AAOMPT platform presentations selection

PL-01

Changes in stumble recovery following orthopaedic manual physical therapy intervention in patients with knee osteoarthritis: a prospective case series

Allen CS^{1,2}, Deyle GD¹, Wilken JM³, Gill NW¹

¹Army-Baylor Doctoral Fellowship in Orthopaedic Manual Physical Therapy, Fort Sam Houston, TX, USA, ²1st Brigade Combat Team, 1st Cavalry Division, Fort Hood, TX, USA, ³Military Performance Laboratory at the Center for the Intrepid, Fort Sam Houston, TX, USA

Corresponding author: chrisallen55@gmail.com

Background: Patients with knee osteoarthritis (OA) demonstrate an increased falls' risk, but it is not known how knee OA affects stumble response and subsequent recovery. In previous trials, an orthopaedic manual physical therapist (OMPT) approach resulted in meaningful improvements for reducing the pain, stiffness, and functional limitations associated with knee OA.

Purpose: Describe stumble recovery in patients with knee OA and observe the changes following OMPT intervention.

Methods: This was a prospective case series with age- and gender-matched controls. Five patients with symptomatic knee OA (57.2 [1.5 years]) and five matched controls (56.8 [3.2 years]) completed the alternate step test and walked on a treadmill with lateral to medial translational walking surface perturbations. Data were collected on strides to recovery and reaction times in response to perturbation. After completing the WOMAC, patients were treated using an OMPT approach for 4 weeks and re-tested.

Results: The patient group demonstrated meaningful clinical improvements in WOMAC scores (mean change 62%, 86.8 [40.6] to 32.6 [31.9]) and alternate step test performance (mean change 28%, 9.3 [2.0] to 6.8 [1.6] seconds) at 4 weeks. At baseline, two of the five patients differed appreciably from their matched controls in both strides to recovery and reaction time. After four weeks of treatment, both patients demonstrated significant improvements following intervention that aligned them more closely with their controls.

Discussion–conclusion: For those patients identified as being at high risk for falls, we observed large improvements in alternate step test performance and stumble recovery strategies following 4 weeks of OMPT intervention.

PL-02

Manual physical therapy management for a pediatric patient diagnosed with atlantoaxial rotatory subluxation with pre-/post-intervention MRI validation: a case report

Baker SM¹, Rot JA²

¹Kids Can Do, Inc., Mokena, IL, USA, ²University of St. Augustine for Health Sciences, St. Augustine, FL, USA

Corresponding author: jrot@usa.edu

Background and purpose: Acute sudden onset torticollis is a rare occurrence in the pediatric population that is most often diagnosed as atlanto-axial rotatory subluxation. Current treatment interventions include anti-inflammatory drugs, hard collar immobilization, cervical traction in a halo cast, physical therapy intervention, and C1–C2 posterior surgical fusion. Minimal research has been performed on manual physical therapy interventions. The purpose of this case report was to demonstrate the effectiveness of manual physical therapy management for a pediatric patient diagnosed with atlantoaxial rotatory subluxation.

Description: The patient was an 8-year-old female who was experiencing sudden onset torticollis following a thyroglossal cyst removal. Magnetic resonance imaging (MRI) confirmed the diagnosis of atlantoaxial rotatory subluxation. Upper cervical non-thrust manipulation, manual cervical distraction, and myofascial interventions were implemented during the course of treatment.

Outcomes: Following 20 intervention sessions within a six-week period, the patient reported a complete resolution of pain and dizziness from 8/10 to a 0/10 using the verbal analogue scale. The patient demonstrated normal posture and full cervical active range of motion. MRI confirmed complete resolution of the atlantoaxial rotatory subluxation. The Neck Disability Index score was 66% disability at initial examination and 0% disability at the time of discharge.

Discussion–conclusion: This case report demonstrated that manual physical therapy management

Full platform presentations can be found at: <http://www.maney.co.uk/web/jmt-extra-content>

can result in a successful outcome for a pediatric patient diagnosed with atlanto-axial rotatory subluxation with pre-/post-intervention MRI validation.

