# 2021 AAOMPT Annual Conference

# Accepted Research Report and Case Report Abstracts

# Cleveland, Ohio, October 6-10, 2021

**ID: 2 (poster)**
Eric Trauber, Fabrication Enterprises

**Title:**

A multimodal approach for an individual with idiopathic coccydynia: a case report.

**Background / Purpose:**

Coccydynia is an ambiguous pathology due to its complexities regarding anatomy, physiology, muscles, neural tissues, and other various structures. The coccyx and sacrum are richly innervated in which activates musculature responsible for movement at the hip. Extrinsic and intrinsic musculature facilitate control of the femoral acetabular joint as well as the lumbopelvic region. A regional interdependence model can help provide a pathoanatomical start point while expanding to other systemic or contextual factors that may contribute to patient's clinical presentation. The purpose of this case study is to examine the effectiveness of a multimodal approach for an individual with idiopathic coccydynia.

**Case Description:**

The patient was a 32-year-old female who presented with complaints of coccygeal pain with insidious onset. She mentioned a history of chronic low back and hip pain She reported 4/10 on the Numerical Pain Rating Scale (NPRS) and a 68 on the Lower Extremity Functional Scale (LEFS). She reported familiar symptoms with prolonged sitting at her workstation, and when performing sitting tasks when teaching exercise classes. Comparable signs were reproduced with the patient placed into a "v-up" position and with sitting in a standard chair. Range of motion assessment yielded general hypermobility of lumbar spine and hip joints. Patient also exhibited weakness of left hip adduction and hip external rotation. Neurodynamics were unremarkable. A multimodal approach consisting of manual therapy directed to the femoral acetabular joint, supervised therapeutic exercise, and individualized therapeutic neuroscience education was implemented. Exercises addressed lumbopelvic motor control and core stabilization. A home self-management program was issued to manage familiar symptoms, challenge lumbopelvic motor control, and progress dynamic stabilization.

**Outcomes:**

The patient was seen for five visits for four weeks. Her NPRS improved from 4/10 to 0/10. LEFS improved from 68/80 to 78/80. She reported she had achieved all her goals and was able to manage her symptoms independently. The order of the provided interventions first focused on the management of familiar symptoms utilizing directed manual therapy to the hip, improve femoral acetabular neuromuscular reeducation, and then enhance lumbopelvic motor control while integrating components into a self-management program.

**Discussion / Conclusion:**

Conservative treatment for coccydynia is successful 90% of cases without further medical treatment. Manual therapy combined with exercise has shown improvement in pain pressure threshold and decreased pain in sitting. Manual therapy may be beneficial in addressing pain and disability, however, there is weak evidence available to make such conclusions. Further research is warranted to identify the effectiveness of conservative measures for managing idiopathic coccydynia.

**ID:** 3 (platform)

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**Title:**

The Influence of Manual Therapy Dosing on Outcomes in Patients with Hip Osteoarthritis: A Systematic Review

**Background / Purpose :**

To identify how dosing of manual therapy (MT) impacts pain, disability, and quality of life for those diagnosed with hip osteoarthritis. A secondary purpose was to categorize optimal MT dosing based on effect sizes.

**Methods :**

Pubmed, CINAHL, OVID databases and reference lists of identified randomized control trials (RCTs) published between January 2000 to July 2020 were searched to find studies that utilized MT for hip OA. Two independent reviewers assessed relevant studies based on predetermined criteria and extracted data for synthesizing. Baseline and end of study means and standard deviations for outcome measures were used to calculate treatment effects for within and between-group differences. Trial Registration Number: PROSPERO database registration number (CRD42020189103).

**Results:**

Ten RCTs were included in our final analyses totaling 768 participants. Five studies were graded as high risk of bias and 5 were graded as having some concerns. The majority of MT type had large within-group effects for pain. Four studies noted large within-group and between group range of motion (ROM) effect sizes. Most studies showed medium to large effect sizes for within-group differences for self-reported functional and quality of life measures. However, between-group effects were variable due to significant variation in reported MT dosing.

**Discussion / Conclusion:**

While trends showed large effects for hip thrust and non-thrust mobilizations, and MWM into hip flexion & internal rotation, with durations of 10 to 30 minutes per session, 2-3 times per week for 2-6 weeks, due to the heterogeneity of MT dosage descriptors, it is difficult to recommend a specific MT dosage for those with hip OA.

**ID:** 4

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**Title:**

EVALUATION OF THE EFFECTIVENESS OF A PAIN NEUROSCIENCE EDUCATION CURRICULUM FOR PATIENTS WHO EXPERIENCE CHRONIC MUSCULOSKELETAL PAIN WITH CONCURRENT OPIOID DEPENDENCE

**Background / Purpose :**

Chronic musculoskeletal pain (CMP) is estimated to affect over 100 million adults annually and is targeted as an instigator of opioid dependence (OpD). Opioid medications are often the first response for patients suffering from CMP, but over 10 million people annually admit to misusing opioids. With the opioid epidemic, the healthcare system now has a population of patients who experience CMP with concurrent OpD. This persistent problem creates a perfect storm of fear of movement, low self-efficacy, and physical dysfunction. A critical component to chronic pain management is understanding how patients view their pain experience. Education may be one key that unlocks the door to functional improvement, but traditional education utilizes anatomical models that focus on tissue damage and peripheral sources of pain. Researchers have explored educating people about pain via Pain Neuroscience Education (PNE), a cognitive-based intervention that facilitates understanding of the biological processes underpinning the pain state. PNE may facilitate understanding pain experiences that are normal and expected, with the intent to reduce fear and increase self-efficacy. The utilization of PNE has not been researched in patients with CMP and concurrent OpD. Therefore, the purpose of this study was to evaluate the effectiveness of a PNE intervention with this specific cohort. We hypothesize that the introduction of an adapted PNE curriculum, as a single intervention, may facilitate change to kinesiophobia, pain self-efficacy, physical function, and knowledge for patients with CMP and concurrent OpD.

**Methods :**

A retrospective chart review categorized the demographics and patient characteristics for 33 subjects who participated in an opioid-management program. A feasibility study was performed to determine the acceptability and delivery of the PNE intervention. A final quasi-experimental study performed with 21 subjects; the experimental group (N=13) received the PNE curriculum, and the control group (N=8) received general health education (GHE). Both groups received interventions in four, 15-minute sessions (once per month), one-on-one with the primary

investigator. All subjects completed the same four patient-reported outcome measures at baseline, post-intervention, and at a 90-day follow-up time point.

**Results:**

The retrospective chart review revealed categorized demographics, participant functional ability, and participation with physical therapy services. The results of the feasibility study revealed positive changes in kinesiophobia, pain self-efficacy, and the knowledge of the PNE concepts, as well as the acceptability of the intervention. The quasi-experimental study results revealed statistically significant effects for the Pain Self-Efficacy Questionnaire (PSEQ) and Neurophysiology of Pain Questionnaire (NPQ) on a paired samples t-test for the experimental group. Results also revealed no time by group interaction over the three time points (pre-, post-, and 90-day) for three of the four outcome measures (via repeated measures ANOVA). The differences between the two groups were displayed in the NPQ via two data collection points and the three data collection points with a statistically significant P-value (P=0.006 and P=0.009 respectively). The PSEQ demonstrated trends toward positive change over the two time points but was not statistically significant (P=0.130).

**Discussion / Conclusion:**

The chart review allowed categorization of patient characteristics and demographics. The feasibility study demonstrated that the PNE curriculum intervention was acceptable in terms of approach and understandability to two subjects. Results from the quasi-experimental study indicate a PNE curriculum is beneficial in assisting subjects to understand the neurophysiology behind their pain experience and amending self-efficacy regarding pain.

**ID:** 5 (poster)

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**Title:**

EFFECTS OF ELECTRICAL DRY NEEDLING ON NEUROLOGIC AND BEHAVIORAL CHARACTERISTICS: A CASE STUDY

**Background / Purpose :**

Dry needling (DN), with and without electrical stimulation, has demonstrated mechanical, biochemical, vascular, and neurophysiological effects in humans. While the DN literature is growing, few studies have investigated the use of needling with or without electrical stimulation in the management of neurobehavioral disorders. The purpose of this case study was to determine if electrical dry needling (EDN) affects cognitive performance and /or behavior in a child with reactive attachment disorder (RAD).

**Case Description:**

One female (11y/o), diagnosed with RAD, who had been participating in neurofeedback cognitive training (NFB-CT) using low resolution electromagnetic tomography (LORETA) for 19 months prior to the study, was investigated. LORETA converts raw EEG data to Z scores whereby improved function is defined as a movement toward Z = 0. The magnitude of the Z score represents the distance between the patient's EEG values and those of age matched normative data. The z-score threshold is the z-score at which the subject receives positive reinforcement during training. Initially, the subject's z-score threshold was 6.50. Over the prior nine NFB-CT sessions, the threshold could not be lowered while maintaining the "success" level during training. Outcomes were z-score threshold (recorded weekly) and Thatcher Symptom Checklist (recorded weeks 0 and 7). The checklist was developed using fMRI, PET, EEG/MEG, and clinical neurological science, to link structure to function based on the spatial overlap of functional and clinical studies. Each behavioral symptom is rated (0 [absent] to 10 [severe]). Intervention involved EDN to the bilateral temporalis and masseter muscles once a week for 8 weeks. Bilateral corrugators and/or lateral pterygoid muscles were included based on the subject's tolerance/response. An EEG was recorded pre/post each intervention for qualitative information. All outcomes were descriptively compared between weeks 0 and 7.

**Outcomes:**

The initial intervention produced immediate reduction in targeted brain waves, and the z-score threshold reduced from 6.50 to 6.48. After 8 interventions, the z-score threshold was reduced to 5.38, and the subject demonstrated an increased number of successful trials per minute at the

lowered threshold. The Thatcher Checklist score reduced from 82 to 45. The initial reduction in EEG activity was maintained.

