and it had an odds ratio of 2.12. In contrast, patients with a relevant lateral component demonstrated an inverse relationship with the transition from flexion to extension of the lumbar spine as one rises from sitting (p=0.022). Patients with a flexion directional preference did not demonstrate difficulty with this transition (p=0.440). **DISCUSSION:** The findings of this study appear to contradict hypotheses proposed by McKenzie and May as only about one-half of the subjects reported difficulties when rising from prolonged sitting. Among those who reported difficulties with curve reversal after prolonged sitting, the majority had a directional preference for extension followed by a relevant lateral component and finally flexion. No significant association was found between the duration of symptoms and difficulties when rising from prolonged sitting. **CONCLUSION:** The results of this study may be beneficial to clinicians when examining a patient with low back pain to determine a proper sub-classification of derangement. However, clinicians should be cautious when ruling out a derangement if examination findings fail to demonstrate difficulty with the sit-to-stand transition. These findings emphasize the importance of utilizing a comprehensive evaluation to determine an accurate diagnosis for patients with mechanical low back pain.

**THE EFFECTIVENESS OF FUNCTIONAL MASSAGE ON PAIN AND RANGE OF MOTION MEASUREMENTS IN PATIENTS WITH CERVICAL IMPAIRMENTS.**

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**INTRODUCTION:** The purpose of this study was to examine the immediate effects of Functional Massage (FM) on cervical pain and active range of motion. It was hypothesized that the application of FM would result in an immediate improvement in active range of motion (AROM), an immediate decrease in numeric pain rating scores (NPRS), and improved scores on the Neck Disability Index (NDI) over the course of a comprehensive treatment plan that included FM. **METHODS:** A test-retest design was utilized to identify the immediate effects of FM as measured by AROM measurements and NPRS changes. Data was collected on each participant for a maximum of five consecutive sessions or less if the patient no longer met the inclusion/exclusion criteria. The NDI was administered at the first and fifth visits to measure functional outcomes from the overall treatment experience. The subjects (11; mean age = 56.3 years) were selected by each participating clinician as they presented with complaints associated with neck pain and dysfunction. Each clinician made the decision to include functional massage to the cervical and/or upper thoracic spinal segments in their treatment plan based upon their clinical judgment. This clinical outcome study utilized a single-group repeated measures design. All participants were considered to be a single-subject pool. **RESULTS:**  An analysis of AROM measurements (222 measured changes; mean change = 3.83 degrees for all directions measured) showed a statistically significant gain in AROM following the use of FM (p=0.000). AROM changes included 150 measurements that resulted in increased ROM, 65 measurements that resulted in no change in ROM, and 7 measurements that resulted in decreased ROM. NPRS changes (mean change = -1.009) were statistically significant (p=0.000) and resulted in a decrease in pain scores following 120 treatment sessions, no change following 90 treatment sessions, and an increase in pain scores following 12 treatment sessions. NDI changes (mean change = -2.7273) showed a statistically significant (p=0.010) decrease in scores following physical therapy sessions that included FM. NDI changes included nine reports of decreased limitation, one report of no change, and one report of increased limitation from the initial to the final NDI assessment. Although all of the outcome measures demonstrated statistically significant changes, clinically significant changes were not observed for those outcome measures. **DISCUSSION/CONCLUSION:** FM appears to show a statistically significant result in a single session for increasing AROM and reducing pain as many sessions demonstrated improvements in ROM and NPRS. However, clinical significance was not achieved according to the established guidelines. Further research needs to be performed to determine the effectiveness of FM for the treatment of pain, AROM, and disability in patients presenting with cervical impairments.