PL-03

Diagnostic accuracy of five orthopedic clinical tests for diagnosis of superior labral anterior posterior (SLAP) lesions

Cook CE¹, Beaty S², Kissenberth M², Siffri P², Hawkins R²

¹Division of Physical Therapy, Walsh University, North Canton, OH, USA, ²Steadman Hawkins Foundation of the Carolinas, Greenville, SC, USA

Corresponding author: ccook@walsh.edu

Background: The clinical diagnosis of superior labral anterior posterior (SLAP) tear is extremely challenging and most studies that have advocated selected tests as beneficial have demonstrated study design errors and significant bias.

Methods: The diagnostic accuracy study was a prospective, case-based, case-control design that included 104 subjects with variable shoulder pathology.

Results: Of the five tests, only the Biceps Load II test demonstrated utility in identifying patients with an SLAP-only lesion (LR+ = 1.7, 95%CI = 1.1, 2.6; LR- = 0.39, 95%CI = 0.14, 0.91). There were no tests that demonstrated diagnostic utility when diagnosing any SLAP lesion including those with concomitant diagnoses.

Discussion-conclusions: There are a number of potential reasons for the poor utility in the five test findings. First, the heterogeneous sample included patients with a variety of shoulder disorders, including those with SLAP lesions. Second, the study was organized using very strict methodological controls that should reduce the risk of bias, which normally overinflates the accuracy of a specific tool. Lastly, the findings may truly reflect the stand-alone, diagnostic utility of the five tests, suggesting that each when used alone provides little usefulness toward decision making of the diagnostic clinician.

PL-04

Investigation of non-mechanical findings during spinal movement screening for identifying and/or ruling out metastatic cancer

Cook CE¹, Hegedus EJ², Ross MD³

¹Doctor of Physical Therapy Division, Walsh University, North Canton, OH, USA, ²Physical Therapy Department, School of Health Sciences, High Point University, High Point, NC, USA, ³US Air Force Physical Medicine Training Program, Fort Sam Houston, TX, USA

Corresponding author: romoross@msn.com

Background and purpose: When evaluating patients with low back pain, physical therapists have used the presence of non-mechanical findings during a spinal

movement screen as one factor in determining if physician referral is necessary. To our knowledge, there are no studies that have investigated the accuracy of this strategy in a situation of diagnostic uncertainty. This study investigated the diagnostic accuracy of lumbar movement restrictions and pain in patients with metastatic bone cancer.

Methods: This study included 1109 consecutive patients (655 women) with low back pain (mean age = 54.8 ± 16.3 years) evaluated at a spine surgery center who received a clinical movement screen and an imaging supported diagnosis by an orthopedic surgeon. No report of pain during movement and no limitation of movement were considered the targeted findings as these are associated with non-mechanical findings.

Results: Sixty-six patients (5.9%) were diagnosed with metastatic cancer; 61 patients (5.5%) had metastatic bone cancer with concomitant diagnoses (stenosis, fracture, etc.) and five patients (0.4%) had metastatic bone cancer without a concomitant diagnosis. While there were no significant findings associated with movement restrictions, pain-free lumbar movements in all directions for patients with metastatic bone cancer without concomitant diagnoses was associated with a post-test probability of 0.00 (+likelihood ratio = 2.4, -likelihood ratio = 0.0), suggesting that pain found during any of the motions is useful in ruling out spinal cancer.

Discussion-conclusion: These findings may help physical therapists understand the true utility of a movement screen to rule out non-mechanical conditions.

PL-05

A magnetic resonance image provides no value in the diagnosis of superior labral anterior posterior (SLAP) lesions

Cook CE¹, Beaty S², Kissenberth M², Siffri P², Pill S², Hawkins R²

¹Division of Physical Therapy, Walsh University, North Canton, OH, USA, ²Steadman Hawkins Foundation of the Carolinas, Greenville, SC, USA

Corresponding author: ccook@walsh.edu

Background: The diagnosis of superior labral anterior posterior (SLAP) tear with non-contrast magnetic resonance imaging (MRI) has been reported previously to provide high levels of specificity and low levels of sensitivity. In cases where concomitant shoulder problems exist, diagnosis is considered more difficult.

Purpose: To measure the diagnostic accuracy of a non-contrast MRI for the diagnosis of an SLAP lesion in a population of patients with high levels of disability.