**Discussion / Conclusion:**

Electrical DN to facial muscles decreased brain wave activity in hyperactive regions per EEG and improved cognitive and behavioral function in a child with RAD who had plateaued in her NFB-CT. This enabled her to resume progression with her NFB-CT and achieve more behavioral and cognitive functional goals. To the authors' knowledge, this is the first investigation of the role of EDN in neuropsychology realms, and the initial results are promising. More studies are needed to elucidate the role of EDN as an adjunct to neuropsychology treatments for cognitive and behavioral dysfunction.

**ID:** 6 (poster)

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**Title:**

# EFFECTIVENESS OF CERVICOTHORACIC AND THORACIC MANUAL PHYSICAL THERAPY IN MANAGING UPPER QUARTER DISORDERS - A SYSTEMATIC REVIEW

**Background / Purpose :**

Physical therapists often use cervicothoracic and thoracic manual techniques to treat musculoskeletal disorders of the upper quarter, however, the overall effectiveness of this approach remains to be elucidated. The purpose of this systematic review was to explore studies that examined the short- and long-term effectiveness of manual physical therapy directed at the cervicothoracic and thoracic region in the management of upper quarter musculoskeletal conditions.

**Methods :**

The electronic databases MEDLINE, AMED, CINAHL, and Embase were searched from their inception through October 30, 2020. Eligible clinical trials included those where human subjects treated with cervicothoracic and/or thoracic manual procedures were compared with a control group or other interventions. The methodological quality of individual studies was assessed using the PEDro scale.

**Results:**

The initial search returned 950 individual articles. After the screening of titles and abstracts, full texts were reviewed by two authors, with 14 articles determined to be eligible for inclusion. PEDro scores ranged from 6-10 (out of a maximum score of 10). In the immediate to 52-week follow-up period, studies provided limited evidence that cervicothoracic and thoracic manual physical therapy may reduce pain and improve function when compared to control/sham or other treatments.

**Discussion / Conclusion:**

Evidence provides limited support for the short-term effectiveness of cervicothoracic and thoracic manual physical therapy in reducing pain and improving function in people

experiencing upper quarter musculoskeletal disorders. Evidence is lacking for long-term effectiveness as only two studies explored beyond 26 weeks, and this was for patient-perceived improvement.

**ID:** 7 (poster)

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**Title:**

Treatment Of Lumbar Radiculitis In A Patient With A Lateral Ankle Sprain: A Case Report

**Background / Purpose :**

Lateral ankle sprains (LAS) are one of the most common musculoskeletal injuries with a pooled prevalence of approximately 12% in the general population. Differential diagnosis of LAS may include neurogenic involvement of the lumbar spinal or fibular nerves due to their respective referral patterns and anatomic location. Symptoms of radiculitis may include pain and/or neural sensitivity in the affected dermatomes. Evidence is currently lacking for the effective management of LAS with concomitant lumbar radiculitis. The purpose of this case report is to describe the differential diagnosis and successful course of care in an individual with acute LAS and concomitant lumbar radiculitis.

**Case Description:**

The patient was a 35-year-old female three weeks post LAS referred to therapy via physician. She experienced immediate ankle pain, swelling, and difficulty weight bearing. She denied previous ankle sprains but did report previous low back pain. She complained of difficulty ambulating, standing, and negotiating stairs. She reported lateral ankle pain with a shooting pain that traveled up the lateral aspect of the leg and of severe pain with light touch of the lateral aspect of her ankle. The patient demonstrated hypomobility at the talocrural and proximal tibiofibular joints. She demonstrated hypomobile and painful L4 and L5 segments as well as a positive SLR and painful lumbar ipsilateral side bending, both of which reproduced her lateral ankle pain. Based on these findings, lumbar radiculitis was included in the differential diagnosis as a potential contributor to peripheral sensitization of her lateral ankle.

**Outcomes:**

The patient attended 10 sessions of therapy. Interventions included manual therapy techniques, range of motion (ROM) exercises, trunk stabilization training, strengthening, and motor control training for her gluteus medius, tibialis posterior, gastroc-soleus complex, and fibularis musculature. Outcomes measures included manual muscle testing, ankle ROM, lumbar ROM, neurodynamic testing, light touch sensitivity, and the Lower Extremity Functional Scale (LEFS). After 3 sessions, she demonstrated a negative SLR, pain free lumbar ROM, improved ankle ROM (15 deg ankle dorsiflexion), and decreased pain to light touch (3 points NPRS). After 8

sessions, ankle ROM was symmetrical, manual muscle testing performance improved (1 full grade), and her LEFS score increased by 28 points (MCID 12 points).

**Discussion / Conclusion:**

Differential diagnosis of LAS may include lumbar conditions. In this case report, the patient's ankle symptoms were reproduced during lumbar motion testing and neurodynamic testing. Additionally, peripheral sensitization and an inability to actively dorsiflex reinforced the working hypothesis that a spinal nerve was a contributing factor. Treatment directed toward the lumbar spine was followed by decreased symptoms both neurodynamically and peripherally, as well as an improved tolerance for treatment. Epidemiological research is necessary to identify the prevalence of concomitant pathologies, and subsequently, which treatments may be most effective for optimal outcomes.

**ID: 8 (platform)**

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**Title:**

The Unknown Prevalence of Post-Randomization Bias In 15 Physiotherapy/Physical Therapy Journals Is A Problem: A Methods Review

**Background / Purpose :**

The randomized clinical trial (RCT) research design rightly serves as our most robust evidence to assess between-group differences. However, issues such as the prevalence of post-randomization bias in RCTs may influence the quality of this evidence. The International Society of Physiotherapy Journal Editors (ISPJE) implemented prospective clinical trial registry requirements in member journals to prevent these post-randomization issues. The purpose of this study was to determine: 1) if manuscripts were published consistent with the prospectively registered protocol; 2) if there were any differences in the PEDro determined external and internal validity of RCTs that were/were not prospectively registered; and 3) to what extent physiotherapy/physical therapy journals comply with their published clinical trial registry policy for RCTs.

**Methods :**

Systematic review (SR) methodology was used to create the sample of RCTs. Trials were included if they involved musculoskeletal physiotherapy/physical therapy interventions in MEDLINE-indexed ISPJE member journals published in the English language between January 2016 and July 2020. The identification of the RCTs and data extraction were performed independently by two blinded reviewers. Each trial was assessed for consistency with the associated publicly available trial registry and PEDro score.

**Results:**

One hundred and thirty-eight RCTs were identified. One-third of RCTs were prospectively registered (49/138); Consistency with prospective intent could not be determined for two-thirds (89/138) of the RCTs. Of prospectively registered RCTs, 4/49 reported results inconsistent with the primary aims and outcomes from the clinical trial registry despite apparent high methodological quality (PEDro score). Differences between registered and unregistered RCTs for PEDro scores had a medium effect size ($r$=0.30). Two of 15 journals followed their clinical trial registration policy 100% of the time; in one journal, the published RCTs were consistent with the clinical trial registration.

**Discussion / Conclusion:**

Readers should approach musculoskeletal RCT manuscripts with caution because post-randomization bias may be prevalent. One in twelve registered published trials is inconsistent with the prospective registration. The proportion of trials not meeting prospective assumptions is likely higher in the remaining 2/3$^{rd}$ of trials that were not prospectively registered. Further assessment was limited because a complete data analysis plan is not a requirement of clinical trial registration. Tools used to appraise RCTs, such as the PEDro, are predicated on the premise that research questions were generated prospectively, and authors followed their prospective intent. If the assumptions of prospective intent are not met, it brings the validity of SRs into question as RCTs included within them cannot be accurately assessed for bias. Authors need to ensure that they correctly complete prospective trial registration and report the trial as planned. Journal editors need to consistently enforce journal trial registration policies and ensure that manuscripts are consistent with trial registrations.

**ID: 9 (platform)**

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**Title:**

CERVICAL LATERAL FLEXION PRE-POSITIONING ISOLATES C1-2 SEGMENTAL CERVICAL AXIAL ROTATION: A CADAVERIC STUDY

**Background / Purpose :**

(Sub-)occipital pain and other cervicocephalic syndromes can result from atlanto-axial (C1-2) joint hypo- or hypermobility. However, sparse research has been published to assess the isolated C1-2 range of motion (ROM) in the transverse plane. Investigations evaluating cervical spine movement's reliability using smartphones showed inconsistent outcomes, while Computerized Tomography (CT) scan reliability for C1-2 ROM has not been investigated.

Objectives: To assess (1) intra-rater reliability of measuring cervical lateral flexion ROM using iPhone and cervical rotation in the transverse plane (CRTP) ROM in cervical neutral position and at end-ROM right cervical lateral flexion position using iPhone and CT scan; and (2) segmental (C0-C7) CRTP ROM in cervical neutral and end-ROM cervical lateral flexion positions to determine whether CRTP in pre-positioned cervical lateral flexion mainly assesses C1-2 mobility.

**Methods :**

Ten Thiel-embalmed cadaveric specimen age 80.8 ± 12.2 years were used to assess: (1) *intra-rater reliability* of (a) cervical lateral flexion ROM; (b) cervical rotation ROM in the transverse plane (in neutral and end-ROM cervical lateral flexion) using an iPhone application and (c) C1-2 segmental CRTP in neutral and end-ROM cervical lateral flexion position using CT scan; and (2)*total available CRTP and cervical segmental contribution* in cervical neutral and end-ROM cervical lateral flexion pre-positions. *Reliability* was assessed using intraclass correlation coefficient (ICC3,k). To calculate the effect of end-ROM cervical lateral flexion pre-positioning on the total available CRTP, the Wilcoxon signed-ranks test was performed. The segmental CRTP contribution was calculated using Friedman ANOVA. The C1-2 segmental contribution to the total available CRTP in end-ROM cervical lateral flexion pre-position was calculated using percentages.