**THE IMMEDIATE EFFECTS OF THE MDT [MECHANICAL DIAGNOSIS AND TREATMENT] APPROACH ON PATIENTS WITH SHOULDER PAIN.** Farrimond KK, Lenhart AM, Wall MP, Vaughn D; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** McKenzie, in his original description of the MDT approach, maintained that the system could be applied to extremity problems. The current literature is lacking with respect to the effectiveness of the MDT approach in extremity problems. This retrospective study focused on shoulder pain because it is the third most common musculoskeletal problem seen in physicians’ offices behind back and knee problems. There are three distinct syndromes identified through an MDT examination: postural, dysfunction, and derangement. The purpose of this study was to examine the immediate effects of the MDT approach in the physical therapy treatment of patients with shoulder pain. **METHODS:** A retrospective study was conducted on patients with a medical diagnosis of shoulder pain, shoulder impingement, shoulder tendinopathy, or rotator cuff tear. The study specifically examined the effects of the MDT approach on patients who were diagnosed with a derangement syndrome by a physical therapist certified in the MDT examination and treatment system. Scores from the patients’ Visual Analog Scales (VAS) and Simple Shoulder Tests were used to measure the effectiveness of the MDT approach. Data were collected via a chart review from the files of Louise Merkx-Quinn, PT, OCS, Cert MDT on all patients from July 2008 – January 2013 with a MDT diagnosis of shoulder derangement. The sample included 13 subjects ages 20-80 (mean 52 ± 15.49). A paired samples test was used to compare mean change scores of the outcome measures. **RESULTS:** Based on Fisher’s Skewness and Kurtosis Coefficients, the data set had a normal distribution. The mean change scores for the VAS (4.35 ± 1.63) and The Simple Shoulder Test (3.54 ± 2.76) were statistically significant (p<0.001). Repeated extension was the most common loading strategy used to manage the derangement (7/13 cases). **DISCUSSION:** The outcomes of this study provide preliminary evidence to support utilization of the MDT system in managing pain and loss of function in patients with shoulder disorders. This study offers insights into the trends in diagnosis and treatment of shoulder derangement, but it has limited generalizability due to the exclusion of the two remaining MDT classifications for patients with shoulder pain. **CONCLUSION:** This study provides preliminary evidence that a highly trained MDT therapist can successfully use the MDT approach to reduce shoulder pain and increase function for patients with a MDT-based diagnosis of derangement syndrome. **ACKNOWLEDGEMENTS:** Daniel Vaughn, Louise Merkx-Quinn, Matt Schmitz, and the staff at Back in Motion.

**THE EFFECTS OF EXERCISE IN PATIENTS SEVERELY IMPAIRED DUE TO MULTIPLE SCLEROSIS: A MULTIPLE SINGLE SUBJECT DESIGN.** Latshaw C, Mohney E, VanDyken L, Walworth K, Baker B, Shoemaker M; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Multiple sclerosis (MS) is a progressive disease that leads to the destruction of the myelin, oligodendrocytes, and axons of the central nervous system. Up to 60% of individuals with MS are no longer considered fully ambulatory 20 years after the initial onset of the disease. Despite extensive research, there is still no cure. The effects of exercise have been explored with positive results for the management of symptoms such as fatigue, depression, decreased muscle strength and endurance, and functional impairments. However, the majority of these studies have focused on mild- and moderately-impaired individuals with MS who are ambulatory. The population of individuals with MS who are non-ambulatory is underrepresented with regards to assessment, intervention, and standardized measures. This study is part of an ongoing pilot study, and it has been modified based upon the results drawn from two previously unpublished studies that targeted a similar population and utilized the same exercise protocol. The purposes of this pilot study were to provide insight into potential assessment tools that are responsive enough to detect changes in individuals with MS, determine the effectiveness of exercise and balance training in non-ambulatory individuals with MS, and investigate any carryover benefits of strength and functional ability that an exercise program may offer this population. **METHODS:** This study utilized an AB research design over the course of 10 weeks with a follow-up at four weeks post-intervention. Phase A consisted of a two-week, four-visit control period with outcome measures assessed at each visit. Phase B consisted of an eight-week intervention period which included an exercise program that was performed three days per week in 60-90 minute sessions with rest periods as needed. The exercise program consisted of dynamic seated balance training via the Equitest System, seated reaching activities with close guard, proprioceptive neuromuscular facilitation (PNF) for the upper extremities and core using a unilateral asymmetrical pattern, manual resisted rowing and pushing activities for the upper extremities, Handy Helper grip strengthening, and upper body ergometry. Exercises were closely monitored and progressed once a subject was able to successfully perform a given intervention at their current level for two consecutive visits without compensation. Outcome measures were administered bi-weekly during Phase B. Outcome measures included the Modified Fatigue Impact Scale (MFIS), Multiple Sclerosis Impact Scale (MSIS-29), Patient Specific Functional Scale (PSFS), Box and Block Test (BBT), handheld grip dynamometry, and Function in Sitting Test (FIST). Meaningful changes in outcome measures were determined using the two standard deviation band method, minimal detectable change (MDC) and minimal clinically important difference (MCID) values, and visual trends. **RESULTS, DISCUSSION, AND, CONCLUSION:** These sections will be presented on DPT research day. **ACKNOWLEDGEMENTS:** Student volunteers from the GVSU DPT Class of 2014.