Methods: The diagnostic accuracy study was a prospective, case-based, case-control design that included 77 subjects. Each subject was evaluated with a non-contrast MRI and arthroscopic surgery to determine the presence of an SLAP lesion.

Results: Nearly 3/4ths of the subjects demonstrated concomitant shoulder problems, many with greater than 2 years of symptom duration, and had high levels of baseline pain/disability. The MRI provided no value for the diagnosis of an SLAP-only lesion (LR+ = 0.86, 95%CI = 0.73, 1.1; LR- = 1.1, 95%CI = 0.27, 3.9) or the diagnosis of any SLAP lesion including those with concomitant diagnoses (LR+ = 0.97, 95%CI = 0.86, 1.2; LR- = 1.2, 95%CI = 0.03, 4.1).

Discussion-conclusion: The study sample had a large number of concomitant problems, and past studies have shown that with this population, a non-contrast MRI yields lower diagnostic accuracy and is less cost-effective than a contrast MRI/arthrogram. Our findings support that if a non-contrast MRI is used there is a stronger chance of a misdiagnosis than if not used. Further studies are needed to determine the best cluster of test findings that are unique to an SLAP lesion, especially with patients with multiple shoulder diagnoses.

PL-06

Vertebral artery haemodynamics during atlantoaxial joint manipulation: a pilot study

Erhardt JW

Providence St. Vincent's Medical Center, Portland, OR, USA

Corresponding author: Jon@ErhardtPT.com

Background and purpose: Atlantoaxial (A/A) joint manipulation is a technique used by orthopaedic manual physical therapists. Limited research exists investigating the relationship between A/A manipulation and vertebral artery flow. With mixed opinion and conflicting evidence regarding the clinical relevance of performing pre-manipulative testing for vertebrobasilar insufficiency and poor evidence in support of its validity, further research is needed to investigate this relationship.

Purpose: To investigate the effect, if any, of A/A joint manipulation on haemodynamic flow of the vertebral artery between C1 and C2 during manipulation.

Methods: One 38-year-old female subject was recruited and screened for contraindications to spinal manipulation. The suboccipital portion of the vertebral artery was obtained by a registered vascular technician using ultrasound with color flow and pulse-wave Doppler imaging before, during and immediately after manipulation. Manipulation was performed by a physical therapist who is a Board Certified Orthopedic Specialist and a Certified Orthopaedic Manipulative Therapist. Results: Before versus After manipulation:

peak systolic velocity 0.599 m/s versus 0.610 m/s; peak diastolic velocity 0.227 m/s versus 0.238 m/s; resistance index 0.62 versus 0.61.

Discussion: This appears to be the first study investigating vertebral artery haemodynamics during/immediately after A/A joint manipulation. While not statistically significant, there was essentially no change in haemodynamic flow from this A/A joint manipulation suggesting this orthopaedic manual therapy technique does not compromise vertebral artery flow.

PL-07

Orthopaedic manual physical therapist approach for the treatment of acromioclavicular joint pain: a prospective cohort study

Harris KD, Deyle GD, Gill NW, Howes RR

Army-Baylor University Doctoral Fellowship in Orthopaedic Manual Physical Therapy, Physical Therapy Service, Brooke Army Medical Center, Fort Sam Houston, TX, USA

Corresponding author: jm.brismee@ttuhsc.edu

Background: There are no studies on the physical therapist management of non-acute acromioclavicular joint (ACJ) pain.

Purpose: To observe the changes in pain and disability following an Orthopaedic Manual Physical Therapist (OMPT) approach for non-acute ACJ pain.

Methods: The chief inclusion criterion was >50% pain relief with an ACJ diagnostic injection. Patients were excluded if they had sustained an ACJ injury within the last 12 months. Treatment was conducted utilizing an Orthopaedic Manual Physical Therapist approach treating all associated impairments in the shoulder girdle and cervico-thoracic spine. The primary outcome measure was the Shoulder Pain and Disability Index (SPADI). Secondary measures were the American Shoulder and Elbow Surgeon (ASES) and Global Rating of Change scales. Outcomes were collected at baseline, 4-weeks, and 6-months. The SPADI and ASES values were analyzed with a repeated measures analysis of variance (ANOVA).