**Results:**

Both, the iPhone as well as the CT scan measurements showed high intra-rater reliability coefficients (ICC3,k>.97) for measuring cervical lateral flexion ROM and CRTP ROM in both, cervical neutral as well as end-ROM lateral flexion position. End-ROM cervical lateral flexion

pre-positioning decreased the total available CRTP significantly ( $p = .005$) by 44% compared to CRTP in neutral position. End-ROM cervical lateral flexion pre-positioning had a statistically significant effect on all cervical segments, except C1-2, for CRTP. In end-ROM cervical lateral flexion pre-positioning, 89% of the total available CRTP occurred at C1-2 and only 1% at C2-C7, nearly excluding the disc segments from CRTP in end-ROM cervical lateral flexion pre-positioning.

**Discussion / Conclusion:**

Cervical lateral flexion pre-positioning prioritizes C1-2 movement assessment during cervical axial rotation by locking the other cervical segments. Therefore, it could be used for evaluating the C1-2 segment mobility regarding axial rotation by nearly excluding the other cervical segments from moving in axial rotation.

**ID: 10 (platform)**
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**Title:**

Are existing trials of manual therapy for low back pain more pragmatic or explanatory?

**Background / Purpose :**

Low back pain (LBP) is a common health condition and a leading cause of activity limitation, work absence, and years lived with disability globally. Manual therapy is an intervention used to manage LBP and has been investigated in research across multiple disciplines. Various aspects of trial design may be geared more toward efficacy (i.e.. explanatory) or effectiveness (i.e.. pragmatic), which may alter the applicability of findings to clinical practice. However, there is limited evidence suggesting that trials of manual therapy for LBP are more likely to be explanatory or pragmatic overall. Thus, the purpose of this systematic review was to determine whether manual therapy trials for non-specific low back pain (NSLBP) - that is, LBP not attributable to a known cause - are more explanatory or pragmatic to assist with clinical application.

**Methods :**

Randomized clinical trials (RCTs) published between 2000 and 2021 that investigated manual therapy as a treatment for patients with NSLBP were included. Studies were screened by 2 independent raters and scored using the Rating of Included Trials on the Efficacy-Effectiveness Spectrum (RITES) tool to assess included studies across the 4 domains of participant characteristics, trial setting, flexibility of interventions, and clinical relevance of experimental and comparison interventions. Each domain was rated on a scale of 1 to 5, with 1 indicating strong emphasis on efficacy and 5 indicating strong emphasis on effectiveness.

Descriptive statistics were calculated for all 4 domains.

**Results:**

Following screening, 131 RCTs were included. Findings suggest that the existing body of literature investigating manual therapy for NSLBP is slightly skewed toward efficacy for participant characteristics (mean=2.88, SD=1.14) and more so for trial setting (mean=2.31, SD=1.25) and flexibility of interventions (mean=2.43, SD=1.28). The only domain found to be oriented toward effectiveness was clinical relevance of experimental and comparison intervention(s) (mean=3.28, SD=1.42).

**Discussion / Conclusion:**

The existing body of RCT evidence related to manual therapy for NSLBP is slightly skewed more toward efficacy than effectiveness across most domains of trial design, with the exception being clinical relevance of interventions. A systematic review by Roenz et al demonstrated that the use of a pragmatic vs prescriptive design for delivery of interventions alone could substantially impact the outcomes obtained. Researchers may wish to design future trials with more of an emphasis on effectiveness across all domains to mirror real-world clinical practice and improve external validity more closely. Furthermore, consumers of research may wish to consider the pragmatism of individual studies and can utilize tools such as the RITES tool to better clarify and understand the nature of a study and its applicability to clinical practice.

**ID:** 11 (platform)

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**Title:**

Physical Therapist Student Confidence and Utilization of Manipulations following the inclusion of Biofeedback Training during Instruction

**Background / Purpose :**

Assessment of Doctor of Physical Therapy (DPT) student's performance of specific hands-on skills is generally only at the culmination of the course. Little is known about the long-term maintenance of the skills acquired during the entirety of their didactic curriculum. The objective of this study was to assess DPT student's confidence and utilization of thoracic and lumbar manipulations throughout their physical therapy curriculum.

**Methods :**

A convenience sample of 38 students across two cohorts was employed. A survey was completed by each participant three times over the course of their DPT education. Online consent was achieved prior, and surveys were completed via Survey Monkey. Group one received training as normal, and group two received instruction modified to include smaller group sizes and the utilization of biofeedback equipment in the learning of the manipulation techniques. A Mann Whitney U test was performed for between group comparisons over each time point. The significance value was set to p= 0.05. The study was approved through East Tennessee State University's

Institutional Review Board in December 2017.

**Results:**

39 total students consented and completed the study across the three collection periods. No significant difference across the groups was noted in the confidence or utilization of those manipulations. The participants surveyed demonstrated 91.9% confidence for thoracic manipulations and 74.2% confidence for lumbar manipulations. 97.6% of students reported agreement that they were adequately trained in manipulation and 92.4% of students reported they were very likely or somewhat likely to perform manipulation when indicated.

**Discussion / Conclusion:**

Indications that both methods of instruction for thoracic and lumbar manipulation was appropriate and led to increased student confidence in, and an increased likelihood of performing the techniques. While no significant difference was found amongst the groups or over time, a high percentage of students in both groups expressed confidence in performing these techniques. The high expressed confidence could have led to the lack of difference found in the two groups over time. There is conflicting research that biofeedback and variation in types of instruction show a difference in students learning on the psychomotor skills. However, most of these studies look at singular moments and do not follow over time. Limitations of this study include a small sample size, cohorts only from a single university and the potential lack of reliability of the survey tool utilized. Future research to look at both the methods of instruction as well as student long term utilization and confidence is needed.

**ID:** 12 (platform)

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**Title:**

DELIBERATE PRACTICE WITH REAL-TIME BIOFEEDBACK TO IMPROVE MANUAL THERAPY SKILLS OF PHYSICAL THERAPY STUDENTS

**Background / Purpose :**

Joint mobilizations are widely used in manual physical therapy practice and considered an entry-level training requirement in Doctor of Physical Therapy (DPT) programs. Precision in performing manual therapy techniques is a difficult skill to acquire and studies have suggested novice mobilization force parameters and consistency are variable. Therefore, the purpose of this process improvement project was to 1) quantify first year Army-Baylor DPT program student (n=25) force parameters, 2) identify patterns of confidence and consistency while performing peripheral and spinal

patterns of confidence and consistency while performing peripheral and spinal mobilizations, and 3) develop a deliberate practice protocol to enhance manual therapy psychomotor skill acquisition.

**Methods :**

Students attended a 1-hour introductory session focused on manual therapy concepts and familiarization of joint mobilization techniques using capacitance-based force pad sensor technology. Each participant then applied knee and lumbar spine mobilizations to a volunteer student-model while force parameters were recorded using the quantitative feedback force pad device. Participants completed surveys assessing their perceived knowledge and skill in applying graded mobilizations both before data collection and after completing their formal manual therapy education.

**Results:**

Pooled mean peak forces for the cohort were 75.71N (± 34.10) for knee Grade III and 86.38N (± 43.02) for Grade IV. Mean peak forces for lumbar Grade III mobilizations were 205.16N (±

58.18) and 205.18N (± 69.66) for Grade IV. Mean oscillation frequency was 0.79 ± 0.29 for knee Grade III and 1.13 ± 0.35 for Grade IV. Mean oscillation frequency was 0.88 ± 0.25 Grade III and 1.29 ± 0.35 for lumbar Grade IV. Student median confidence score in applying graded mobilizations was low (1, 0-4 ordinal scale). Students mean peak force intra-rater reliability ranged from 0.184 to 0.803 using ICC 3,1. Mean peak forces for 24% of students (6/25) fell within 2SD of the faculty reference standard for knee flexion and 44% (11/25) fell within 2SD for lumbar mobilizations. Deliberate practice protocols were developed to create a methodology toward utilizing force sensors within an educational environment.

**Discussion / Conclusion:**

Student applied mobilization forces reflected a wide range of variability that were larger in magnitude than faculty reference standards for knee and lumbar mobilizations. This variability of mean peak force data suggests poor intra-rater reliability of entry level students. Designing deliberate practice methods has the potential to enhance joint mobilization skill acquisition and consistency of performance. The use of novel technology to provide accurate real-time biofeedback, implemented through deliberate practice, may improve the joint mobilization education of entry-level DPT students. Further research is still needed to validate the use of capacitance-based force pad sensor technology and deliberate practice in mobilization skill acquisition.

**ID:** 13 (poster)

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**Title:**

How common is long-term opioid utilization after lumbar fusion? a systematic review

**Background / Purpose :**

Manual therapy for back pain is a proven, safe, and effective alternative to invasive procedures and opioid usage, however, surgery often becomes the end state. The rate of elective spinal fusions has grown approximately 63% between 2004 and 2015. By the time surgery is warranted, literature estimates preoperative opioid use to range from 20% to over 70%, with nearly 20% of this population being opioid dependent. Most patients expect surgery to result in reduced pain, improved function, and less need for opioid-based pain medication. Unfortunately, some studies show that only a small portion of patients who undergo surgery will be able to reduce narcotic use afterwards and other studies find that many patients end up utilizing opioids long-term. Of particular concern are findings that suggest a substantial number of patients who were opioid-naive before surgery become long-term opioid users
following surgery, which may contribute to surgery-induced dependence on opioids. While there are data to suggest long-term opioid use after spinal fusion may be common in some settings, the reporting of long-term opioids in clinical trials and observational studies for lumbar spine fusion is unknown. The purpose of this review was to 1) identify the proportion of longitudinal studies that report opioid use after surgery, and 2) from these studies, identify the rates of long-term opioid use after a lumbar spine fusion procedure.

**Methods :**

The authors performed a systematic search of the literature from January 1, 2005, to June 30, 2020, utilizing PubMed, CINAHL, Cochrane Central Register of Controlled Trials, and OvidMedline to identify trials assessing the effectiveness of lumbar fusion for the management of low back pain.