Results: Thirteen patients (11 male, 2 female; mean age = 41.1 years) completed treatment. The ANOVA was statistically significant for the SPADI ($P < 0.001$) and the ASES ($P < 0.001$). *Post hoc* comparisons revealed statistically significant and clinically meaningful improvement for both the SPADI at 4 weeks ($P = 0.001$) (25.9 points [95%CI = 11.9, 39.8]) and the ASES at 4 weeks ($P < 0.001$) (27.9 points [95%CI = 14.7, 41.1]). Improvements remained at 6 months.

Discussion-conclusion: Statistically significant and clinically meaningful short-term and long-term improvements were observed in all measures following an average of 6.4 visits. This is the first clinical trial of physical therapist management of non-acute ACJ pain.

PL-08

A retrospective analysis regarding the use of a 'two factor prediction rule' for streamlined referral of patients with acute low back pain to physical therapists.

Koch WK, Kramer CD

Park Nicollet Health Services, Minneapolis, MN, USA, Regis University, Manual Therapy Fellowship, Denver, CO, USA

Corresponding author: Chris.Kramer@Parknicollet.com

Background: A 5-factor Clinical Prediction Rule (5FCPR) predicting improvement with thrust manipulation for patients with acute low back pain (ALBP) has been derived and validated. A less robust two-factor rule (2FCPR), which is easier to implement in a primary care environment, has also been described.

Purpose: To develop a program to expedite referral to physical therapy (PT) for patients with ALBP.

Methods: Medical providers were trained in the use of the 2FCPR (no pain below the knee, symptom duration <16 days) to initiate referral to PT. Patients were treated within 2 days by physical therapists utilizing lumbopelvic thrust manipulations, trunk stabilization exercises, and an impairment-based treatment program.

Results: The Modified Oswestry Disability (ODI) scores for all patients ($n=176$, all meeting the 2FCPR) improved by 54 and 69% by visit 3 and discharge, respectively (mean 4.1 visits; $P<0.0001$ for improvements from baseline to discharge). A total of 139 patients met the 5FCPR (+5FCPR), and 37 did not (-5FCPR). Mean improvements for the +5FCPR group were 57 and 70% for visit 3 (significantly lower than -5FCPR, $P=0.03$) and discharge, respectively (mean 4.1 visits). Modified Oswestry Disability score improvements were 44 and 65% for visit 3 and discharge, respectively, for the -5FCPR group (mean 4.2 visits).

Discussion-conclusion: Patients referred using the 2FCPR demonstrated significant decreases in ODI. Patients meeting the 5FCPR improved more rapidly than those not meeting the 5FCPR. Given the similarity in outcomes regardless of status on the full CPR, the 2FCPR appears to be a useful tool for streamlining PT referral for ALBP.

PL-09

Comparison of neurodynamic examination findings in normal, painless and painful diabetic peripheral neuropathy subjects: a cross-sectional study

Kumar SP¹, Adhikari P², Jeganathan PS³, D'Souza SC², Misri ZK⁵

¹Departments of Physiotherapy, ²Departments of Medicine, ³Departments of Physiology, and ⁵Departments of Neurology, Kasturba Medical College (Manipal University), Mangalore, India

Corresponding author: senthil.kumar@manipal.edu

Background: Neurodynamic assessment includes neurodynamic testing and nerve trunk palpation. Diabetes has been shown to affect neural micro-circulatory networks and neural connective tissue sheaths, which may affect neurodynamic properties.

Purpose: To compare the neurodynamic examination findings in diabetic subjects (D), painless neuropathy and painful diabetic peripheral neuropathy (PDPN) with normal (N) subjects.

Materials and methods: Observer-blinded cross-sectional study of 164 subjects (98 male, 66 female) of mean age 64.4 ± 7.1 years. The tester performed neurodynamic testing and nerve trunk palpation to bilateral lower limb sciatic, tibial and common peroneal nerves. The outcomes of presence of pain (P)/resistance (R)/muscle spasm (MS), and range of motion (ROM) of neurodynamic tests, and presence/absence of mechanical allodynia on nerve trunk palpation (NTP) were documented. One-way analysis of variance was used for comparing neurodynamic test (NDT) findings across the nerve-groups at 95% confidence interval.

Results: There were 38, 51, 30, 45 subjects respectively in N, D, PLN and PDPN groups. The PDPN group had the greatest abnormalities in neurodynamic examination findings in P ($n=20$), R ($n=3$), MS ($n=22$), ROM of 41.2 ± 15.8 degrees in NDT and all three nerves were sensitive to nerve trunk palpation ($n=29$) when compared to N group which had only R ($n=38$) during NDT, ROM of 81.8 ± 4.8 degrees, and negative NDT and NTP, significantly at $P<0.05$.

Discussion-conclusion: PDPN group had greater abnormalities in neurodynamics (positive NDT and mechanical allodynia on NTP) than normal subjects studied. The study findings implicate neurodynamic examination in diabetic individuals.

PL-10

Reliability of a seated three-dimensional passive intervertebral motion test for mobility, end-feel and pain provocation in patients with cervicalgia

Manning DM, Dedrick GS, Sizer PS, Brismée JM
Center for Rehabilitation Research, Texas Tech University Health Sciences Center, Lubbock, TX, USA

Corresponding author: danam.manning@ttuhsc.edu

Background: Neck pain is a common condition treated with orthopaedic manual therapy. To date, no study has evaluated the reliability of 3D segmental passive intervertebral motion (PIVM) testing of the cervical spine in symptomatic subjects in a functional, seated position.

Purpose: To evaluate the inter-rater reliability of 3D cervical segmental PIVM performed in the seated

position to assess joint mobility, end-feel and pain provocation in symptomatic subjects.

Methods: Subjects ($n=64$), age 44 ± 15.6 years, mean neck pain 3.4 ± 1.6 cm on NPRS, were evaluated by two of three different raters with various orthopaedic manual therapy education and experience. To perform the test, the rater passively invoked side-bending motion at each cervical joint from C2C3 to C6C7, allowing segmental synkinetic rotation and extension to occur. Each joint was assessed for mobility, end-feel and pain provocation. Kappa statistics were used to determine the inter-rater reliability for each variable for both the most and least painful sides.

Results: Per cent agreements for pain provocation, hypomobility, and end-feel ranged from 65 to 83%, 62 to 84%, and 68 to 87%, respectively. Kappa values for pain provocation, hypomobility, and end-feel on the most painful side were fair to moderate (0.29–0.53, 0.21–0.48, and 0.25–0.50, respectively), and on the least painful side were fair to substantial (0.43–0.65, 0.33–0.58, and 0.28–0.60, respectively).

Discussion–conclusion: This is the first investigation to assess reliability of 3D cervical segmental testing in sitting and to assess reliability of end-feel. The seated 3D PIVM test is sufficiently reliable for clinical use in patients with cervicgia for the assessment of joint mobility, end-feel, and pain provocation.

PL-11

Synergistic activation of the superficial multifidus and the muscles of the abdominal wall during voluntary abdominal muscle activation strategies.

Matthijs OC, Dedrick GS, Brismée JM, McGalliard MK, James CR, Sizer PS

Center for Rehabilitation Research, Texas Tech University Health Sciences Center, Lubbock, TX, USA

Corresponding author: phil.sizer@ttuhsc.edu

Background: Clinicians often complement spine orthopaedic manual therapy by activating patients' multifidi (MF) and abdominal muscles for stabilization, injury deterrence and recurrence prevention.

Purpose: This study aimed to investigate whether volitional abdominal muscle activation produced synergistic co-contraction of the superficial MF.

Methods: This within-subjects design incorporated a convenience sample of 34 healthy subjects (19 women and 15 men; 22–56 years). Surface electromyographic measurements of bilateral superficial MF at L5, bilateral longissimus thoracis at L1, right external oblique and right internal oblique were recorded during the abdominal-drawing-in-maneuver (ADIM) and abdominal-bracing-maneuver (ABM) with subjects in three body positions: supine, four-point kneeling, and upright standing. Ultrasound imaging confirmed transverse abdominis muscle activation

during all screening and testing. Data were analyzed using the Cochran Q test and repeated-measures ANOVA ($\alpha=0.05$).