**Results:**

Of 6,872 potential studies identified, 329 met criteria for final inclusion, with only 32 (9.7%) reporting any type of postoperative opioid use (21 tracked opioid use for a minimum of 6 months). Long-term opioid use after surgery ranged from 6% to 85.9% based on only 6.4% of all studies reporting a long-term opioid use outcome (minimum of six months).

**Discussion / Conclusion:**

Overall, the metric of postoperative opioid usage has been poorly reported in lumbar fusion trials. Patients may expect a reduced need for opioid-based pain management after surgery, but the limited data available suggests many individuals continue to use opioids long-term. Without data on long-term use, it is impossible to say how effective these surgeries are at reducing pain or opioid usage. This poor reporting tempers conclusions and limits a patient's ability to make fully informed decisions about procedure effectiveness. If the patient expects to stop narcotics post-procedure and few studies look at this outcome, this expectation cannot be adequately addressed. Future trials should track opioid utilization after surgery as a core outcome as well as manual therapy’s ability to reduce dependence on long-term opioid use.

**ID:** 14 (platform)

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**Title:**

THE EFFECTS OF CERVICAL AND THORACIC THRUST MANIPULAITONS ON SHOULDER RANGE OF MOTION IN PATIENTS WITH ROTATOR CUFF RELATED SHOULDER PAIN

**Background / Purpose:**

Thrust manipulation (TM) to the cervical and thoracic spines have been investigated in Rotator Cuff Related Shoulder Pain (RCRSP), however the effects on muscle length have not been quantified. The purpose of this study was to investigate the immediate and medium-term effects of cervical and thoracolumbar TM on shoulder flexion range of motion (ROM).

**Methods:**

Twenty subjects with RCRSP were recruited via convenience sample and randomly allocated to receive either a C6-C7 (mean age 32.2 ±5.8; 7 male, 3 female) or T12-L1 (mean age 28.9 ±5.3; 5 male, 5 female) TM. Outcome measures of pain intensity and two shoulder flexion ROM values for latissimus dorsi muscle length were assessed before treatment, immediately post-treatment, and 2 weeks after treatment.

**Results:**

Statistically significant increase in shoulder ROM with cervical TM (3.75 cm; $p<.01$) and thoracolumbar TM (7.25 cm; $p<.01$) were demonstrated immediate post-treatment. No significant differences were noted at two-week follow-up.

**Discussion / Conclusion:**

Cervical and thoracolumbar TM demonstrated within session immediate increased shoulder ROM in patients with RCRSP. Potential mechanisms for this change include reduction of muscle tone through alteration of Golgi Tendon Organ and muscle spindle activity via stretch-reflex response or descending pain inhibition (Willard, Pickar). Clinicians may consider cervical or thoracolumbar TM to improve immediate shoulder flexion ROM as part of a multi-modal treatment approach.

**ID:** 15 (poster)

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**Title:**

PHYSICAL THERAPY MANAGEMENT OF VERTIGO AND CEPHALGIA SECONDARY TO TRIGEMINAL CENTRAL SENSITIZATION: A CASE STUDY

**Background / Purpose :**

Vertigo can be caused by semicircular canal dysfunction, but rarely is the trigeminal tract involvement discussed. This case report describes the differential diagnosis and treatment of a patient suffering for four years with unexplained eye pain, tinnitus, aural fullness, dizziness/vertigo, and cephalgia. The neurological link between trigeminal sensory distribution, the muscle spindle fibers innervated by C1-3, and the mechanoreceptors of the C0-2 joints need to be clearly understood to rehabilitate this patient population.

**Case Description:**

A 56-year-old female presented to physical therapy complaining of 8/10 vertigo, 10/10 left facial pain, tinnitus and left aural fullness, ophthalmalgia, and left posterior cephalgia. She had sought medical care from a specialist for four years without success. The physical therapy evaluation found normal seated cervical active range of motion, but she had to go slowly to not be symptomatic. Cranial nerve testing and cervical segmental stress was negative. Passive CO-C2 flexion and left rotation provoked her symptoms.

**Outcomes:**

After four treatment sessions, she reported 0/10 dizziness and pain. The patient's tinnitus and aural fullness resolved, and she could quickly rotate, flex and extend. She was able to rotate, flex and extend her cervical spine at a quick speed without symptoms.

**Discussion / Conclusion:**

Her posterior skull pain was due to C0-1 capsule fiber abnormalities. This refers pain into the C1-2 distribution. This was likely the precursor to the face and ear symptoms.

In the trigeminal cervical nucleus, the nociceptive afferents from C1, C2, and C3 spinal nerves converge onto second order neurons that also receives afferent information from adjacent cervical nerves and from the first division of the trigeminal nerve, via the trigeminal nerve spinal tract. Convergence between cervical afferents allows for upper cervical pain to be referred to regions of the head innervated by cervical nerves.

The ear and orbital symptoms were due to trigeminal afferent overlap with the abnormal afferent input from C1-3. Given the appropriate stimulus and convergent connections in the central nervous system, any structure innervated by cranial nerve V, X, VII, or IX can cause head or facial pain.

Her dizziness was caused by abnormal input from the muscle spindles innervated by C1-3 that project onto a shared second order neuron with a trigeminal afferent neuron in the dorsal column that then projects to the thalamus and cerebellum.

Tinnitus was likely caused by the vagus nerve and the afferent neurons from C1-3 sharing a second order neuron in the trigeminal nucleus.

**ID:** 16 (poster)

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**Title:**

MANAGEMENT OF FEMORAL-SAPHENOUS NERVE SENSITIVITY USING A MULTIMODAL APPROACH: A CASE REPORT

**Background / Purpose :**

Foot and ankle symptoms may be localized but can involve proximal contributions including the lumbar spine and/or peripheral nerve entrapments. The following case describes medial foot pain suspected to be related to femoral-saphenous nerve (FSN) sensitivity. FSN entrapment affects less than 1% of the population with potential causes being insidious or related to trauma/surgery. The FSN arises from the L2-4 spinal levels with the most common areas of entrapment being the adductor triangle and the fascia between the gracilis and sartorius muscles.

The purpose of this case report is to describe a potentially overlooked cause of foot pain and a comprehensive treatment approach resulting in significant improvements

**Case Description:**

A 69-year-old female referred from her podiatrist for “anterior tibialis tendinitis” presented with two separate areas of foot pain. Her primary complaint was waking at night from sharp/burning pain (P1) in the medial arch of her right (R) foot and a different sharp pain (P2) in the mid dorsum of her R foot. Her symptoms began 2 months prior to her evaluation after working additional hours at her retail job. Aggravating factors were standing > 1 hour, negotiating stairs into her 3rd floor apartment, and thigh compression from her cat sitting in her lap. Her significant medial history included a bilateral total hip arthroplasty with R revision due to metallosis. She completed 17 visits over nine weeks.

Initial treatment was directed locally with manual therapy and exercise. P1 was reproduced in subsequent visits with repeated lumbar motions, palpation along the FSN, and FSN tensioning prompting the addition of proximal interventions. Other clinical tests that guided decision making were a negative prone knee bend & SLR test, and the inability to reproduce P1 with lumbar mobility testing. The last session included dry needling to improve hemodynamics and decrease nerve sensitivity which was reserved per patient request. She reported the greatest improvement via email in P1 and her sleep quality after the final session. Primary outcome measures included the patient specific functional scale (PSFS), lower extremity functional scale (LEFS), and numeric pain rating scale (NPRS).

**Outcomes:**

LEFS scores at the first visit, the tenth visit, and at 8 months were 23/80, 47/80 & 51/80. NPRS at baseline was rest: 5/10, best: 3/10 & worst: 9/10 and at the 8 months (rest/best/worst: all 0/10). PSFS at baseline was an average score of 5.3/10 for walking/chores/walking upstairs) and at 8 months (10/10 for all).

**Discussion / Conclusion:**

This case describes clinical decision making to include proximal treatment and a multimodal approach for medial foot pain resulting in a significant improvement over nine weeks, that were sustained at 8 months. A regional approach, including dry needling, may be a viable option for similar presentations.

**ID:** 17 (poster)

Joan Colette Hollis, Veterans Administration Hospital

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**Title:**

IS HYPERMOBILITY SPECTRUM DISORDER A BENIGN LOW BACK PAIN COMORBIDITY? A SYSTEMATIC REVIEW

**Background / Purpose :**

**Background/ Purpose**: Hypermobility Spectrum Disorder (HSD) is one of the most common inherited genetic disorders, affecting as many as 10 million Americans. While joint hypermobility can be asymptomatic, it can be the prominent symptom of more serious systemic diseases with multiple comorbidities. The relationship between HSD and Low Back Pain (LBP) has been poorly understood, with conflicting evidence on whether HSD is a risk factor for LBP, or a prognostic outcome variable. The Beighton Scale is a nine-point clinical test used to evaluate HSD. A previous review for evaluation for a LBP subgroup found the Beighton Scale to have good interrater reliability. We performed a systematic review to evaluate whether HSD is a risk factor for LBP, or a prognostic indicator for outcomes, and its clinical relevance as a screening tool for systemic pathology.

**Methods :**

Our review was designed consistent with the 2009 Cochrane Method Guidelines using CINAHL, MEDILINE, PsycINFO, PubMed, and Complementary and Alternative Medicine Specialist Library, from inception to January 31,2021. Two independent reviewers used the PEDro scale and the 2009 Cochrane Risk of Bias Screening Tool to evaluate the studies.

**Results:**

Thirty-one unique abstracts were screened and four excluded because of a comorbidity focus or a non-LBP treatment. The remaining (n=27) full text articles were reviewed, and studies (n=13) were excluded because they were review articles (n=3), surveys (n=4), case studies (n=2), or did not include LBP (n=3). Both reviewers independently evaluated the remaining studies (n=14) and resolved disputes by discussion. Data extracted from each article included: author, publication date, setting, sample size, subject age and gender, duration of pain, Beighton score, tools used to quantify LBP, and statistical analysis.

**Discussion / Conclusion:**

Of the 14 studies, 8 investigated correlations between HSD and the incidence of LBP, 3 investigated the prognosis for LBP patients with HSD, and 3 studied exercise treatment effectiveness. Most of the studies showed subjects with HSD did not have a higher incidence of LBP than non-HSD subjects. Three prognostic studies demonstrated that LBP patients with HSD and the diagnosis of Lumbar Herniated Disc had a worse prognosis, than non-HSD patients treated with exercise, steroid injections, and surgery, over two years. Individualized, core stabilization exercises for LBP patients with HSD, by a physical therapist demonstrated effective treatment, while self-directed strength and conditioning exercises over twelve weeks, did not show improvement. The Beighton Scale comprises the basis of several more comprehensive scales and is an important tool for physical therapists to identify HSD in LBP patients, a comorbidity which adversely influences treatment outcomes.

**ID:** 18 (poster)

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**Title:**

BETWEEN-WEEK RELIABILITY OF THE CERVICAL RANGE OF MOTION (CROM) DEVICE FOR UPPER CERVICAL ROTATION

**Background / Purpose :**

**Background/Purpose:** Cervical range of motion (ROM) serves as a functional measure of one's capacity for head and neck movement and can also act as an outcome measure. It can also act as a potential diagnostic indicator of underlying pathology and dysfunction. The Cervical Range of Motion (CROM) device is an outcome measurement tool used to assess cervical mobility and is considered a standard of practice. Many studies have reported strong validity and between-week reliability of the CROM device supporting the clinical value of the instrument. Recent studies have examined the use of the CROM device to measure upper cervical flexion and extension, however, no study to date demonstrates its use in measuring isolated upper cervical rotation. The purpose of this study is to assess between-week test-retest reliability of the CROM device in measuring upper cervical rotation.

**Methods :**

**Method:** Thirty students participated in this test-retest reliability study. The CROM device was used to measure left and right cervical rotation in seated neutral and then with a fully

flexed head-neck to help isolate movement to the upper cervical spine. Students were asked to rotate their head and neck as fully and comfortably in each direction and back to neutral three times. The mean average of each ROM trial was recorded and later used for statistical analysis. All participants returned for the second day of testing one week after their first session and performed the same sequence of testing. Interclass correlation coefficient (ICC) was calculated for all motions. Measurement error was determined using standard error of measurement (SEM) and minimal detectable change (MDC).

**Results:**

**Results:** The CROM device demonstrated moderate to good reliability (ICCs 0.65-0.9) of full and upper cervical rotation. The SEMs for full and upper cervical rotations ranged from 2.2° to 3.1°, respectively. The corresponding MDC $_{90}$ values ranged from 3.6° to 5.1°.

**Discussion / Conclusion:**

**Discussion/Conclusions:** The results of this study suggest that the CROM device is a reliable outcome tool for measuring full and upper cervical rotation. These findings are concordant with those from previous research. These results also support the notion that cervical rotation can be biased to the upper cervical spine whilst the head and neck are fully flexed. The SEMs and MDCs of this study are small and suggest that the chance of repeated measurement error was relatively minimal for the between-week trials. The clinical implications of these findings suggest that therapists can utilize the CROM device to examine all planes of upper and full cervical mobility more completely. It may also assist in identifying upper cervical ROM limitations associated with underlying cervical pathology or motion dysfunction.

**ID:** 19 (poster)

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**Title:**

WHAT FACTORS INFLUENCE COST IN PEOPLE WITH LOW BACK PAIN?

**Background / Purpose :**

Low back pain (LBP) is the leading cause of disability worldwide and the costliest musculoskeletal disorder. In the US, the total cost of LBP management can be up to 625 billion dollars. This total cost includes direct and indirect cost, with direct cost accounting for 14.5% of total cost. Direct cost is direct monetary exchange of medical care and indirect cost is the economic burden with no direct monetary exchange. Known risk factors that influence cost for LBP include comorbidities, gender, neurological impairments, depression, and chronicity. Due to a correlation between physical activity and comorbidities/known risk factors, we believe patient reported outcome measures (PROs) and physical performance tests (PPTs) may offer further insight into the prediction of direct costs. To our knowledge, there is no literature exploring these concerning risk factors.

**Purpose:** Determine the costliest risk factors that influence direct cost of care in individuals with LBP by analyzing already known risk factors to potential risk factors such as PROs and PPTs.

**Methods :**

We performed a retrospective direct cost analysis for individuals with LBP and/or leg pain in the United States. Data was collected from a database from an ongoing research study between July 1st, 2017, to January 1st of 2021. Data gathered included MODI scores, FABQ scores, and subjective information such as mechanism of injury, symptom chronicity, pain location, irritability and nature, surgical history/surgical status. Objective information included range of motion, accessory motion, neural exam, and PPT using the Functional Lumbar Index (FLI). Participants included from the database: LBP with or without radiating pain, previous history of lumbar surgery, and acute/chronic LBP. Participants excluded: cervical pathology, incorrect or excessive missing data. Following data collection, participant's direct cost data was provided. A

Pearson correlation for baseline descriptive variables was performed, followed by a stepwise multiple linear regression to create a model to be used as a predictor of direct cost.

**Results:**

Our study started with a total of 600 participants. Of these 600, 248 participants fit the inclusion criteria. The stepwise multiple linear regression model demonstrated that current surgical status, prior surgical history, and FLI score were significant predictors of LBP cost accounting for up to 36% of the patient's direct cost. Surgical history and surgical status contributed 34% of the prediction while FLI contributed an additional 2% of the prediction of direct cost.

**Discussion / Conclusion:**

Current surgical status, prior surgical history and FLI can predict 36% of a patient's direct cost. Surgical history and surgical status make a substantial contribution to direct cost. Further research is needed to explore other variables that can contribute to LBP cost and if cost is modifiable through conservative treatment. This data can help clinicians be cognizant about a patient's spending and begin to speak to the financial barriers that could be in place for the patient.

**ID:** 20 (poster)

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**Title:**

The Characterization and Treatment Response of Lumbar Radiculopathy after 12 Weeks of Physical Therapy: A Retrospective Cohort Study

**Background / Purpose :**

Patients with low back pain (LBP) contribute to $365 billion dollars in medical costs and are the leading contributor to disability with 264 million workdays lost as reported by the 2010 Global Burden of Disease study. Neuropathic pain has been associated with higher risk of cost expenditure and surgical necessity. The most common form of neuropathic pain is lumbar radiculopathy, which is defined as radicular leg pain originating from a compressed spinal nerve root or dorsal root ganglion. Literature has demonstrated difficulty with characterizing patients with lumbar radiculopathy and their response to treatment. The purpose of this study is to characterize patients with and without radiculopathy at baseline by pain and disability scores to determine whether outcomes differed over 12 weeks of physical therapy. We hypothesized patients with lumbar radiculopathy will demonstrate improvements in outcomes after 12 weeks of PT.

**Methods :**

In this retrospective cohort study, a total of 29 subjects (20 radiculopathy and 9 no radiculopathy) completed 12 weeks of physical therapy intervention. This study did not control for total number of PT sessions or if they attended PT at all. Participants were screened and referred into the study from physicians within the UT Orthopedic Spine Surgery pr Mischer Neuroscience Centers. Participant data was collected by trained physical therapists at Memorial Hermann Spine Hospital or the Woodlands Memorial Hermann Spine center. Patients with radiculopathy are operationally defined as having dermatomal paresthesia, myotomal weakness or reflex changes based on Harrison et al. Participants presenting as no radiculopathy group were characterized by complaints of LBP with or without radiating symptoms into the lower extremities. The mODI and FABQ were used at initial evaluation and follow-up visits for subjective outcome measures. Objective information was gathered through a series of standardized physical performance tests: standard front plank, side plank for symptomatic and

asymptomatic sides, and Sorensen lumbar test or chest raise. A total Functional lumbar Index score was given based on the patient's ability to perform the tests. A 2x2 factorial MANOVA was performed using SPSS 25.0 to examine difference between radiculopathy and non-radiculopathy groups over a 12-week timeframe for the following dependent variables: NPRS, mODI, FLI, and total plank time. A Bonferroni correction was used with an alpha level of 0.05.

**Results:**

Independent t-tests were conducted to determine baseline differences in demographics between groups. There were no significant differences found at baseline between groups, except for mODI total score (26.25% for NR and 40.90% for R, $p=0.02$). The results of the 2x2 factorial MANOVA showed no significant interaction for any of the dependent variables being tested (NPRS, $p=0.958$; mODI, $p=0.478$; FLI, $p=0.435$; avg Plank time, $p=0.516$). The NPRS significantly improved within groups over time, dropping from 48.06 to 12.44 in the NR group and 54.43 to 19.27 in the R group ($p<0.001$). The mODI also significantly improved within groups over time, dropping from 26.25% to 9.56% in the NR group and 40.9% to 18.4% in the R group ($p=0.006$).

**Discussion / Conclusion:**

The results from this study indicate that individuals with lumbar radiculopathies have higher starting disability than those with isolated back pain. Additionally, both groups seem to improve equally over time in both pain and disability. Although pain and disability improve over a 12-week period, physical performance testing does not. This could indicate that pain and disability can be reduced prior to any noticeable improvement in physical performance. Post-hoc power analysis revealed that this study was moderately underpowered with a calculated Beta value of 0.45.