Results: Isolated MF recordings were confirmed during screening. Significantly different abdominal muscle activity patterns were noted during activation strategies (ADIM versus ABM; $P<0.05$). Significant MF co-contractions were observed during ADIM and ABM in all three positions ($P<0.05$). No significant differences in MF root mean square electromyographic were noted for strategy. Position caused a significant change in MF root mean square, but only for the left side in supine ($P=0.015$).

Discussion–conclusion: This experiment was the first to objectify a synergistic activation of the superficial MF during different volitional abdominal activation strategies. The findings help to elucidate mechanisms associated with the superficial MF in response to rehabilitative activation strategies incorporated by orthopaedic manual therapy practitioners during patient management.

PL-12

Physical therapist and physician knowledge of low back pain management

Ross MD, Childs JD, Middel C, Kujawa J, Brown D, Corrigan M, Parsons N

US Army-Baylor University Doctoral Program in Physical Therapy, San Antonio, TX, USA

Corresponding author: romoross@msn.com

Background and purpose: Primary care providers currently serve as the primary entry-point into the healthcare system for patients with low back pain (LBP). If physical therapists could demonstrate equal or higher levels of knowledge than their physicians counterparts, this would provide at least some level of evidence to suggest that physical therapists have adequate knowledge in providing direct access care for patients with LBP. The purpose of this study was to compare knowledge in managing LBP between physical therapists and primary care physicians.

Methods: Fifty-five physical therapists and 130 primary care physicians currently serving in the US Air Force completed standardized examinations assessing knowledge, attitudes, the usefulness of clinical practice guidelines, and management strategies for patients with LBP. These same examinations had previously been used by Buchbinder *et al.* (2009) and Finestone *et al.* (2009) to assess knowledge in managing LBP across a variety of physician specialties.

Results: Physical therapists scored significantly higher than physicians regarding the determination of optimal management strategies for patients with LBP. Scores related to knowledge, attitudes, and the usefulness of clinical practice guidelines were similar between the groups.

Discussion–conclusions: Physical therapists demonstrated knowledge levels that were higher than or equal to those of primary care physicians with respect to optimal management strategies and beliefs about LBP. The results of this study may have implications for health policy decisions regarding the utilization of physical therapists in providing direct access care for patients with LBP.

PL-13

Cervical arterial screening prior to manual therapy interventions

Schmidt SG, Grant R, Spryopolous P, Dansie D, Taylor J, Wang H

University of South Australia, Adelaide, Australia

Corresponding author: stephen.g.schmidt@kp.org

Background: Despite numerous investigations, the role functional arterial screening plays prior to cervical manual therapy remains unclear. Some authors have suggested risks associated with performing tests attempting to provoke symptoms of cerebrovascular ischemia. This study investigated whether there was an effect upon blood flow parameters following application of commonly utilized screening procedures. The null hypothesis was that no significant changes in blood flow would be demonstrated following screening.

Methods: Blood flow parameters were obtained from each vertebral artery in 20 asymptomatic subjects using color duplex Doppler ultrasound. Ultrasound sampling was completed before and after positioning in end-range cervical extension, rotation and combined extension/rotation/lateral flexion to each side. As it was not possible to sample both arteries simultaneously, subjects were randomized as to whether the right or left artery was measured first.

Results: No significant changes in blood flow were demonstrated by paired *t*-tests. Multiple regression analyses showed no interactions between age, gender, neck girth, and side of test. However, sampling order demonstrated an interaction, such that the artery sampled first significantly increased volume flow rate whereas the artery sampled second significantly decreased.

Discussion–conclusions: Due to the interaction of sampling order, this study was unable to completely support the null hypothesis. Future investigation should consider the order effect in study design and when performing screening in clinical settings.

PL-14

Biomechanical measures of knee joint mobilization

Silvernail JL¹, Gill NW¹, Teyhen DS², Allison SC¹

¹Army-Baylor Doctoral Fellowship in Orthopaedic Manual Physical Therapy, Brooke Army Medical Center,

TX, USA, ²US Army-Baylor University Doctoral Program in Physical Therapy, Fort Sam Houston, TX, USA

Corresponding author: jasonsilvernail@googlemail.com

Background and purpose: The purpose of this study was to quantify the biomechanical properties of specific manual therapy techniques in patients with symptomatic knee OA.