**ID:** 21 (poster)

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**Title:**

THE ADDITION OF PORTLAND LOAD TRANSFER TEST TO THE ASSESSMENT CLUSTER FOR GLUTEAL TENDINOPATHY

**Background / Purpose :**

Symptomatic gluteal tendinopathy (GT) involving gluteus medius (GMe) and minimus (GMi), the most common lower limb tendinopathy for which people seek medical help, affects 10-25% of the population and has a considerable negative impact on ambulation and sleep. There is a high positive predictive value for GT when painful palpation test is combined with any of the other physical tests: resisted flexion/adduction/external rotation (FADER-R), single-leg stance (SLS), resisted isometric hip abduction (ADD-R), and flexion/abduction/external rotation (FABER). The SLS is the only test in weight-bearing, and the remainders are in the horizontal position. The Portland test was developed by Cliff Fowler. The subject stands with the weight equally distributed between both feet in a stride position. A quick perturbation is applied to the sacrum and assesses the subjects' ability to remain stable. A positive test occurs when the affected side is not as stable as the normal side when the

test occurs when the affected side is not as stable as the normal side when the perturbations are applied. GMe and GMi are highly active during the stance phase of gait and may be dysfunctional with load transfer during gait in GT. Changes in these muscles during weight-bearing may not be evident since other superficial powerful torque hip abductor muscles may compensate for their deficits and the cluster for GT assesses pain. The purpose of this study was to explore the addition of the Portland test as a functional test in individuals with GT.

**Case Description:**

Ten subjects (9 female,1 male; 30 - 81y/o) referred for primary complaints of lateral hip pain and gait dysfunction. One clinician assessed each patient for the presence of GT. Included subjects had painful palpation over the greater trochanter and at least one other positive clinical test (FADER-R, SLS, ADD-R, and FABER). Subjects who met these criteria were then assessed using the Portland test.

**Outcomes:**

All ten subjects were painful to palpation over the greater trochanter and were positive on at least two of the other tests required to meet the positive clinical diagnosis of GT. Nine of the ten subjects tested positive for the FADER-R test. Eight of the ten subjects were positive for SLS.

Seven of the ten subjects were positive ADD-R test. Nine of the ten subjects were positive for FABER. Nine of the ten subjects were positive for the Portland test.

**Discussion / Conclusion:**

The addition of the Portland test to patients with complaints of lateral hip pain during gait that meets the clinical cluster for GT may be a useful adjunct to identify those individuals that have dysfunctional load transfer during gait.

**ID:** 22 (poster)

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**Title:**

PHYSICAL THERAPY PROFESSIONALS' OPIOID KNOWLEDGE AND ATTITUDES TOWARD OPIOID USE: A PILOT STUDY

**Background / Purpose :**

Physical therapy (PT) professionals can be part of the solution to the opioid crisis. Evidence exists to support the use of PT in treating pain and preventing chronic pain, along with CDC recommendations for the use of PT over prescription medications for the treatment of chronic pain. Many PT professionals are treating patients that are currently taking opioids or have recently taken opioids for post-operative pain or chronic pain. The purpose of this pilot study was to describe PT professionals' opioid knowledge, attitudes towards opioid use, and knowledge on managing an opioid overdose. This data could help inform how physical therapy professionals can best meet the challenges of the opioid crisis.

**Methods :**

Participants in this study were PT professionals in Indiana in all practice settings. A survey was administered online via a Qualtrics link to potential participants. The survey contained 12 questions on demographic information and 55 questions on knowledge and attitudes. The Opioid Overdose Knowledge Scale (OOKS) and Opioid Overdose Attitude Scale (OOAS) were used along with questions developed specifically regarding the PT professionals' role in solving the opioid crisis. Questions (non-demographic or not from standardized measures) were developed through discussion between investigators. Feedback from another rehabilitation professional was considered before using the questions in the final survey.

**Results:**

**1**840 surveys were sent out via email. A total of 67 PT professionals initiated the online survey. 60 participants completed the survey. Most respondents were licensed physical therapists 83.1% (n=54) or physical therapy assistants 12.3% (n=8), along with physical therapy students 4.6%(n=3). Only 7% of respondents agreed with the statement 'I already have enough information about how to manage an overdose'. Over 90% of participants agreed with the statements 'If someone overdoses, I want to be able to help them' and 'I am going to need more training before I would feel confident to help someone who had overdosed'. Only 10% agreed with the statement 'I am already able to inject naloxone into someone who had overdosed'.

**Discussion / Conclusion:**

The findings from the survey indicate many physical therapy professionals surveyed lack knowledge regarding opioid use, particularly the ability to manage an overdose. Most agree they want to be able to help if someone overdoses, but they would need additional training before feeling confident to help someone who had overdosed. Limitations of these findings include the small sample size from one Midwest state. Further investigation on a national level is indicated, as this information could influence strategies to maximize the impact of physical therapy professionals on the opioid crisis. This includes the management of an emergent situation, as well as enhancing care for patients using opioids.

**ID:** 23 (poster)

Max O'Malley, St. Ambrose University

**Title:**

Working with a challenging belief system: Manually Facilitated Motor Re-Education and Pain Neuroscience Education to Treat Neck Pain Following Multiple Fractures to the Atlas

**Background / Purpose :**

Current evidence supports a mixture of cervical, shoulder, and scapulothoracic intervention for neck pain. There is little to be found in the way of using scapulothoracic interventions exclusive of cervical interventions to treat the primary concern of neck pain. This case illustrates a patient with a history and belief system precluding the use of aggressive manual treatment at the cervical spine. The patient was subsequently treated with manually facilitated neuro muscular re-education principles targeting scapular mechanics and Pain Neuroscience Education to return to function.

**Case Description:**

53-year-old auctioneer referred for primary concern of cervical stiffness. Onset 9 months prior following an axial load to the skull; pt. had dropped a post driver on his head while setting up for an auction resulting in 3 fractures in C1 vertebrate as well as fracturing his skull. Pt was subsequently hospitalized, and it was determined that he would not have surgery; rather, he would spend three months in a collar. Following removal of collar pt. had short bout of PT with good outcomes, but symptoms returned after a few months, which brought him to this practitioner’s office. Pt had great apprehension over any manual therapy to the

neck. Subjective complaints included B neck stiffness, and upper trap pain limiting his job tasks as well as functional tasks such as driving. Objective exam revealed rotation limitations to 50 degrees B, both with contralateral neck pain; extension limitation at 50 degrees; flexion just short of chin to chest; levator length deficits; pec minor length deficits; significant scapular abduction and downward rotation in standing posture, inability to recruit low trap during shoulder elevation; significant serratus weakness and rhomboid over mid trap dominance in scapular adduction testing. Shoulder elevation further revealed poor upward rotation of B scapulae and cervical scapular muscle dominance over scapulothoracic musculature. Joint mobility throughout the cervical spine was mildly restricted to normal. Dermatomes, myotomes, reflexes, ULTT were all WNL.

Interventions focused primarily on manually facilitated neuromuscular re-education of the scapulothoracic muscles to counterbalance the dominant cervical scapular muscles thus reducing compression on the cervical spine and improving scapular mechanics, namely upward rotation.

Pain Neuroscience Education was utilized as well to address pt. apprehension and reduce fear of movement. PNE emphasized nerve sensitivity and brain plasticity often being the sources of chronic pain rather than tissue dysfunction; graded exposure was also integrated with manual and exercises to gradually return the pt. to full range of motion.

Manually facilitated scapular upward rotation was utilized and progressed from passive to active assistive to active. Special focus was paid to facilitating low trap and serratus and inhibiting scap elevators/downward rotators, namely levator scapula. STMs were also utilized to inhibit rhomboids as the pt. tended to downwardly rotate in adduction of scapulae. Serratus walkouts and wall slides were utilized in conjunction with the above scapular mobilizations and prone LT exercises to improve upward rotation; the therapist utilized tactile cues in early treatments to maintain upward rotation and gradually weaned as pt. motor learning improved. Progressions from passive to active assisted to active exercise were utilized culminating in prone arm lifts from table focusing on low trap recruitment and avoiding rhomboid and levator/upper trap compensations. HEP included the above exercises progressed in difficulty as pt. showed competence within clinic.

**Outcomes:**

The pt. was seen for 6 visits over 4 weeks. Cervical rotation improved to 70 L and 80 R, extension to 65, flexion achieved chin to chest. Scapular mechanics demonstrated near-full to full upward rotation during elevation and LT muscle testing was 4/5 on R and 4-/5 compared to unable to recruit on initial eval. NDI improved from 40 to 10 percent. Pt also reported reaching his goal of setting up for heavy equipment for auctions at work.

**Discussion / Conclusion:**

Current evidence supports scapulothoracic interventions, in conjunction with cervical interventions, to treat neck pain. This case illustrates the treatment of cervical pain through manually facilitation of neuromuscular force couples of the cervicoscapular muscles and the scapulothoracic muscles in a pt. with pain beliefs precluding direct intervention at the cervical spine.

**ID:** 24 (platform)

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**Title:**

SAFETY MARGINS IN DRY NEEDLING THE TIBIALIS POSTERIOR MUSCLE: ULTRASOUND EVALUATION OF NEEDLE PLACEMENT

**Background / Purpose :**

The tibialis posterior (TP) muscle plays a critical role in the function of the foot and ankle including supporting the medial longitudinal arch, assisting in propulsion of the body during gait, and increasing the frontal plane stability of the foot. TP dysfunction, including trigger point development, may be involved in ankle and hindfoot injuries. Dry needling of tibialis posterior trigger points is one intervention used in the rehabilitation of patients with an ankle or hindfoot injury. Information on the safety of needle placement into the TP is limited in published literature.

The purpose of this study was to determine the accuracy of dry needle placement into the TP muscle using ultrasound guided needle insertion and to measure the safety margins between the needle and the neurovascular bundle containing the tibial nerve and posterior tibial artery.

**Methods :**

20 healthy, non-disabled individuals were recruited for the study. Participants were positioned in right side-lying with the medial side of the right leg exposed. A needle was inserted into the TP guided by identification of anatomical landmarks and muscle contraction. Ultrasound imaging in a short axis view was utilized to visualize needle location, determine accuracy of placement of the needle in the TP, and to measure the distance between the needle and the neurovascular bundle.

**Results:**

Needle placement was determined by ultrasound assessment. The needle was accurately placed into the TP muscle in all participants. The average distance between the needle and tibial nerve was 10.0 ± 4.7 mm and the average distance between the needle and the posterior tibial artery was 10.2 ± 4.7 mm.

**Discussion / Conclusion:**

The results of this study provide data to support that dry needling application into the TP muscle can be completed in an accurate and safe manner for healthy individuals.

**ID:** 25 (poster)

Cheri Hodges, A.T. Still University

Barbara Maxwell, A.T. Still University

**Title:**

PHYSICAL THERAPIST'S UTILIZATION OF CLINICAL TESTS FOR ASSESSMENT OF SACROILIAC JOINT DYSFUNCTION: A 12-YEAR TIME SERIES EXPLORING CLINICAL REASONING

**Background / Purpose :**

The sacroiliac joint (SIJ) continues to be highly debated as a source of pain and dysfunction within the lumbosacral region. While clusters of tests have been identified to assess SIJ dysfunction (SIJD), there is no strong evidence to support the validity of most tests. As the profession moves to a more contemporary biopsychosocial approach to management of conditions in the lumbosacral region, and focuses on evidence-based practice, there is a need to explore the use of such tests and their role within the clinical reasoning process.

This study addressed the following research questions. What are the most common clinical tests, and combinations of tests, used by US physical therapists in evaluation of SIJD? Have these changed over time? How do they relate to current evidence? How do therapists describe their clinical reasoning in the selection of tests?

**Methods :**

An online survey was administered in 2007, 2013 and 2019 to the APTA orthopedic section with additional snowball sampling. The survey was structured around four categories of tests, currently found in the orthopedic manual therapy literature: motion, pain provocation, symmetry, and neuromuscular control. Data analysis involved descriptive statistics, to examine trends over time and content analysis of open-ended question responses.

**Results:**

A total 1,213 participants completed the survey. In response to a filter question (do you currently treat patients with SIJD?) 1,097 reported yes and were included in the final data set. Demographic characteristics of the samples remained consistent, excluding degree status, and location.

Data for symmetry and motion tests demonstrated a decline in use over time, with rank order of the selected tests remaining constant. Pain provocation tests demonstrated increased or consistent usage. Test combinations, within each subset, remained largely consistent.

The overall trend is towards pain provocation testing, and away from symmetry and motion. Therapists reported clinical expertise as most influential in their clinical reasoning, followed by best evidence, and patient values, preference, and expectations.

**Discussion / Conclusion:**

Orthopedic physical therapists consistently report using a multi-test approach which aligns with current best evidence in assessment of SIJD. Preference for specific tests does not appear to have changed over time, however the most recent survey demonstrates a drop in the number of tests used by therapists, aligning with contemporary literature showing movement away from special tests towards a more global biopsychosocial approach. While evidence questions the validity of these clinical tests, many therapists continue to use them in the assessment process. Further exploration of how physical therapists integrate findings from clinical tests into their clinical reasoning process is needed.

**ID:** 26 (platform)

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**Title:**

EFFECTIVENESS OF LUMBOPELVIC STABILIZATION METHODS ON GLUTEAL MUSCLE RECRUITMENT DURING HIP MOVEMENT: A SYSTEMATIC REVIEW

**Background / Purpose :**

Gluteal muscle recruitment is a focus of many spine and lower extremity rehabilitation and injury prevention programs. Stabilization of the lumbopelvic region during hip movement is frequently used to improve the performance of the gluteals. While various methods of lumbopelvic stabilization have been found to be effective in altering trunk musculature recruitment, its effect on gluteal muscle recruitment during hip movement is unclear. The purpose of this review is to study the effect of lumbopelvic stabilization on gluteal muscle recruitment during hip movement.

**Methods :**

Cochrane, PubMed, Sports Discus, CINAHL, SCOPUS, Web of Science and Pedro databases were searched in March 2019 and November 2020 for studies that examined the relationship of trunk stabilization and gluteal recruitment, defined as muscle onset and amplitude, during hip movement measured by surface electromyography. Eligible studies included asymptomatic and symptomatic

participants of any age, gender, or health condition. Studies focusing on non-human participants or gait were excluded. Two authors independently assessed papers for inclusion, study quality and risk-of-bias. Studies were assessed using the Quality Assessment Tool for Observational Cohort and Cross-sectional studies.

**Results:**

Fifteen cross-sectional studies were included in the review. Study quality and risk-of-bias assessment revealed studies of fair to good quality. Four studies included participants with low back or sacroiliac joint (SIJ) pain and the remaining studies included asymptomatic participants. Twelve articles reported earlier muscle onset or increases in gluteus maximus or medius amplitude utilizing internal or external stability methods that included abdominal hollowing, pelvic belts, and other non-descriptive lumbopelvic stabilization techniques during hip

movement. Seven out of nine studies that utilized biofeedback tools found increases in gluteus maximus or gluteus medius amplitude. There was no significant change in gluteal muscle amplitude and muscle onset with use of the abdominal bracing technique in the studies reviewed. Three of the four studies involving participants with low back or SIJ pain reported improved gluteus maximus amplitude with lumbopelvic stabilization during hip movement.

**Discussion / Conclusion:**

The results of this review suggest that use of pelvic belts or feedback tools with internal stabilization methods to monitor lumbopelvic stability may be helpful in increasing gluteus maximus and medius recruitment during hip movement in those with and without low back or SIJ pain. Incorporating these techniques during hip movement may be a helpful addition to rehabilitation programs in which the goal is to improve gluteal muscle recruitment. Experimental studies looking at the effect over time are recommended.

**ID:** 27 (poster)

**All Authors:**

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Steve Karas, Chatham University

**Title:**

A CRITICAL APPRAISAL AND SUMMARY OF THE APTA'S ORTHOPEDIC SECTION'S LUMBAR SPINE CLINICAL PRACTICE GUIDELINES

**Background / Purpose :**

Physical Therapists often rely on clinical practice guidelines (CPGs) to synthesize the evidence and assist them in patient care decisions. It is important to understand the methodology of the research utilized in compiling these recommendations.

**Methods :**

We attempted to collect and review all references in the APTA's lumbar spine CPGs. We were able to locate 323 of the 327 references. The most common references were cohort studies (41), reviews (49), reliability and validity assessments (24) and randomized control trials (RCTs) (33). Of interest is that there were very few studies that focused primarily on anatomy and epidemiology (6) or sensitivity and specificity of testing (4). We further examined the RCTs to determine average participant age, classification system use, publication year and inclusion/exclusion criteria. We also assessed their Pedro scores.

**Results:**

In the RCTs we reviewed, the range of subject ages was 14 to 80 with an average of 40.8 where reported. A classification system was used in 11 of the 33 papers. The

range in years of publication was 1977-2011 (34 years) with an average publication year of 2004. We found inclusion criteria to be most commonly nonspecific low back pain, low back pain with or without referred/radiating symptoms, acute/subacute LBP, and age range 18-60. The most common exclusion criteria were osteoporosis, pregnancy, prior spinal surgery, and red flags such as: inflammatory disease, malignancy, infection, spinal fracture, signs of nerve root compression or cauda equina syndrome. Pedro scores were calculated for all 33 RCTs and ranged from 4-10 with a 7.5 average, and median of 8.

**Discussion / Conclusion:**

Because clinicians implement the CPGs in daily practice for individuals with LBP, we believe it is essential to recognize the heterogeneity of patient populations in the RCTs used to create them. Clinicians should think critically before applying methods suggested in the CPGs and ensure that

the intervention suggestions are applicable to the patients they are treating. Furthermore, the range in Pedro scores suggests that the quality of studies included should be examined before their inclusion in future CPGs and include a quality cut off. CPG authors may consider a searchable coding system to match high quality interventions and literature for the busy clinician. The CPGs are an extremely useful tool for busy clinicians; however, we suggest that by improving the presentation of future CPGs the interventions provided could be more applicable to specific patient populations and utilized more often.

**ID:** 28 (poster)

Daniel Kaschke, St Ambrose University

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**Title:**

Management of a patient previously undiagnosed with Complex Regional Pain Syndrome using Pain Neuroscience Education, Graded Motor Imagery, and Manual Therapy: A case report

**Background / Purpose :**

Complex Regional Pain Syndrome (CRPS) is typically addressed with a multidisciplinary, individualized approach including physical therapy (PT) as a common conservative treatment option. The purpose of this case study is to describe the use of pain neuroscience education (PNE), graded motor imagery (GMI), and manual therapy (MT) for neural desensitization to improve function in a patient with CRPS-like symptoms.

**Case Description:**

A 40-year-old male presented to physical therapy 6 weeks status-post revision of left tarsal tunnel release. Due to persistent pain following the initial release the patient had been partial weightbearing in a CAM boot for the previous 10 months. After the revision, he described allodynia in the left medial arch with no improvement in his heel pain along with an absence of sweating and cyanotic discoloration when the left foot was in a dependent position. He described significant pain to light pressure on the plantar aspect of his calcaneus. Active range of motion (ROM) and ambulation significantly increased his pain. Numeric pain ratings were 8/10 at worst and 6/10 at best, with a Lower Extremity Functional Scale (LEFS) score of 30% function. Despite the signs and symptoms consistent with CRPS, no diagnosis had been made. Initially PT intervention utilized PNE in conjunction with manual therapy. Manual intervention included soft tissue mobilization, scar

mobilization, and joint mobilizations. Dorsiflexion (DF) ROM improved, however pain increased to 8/10 at best for multiple days after each therapy session with traditional MT. Therefore, therapy shifted to a neurophysiologic approach. The next four weeks of therapy focused on PNE, emphasizing GMI localization and desensitization training with no manual therapy. This allowed improvements so the therapist then was able to progress with a combination of MT techniques as well as continued PNE and GMI.

**Outcomes:**

Active DF ROM improved from initially -14 degrees to 5 degrees; average pain 8/10 initially to 5/10. Pain pressure thresholds increased from 2.0 to 2.9 pounds /inch$^2$ at the calcaneus and from 15.8 to 27 pounds/inch$^2$ proximally at the anterior thigh. LEFS improved to 38%. The patient was able to progress to partial weight bearing out of the boot on soft surfaces with no increase in pain. Treatment is currently ongoing.