Methods: Twenty subjects (7 female/13 male, age 54 ± 8 years, Ht 1.7 ± 0.1 m, Wt 94.2 ± 21.8 kg) participated in this study. One therapist delivered joint mobilizations (tibiofemoral extension and flexion; patellofemoral medial-lateral and inferior glide) at two grades (Maitland's grade III and grade IV). A capacitance-based pressure mat was used to capture biomechanical characteristics of force and frequency during 2 trials of 15 second mobilizations. Statistical analysis included ICC_{3,1} for intrarater reliability and 2×4 repeated measures analyses of variance and *post hoc* comparison tests.

Results: Force (Newtons) measurements (mean, max.) for grade III were: extension 45, 74; flexion 39, 61; medial–lateral glide 20, 34; inferior glide 16, 27. Force (Newtons) measurements (mean, max.) for grade IV were: extension 57, 76; flexion 47, 68; medial–lateral glide 23, 36; inferior glide 18, 35. Frequency (Hz) measurements were between 0.9 and 1.2 for grade III, and between 2.1 and 2.4 for grade IV. ICCs were above 0.90 for almost all measures.

Discussion–conclusions: Maximum force measures were between the ranges reported for cervical and lumbar mobilization at similar grades. Mean force measures were greater at grade IV than III. Oscillation frequency and peak-to-peak amplitude measures were consistent with the grade performed (i.e. greater frequency at grade IV, greater peak-to-peak amplitude at grade III). Intrarater reliability for force, peak-to-peak amplitude and oscillation frequency for knee joint mobilizations was excellent.

PL-15

The effects of thoracic manipulation on lower extremity mobility – a randomized controlled trial

Sueki DG, Almaria SM, Bender MA, Kamara M, Magpali A, Mancilla A, McConnell BJ, Montoya RC, Murphy AW, Romero ML

Department of Physical Therapy, Mount St. Mary's College, Los Angeles, CA, USA

Corresponding author: derrickssueki@yahoo.com

Background: Literature has begun to establish a relationship between manual interventions focused on the mid-thoracic spine and upper quarter function, but no research has been conducted to date to determine whether similar relationships exists

between the mid-thoracic spine and the lower quarter.

Purpose: To determine whether a relationship exists between lower extremity mobility, measured by passive straight leg raise (SLR) testing, and mid-thoracic spinal manipulation.

Methods: Forty-one symptomatic and asymptomatic subjects recruited through convenience sampling were randomly assigned in a double-blinded study. An experimental group received mid-thoracic spine manipulation and a control group received no manipulation. SLR was measured at initial onset of sensations in the lower extremity. Measurements were taken prior to the intervention, immediately after, and one-week after the initial testing.

Results: The mean age of subjects was 25.4 years old. A one-way analysis of variance of per cent change in SLR was found to be significant, $F(1,39)=4.528$, $P=0.040$. Mean SLR changed from 66.1 to 72.1 degrees (6.0 degrees) in the experimental group while SLR in the control group increased from 54.3 to 54.9 degrees (0.6 degrees). The SLR was reassessed one week after the initial intervention, but these changes were not significant ($P=0.154$).

Discussion–conclusions: Results of this study suggest that a relationship between mid-thoracic manipulation and SLR may initially exist, but was not maintained at the one-week follow-up. Future research investigating the effect of thoracic spine manipulation in patients with lower extremity mobility limitations is warranted.

PL-16

Use of the multifidus isometric technique in patients with acute neck pain

Viti JA, Rot JA, Augustsson H

University of St. Augustine for Health Sciences; First Coast Rehabilitation, St. Augustine, FL, USA

Corresponding author: jviti@usa.edu

Background: Acute facet capsular entrapment is a syndrome that is thought to occur suddenly during motion of the cervical spine or after sleeping in an awkward position. The patient reports a sudden 'catch' unilaterally, or awakens with pain that typically results in markedly reduced motions of side bending and rotation to the painful side and reduced backward bending. The multifidus isometric technique is hypothesized to pull the entrapped facet capsule from the facet joint resulting in increased range and decreased pain levels.

Methods: Sixteen patients (5 males/11 females) were treated with complaints of sudden onset of acute neck pain and limitation in range of motion of side bending and rotation to the painful side and backward bending. The multifidus isometric technique was performed to facilitate contraction of the

multifidus on the painful side (four sets of four repetitions [5–10 seconds holds]) during two treatment sessions within 24 hours. All range of motion measurements were taken with a standard goniometer.

Results: The mean increase in AROM from initial examination to completion of the second treatment session was 33.4 degrees for rotation, 22.1 degrees for backward bending, and 21.2 degrees for side bending. The mean improvement in the Neck Disability Index administered just prior to the second treatment session was 16.6%.

Discussion–conclusions: The multifidus isometric technique was useful in restoring AROM in sixteen patients with acute neck pain. Further research is warranted to investigate outcomes in larger populations and compare outcomes to interventions such as manipulation and exercise.

PL-17

A fluoroscopic comparison of general and semi-specific traction of the cervical spine

Werstine RJ, Birmingham T, Jenkyn T

The University of Western Ontario and the Fowler Kennedy Sports Medicine Clinic, London, Ontario, Canada

Corresponding author: rwersti@uwo.ca

Background: Manual traction is a commonly used technique for the treatment of cervical spine pathology; however, the amount of separation that occurs with the use of this technique and where the separation occurs has yet to be quantified.

Purpose: To quantify and compare the amount change in inter-vertebral space (IVS) between the C3–4, C4–5 and C5–6 spinal segments using general (force applied to the occiput) and semi-specific (force applied to C5) manual traction.

Methods: During one test session, general and semi-specific manual traction of 20 kg of force were applied in a randomized order to the cervical spines of 20 healthy participants while the separation between vertebrae was measured with fluoroscopy. Fluoroscopic images of the cervical spine were obtained prior to and during the application of the two traction techniques. The percentage of change in the IVS of C3 to C6 were calculated for both traction techniques and compared.

Results: An ANOVA indicated significant interactions between technique and position, and technique and level ($P<0.05$). *Post hoc* testing indicated that when combining levels, semi-specific traction created significantly greater IVS separation anteriorly ($P=0.003$). When combining anterior and posterior positions, semi-specific traction created significantly greater IVS separation at the C5/6 level only ($P=0.006$).

Conclusion: Manual traction produces IVS separation similar in magnitude to previous reports for mechanical traction. Semi-specific traction produces more separation at C5/6 and provides no protective effect that limits separation at levels above the level at which the traction force is being applied.

PL-18

The effect of knee varus mobilization applied to patients with imaging evidence of degenerative meniscus tear: a case series

Yung EY, Tonley JC

Kaiser Permanente Orthopedic Physical Therapy Residency Program, West Los Angeles, CA, USA

Corresponding author: elkyung@yahoo.com

Background: Passive physiologic knee flexion/extension mobilization has traditionally been utilized by manual therapists for managing impairments related to degenerative knee meniscus tear. However, there are some patients who either do not present with restrictions in the sagittal plane or cannot tolerate the sagittal plane mobilization and would benefit from an alternative. A case report was presented recently that used knee varus mobilization in a patient with meniscus tear. It is not known if the

positive result of such mobilization can be observed in other patients with similar presentation. Therefore, the purpose of this case series was to present the use of knee varus mobilization in patients with meniscus tear related knee pain.

Description: A series of four patients with a mean age of 57.5 ± 9.6 (90%CI) had an initial Lower Extremity Functional Scale (LEFS) average of 38.8 ± 13.3 (90%CI) out of 80. The patients presented with knee pain, and magnetic resonance imaging evidence of degenerative meniscus tear. Decreased mobility was noted for knee varus mobility examination in all patients. Therefore, knee varus mobilization was utilized in these patients.

Outcomes: Patients were seen for 2.5 ± 0.47 (90%CI) visits with a final LEFS average of 62.5 ± 11.95 (90%CI). Global Rating of Change was +5. Other impairments were addressed after the final LEFS was collected to isolate the effect of knee varus mobilization.

Discussion–conclusions: Varus mobilization is promising and offers a viable alternative to traditional mobilization for meniscus tear; though more study is warranted to determine cause and effect.