**Discussion / Conclusion:**

The physical therapist identified a clinical pattern consistent with CRPS, which necessitated a shift from strictly MT to the use of neurophysiologic intervention. This case demonstrates the importance of using PNE and GMI in patients with CRPS-like symptoms who do not tolerate traditional MT. In patients with centralized pain syndromes, neural desensitization through PNE and GMI may allow for improvements in mobility and function when pain is a limiting factor to traditional orthopedic manual physical therapy.

**ID:** 29 (poster)

Alex Birely, St. Ambrose University

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**Title:**

INCORPORATING LATERAL SHIFT END FEEL ASSESSMENT INTO CHRONIC LBP EVALUATIONS: A CASE REPORT

**Background / Purpose :**

Chronic low back pain has a prevalence of 19.6% for those ages 20-59[1]. The purpose of this case report is to emphasize the addition of lateral shift end feel assessment into chronic low back pain evaluations.

**Case Description:**

A 68-year-old male presented with a 10-year history of chronic low back pain (S1) with secondary right calf pain (S2) and right foot numbness/tingling (S3). The patient described S1, the most debilitating, as a constant ache in the central lower lumbar spine that worsened with standing >10 minutes, ambulating >10 minutes, and home care tasks. S2 was described as a "shooting pain", related to S1, aggravated with standing or ambulating >10 minutes. S3 was described as numbness from base of 1$^{st}$ metatarsal spreading over the dorsal forefoot. S3 was only elicited with ambulation >10 minutes.

Initial examination findings: A) Normal neurological screen (Reflexes, Babinski, Clonus, and Sensation). SLR 45 degrees on left and 35 degrees on right with provocation of S1 and S2 with dorsiflexion-adduction sensitizer. B) Lumbar ROM: Flexion finger to ankle, extension 5 degrees with reproduction of S1. Right lumbar posterior quadrant reproduced S1. C) Strength: Grossly intact with 4/5 weakness of right hip abduction and hallux extension. D) Joint mobility: posterior-anterior mobilizations tender at L4-5 and L5-S1 centrally and on right. No observed lateral shift but firm end-feel and reproduction of S1 noted when mobilizing trunk to right past neutral. E) Functional

end-feel and reproduction of S1 noted when mobilizing trunk to right past neutral. E) Functional assessment: Uncompensated right trendelenburg gait and significant ankle pronation bilaterally during stance phase. F) S3 was unable to be reproduced with neural or mechanical provocation tests.

**Outcomes:**

The patient was seen twice per week for six weeks. S1 improved and S2 resolved within 4 visits utilizing manual intervention focused on right foraminal and facet opening at L4-5, L5-S1. S3 was unrelated as symptoms resolved when patient purchased new footwear prior to visit 6. S1 resolved at visit 9 after intervention was adjusted to include lateral shift with grade IV+ overpressure beyond neutral and self-shift correction on HEP. At discharge, the patient's lumbar extension was asymptomatic to ~15 degrees, SLR was 50 degrees bilaterally, right hip abduction and hallux extension strength were 5/5, NPR score was 0/10 (initially 6/10), and the patient could stand and ambulate for greater than 1 hour.

**Discussion / Conclusion:**

This case presents the importance of assessing lateral shift past neutral in physical therapy evaluations and incorporating into potential treatments for chronic low back pain. This poses as a potential assessment and treatment intervention if relevant to a patient's symptom presentation.

**ID:** 30 (poster)
Saravanan Balasubramani, Institute of Therapeutic Sciences, Novi, Michigan

**Title:**

THE EFFECTS OF COMBINED CERVICO-THORACIC AND CRANIAL MOBILIZATION IN AN INDIVIDUAL WITH TENSION AND CERVICOGENIC HEADACHE

**Background / Purpose :**

Tension headache (TH) presents with a pressing, dull sensation of a tight band around the head. Cervicogenic headache (CCH) presents with unilateral non-pulsatile pain in the occiput radiating to the frontoparietal and orbital region caused by mechanical dysfunction of the musculoskeletal units of the neck and thoracic region. This case report documents the outcome of cervical and upper thoracic manual physical therapy (MPT) combined with cranial mobilization on a subject with CCH and TH.

**Case Description:**

A 59-year-old female patient presented with global headache, neck stiffness, with specific sharp burst pain radiating from the base of the neck to the right side of the forehead and retro-orbital region. Patient assessment elicited tenderness over the C2-T4 spinous process, right C2-C3 facet joint, right cervicothoracic paraspinal muscles, galea aponeurotica, temporalis, frontalis, and occipitalis, with restrictive active cervical right rotation, positive provocation of symptoms during Cervical Flexion-Rotation test

right rotation, positive provocation of symptoms during Cervical Flexion-Rotation test (FRT), and T1-T4 hypomobile posteroanterior glide.

**Outcomes:**

The intervention included soft tissue mobilization of the suboccipital extensor (SOE), semispinalis capitus, and levator scapula combined with dry needling to the SOE and upper trapezius, followed by passive cervical forward nodding in right rotation, grade III-IV posteroanterior gliding over left C1 transverse process and C3-C7 right facet joints. Upper and mid-thoracic thrust manipulations were applied in supine. Treatment was concluded with strengthening deep neck flexor, SOE, middle trapezius, and serratus anterior musculature. The patient attended a total of 12 visits over 6 weeks, at her 5 $^{th}$ visit, she reported a decrease in unilateral occipital and frontal-ocular headaches with persisting dull global headache and a tight sensation in the head. This was due to galea aponeurotica causing intrinsic tension tightness which in turn caused compressive effects on frontal, sagittal, and lambdoid sutures. Additional impairment of the temporalis could cause the same effects on the squamous suture. Hence soft tissue mobilization was extended to the galea aponeurotica and temporalis followed by manual stretching of the squamous, zygomatic, frontal, coronal, and lambdoid sutures. Post-intervention outcome showed negative tenderness over musculature, C2-T4 spinous process, right C2-C3 facet, and negative FRT test. Functional outcome measures showed an improvement in Headache

Disability Index from 66% to 6%, Neck Disability Index from 64% to 0%, and Visual Analog Scale improved from 4/10 at best, 10/10 at worst to 0/10 at discharge.

**Discussion / Conclusion:**

MPT intervention addressing the occipital and unilateral frontal-ocular headache targeting the cervical and thoracic region appeared to benefit the cervicogenic component of the headache presentation. The addition of MPT intervention to the galea aponeurotica and temporalis with manual stretching of the squamous, zygomatic, frontal, coronal, and lambdoid sutures appeared to additionally benefit the global cranial component of the headache presentation.

**ID:** 31 (platform)

Laura Favaro, Daemen College

Jason Grandeo, University of Lynchburg
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**Title:**

Is it a pain in the neck or just good practice? Compliance with reporting interventions in research studies: a systematic review

**Background / Purpose :**

Thorough reporting of intervention methods and design in published research is essential for evidence-based clinical practice, protocol replication and validation in future studies. Multiple peer-reviewed randomized control trials all recommend exercise therapy for treating chronic neck pain. However, translation to clinical practice is limited due to incomplete reporting of the dosing parameters (frequency, duration, intensity/load). To standardize and improve reporting quality in healthcare research, the Equator Network promotes the use of the Template for Intervention Description and Replication (TIDieR) and the Consensus on Exercise Reporting Template (CERT) reporting guidelines. The purpose of this systematic review was to assess the accuracy of exercise prescription cited in the literature for the treatment of patients with chronic neck pain using the TIDerR and CERT.

**Methods :**

Three databases, MEDLINE (OVID), CINAHL, and PubMed, were searched for randomized controlled trials published between January 2000 and May 2020. Studies included met the criteria of therapeutic exercise as a primary intervention for chronic neck pain present for at least three months. Compliance with TIDieR and CERT guidelines and risk of bias was assessed using the Cochrane Risk of Bias Tool Version 2 (ROB2). The RoB2 provides an algorithm to rate overall bias in randomized controlled trials.

**Results:**

Fifty randomized clinical trials met the inclusion criteria and were independently appraised by the authors for guideline reporting compliance. The overall average reporting compliance for the TIDieR and CERT was 51.0% and 45.3%, respectively. The overall risk of bias for 52% (n=26) of the studies included in this systematic review were high, and 20% (n=10) of the studies were scored low. The average reporting compliance for the studies with low bias was 60.7% for TIDieR and 54.4% for CERT guidelines. Exercise therapy prescription for 34% of the studies (n=17) were ranked good (reporting frequency, duration, and intensity) while 20% (n=10) were ranked poor (reporting 1 or 0 dosing criteria).

**Discussion / Conclusion:**

According to the clinical practice guidelines of neck pain, moderate evidence supports the use of exercise therapy, while weak evidence supports manual therapy in the treatment of chronic neck pain. Fredin and Loras found the combination of these therapies does not seem to be more effective for patients with chronic neck pain over exercise alone. Incomplete exercise therapy dosing parameters challenges evidence-based clinical practice, protocol replication and validation in future studies. High risk of bias in more than half of the studies reviewed further complicates application in clinical practice. Incomplete exercise dosage parameters may impede patients from receiving the most beneficial care and the best outcome. Given the limitations of exercise therapy prescription and the low methodological quality of the studies included, further research is required to benefit the physical therapy profession.

**ID:** 32 (poster)

Garrett Petry, MotivityPT Steamboat Springs, United States

**Title:**

SUSTAINED SOFT TISSUE MOBILIZATION (SSTM) OUTPERFORMS TRADITIONAL PHYSICAL THERAPY AND DRY NEEDLING IN A PATIENT WITH UNRESOLVED KNEE PAIN POST TOTAL KNEE ARTHROPLASTY

**Background / Purpose :**

Total knee arthroplasty is the most performed orthopedic surgery in the lower extremity. A projection from 2019 estimated, in 2020 there would be 1.06 million TKAs performed in the US, 3.42 million in 2030 and the number of TKAs are expected to increase by 855% between 2012 and 2050. Dissatisfaction rate of 18.6% has been noted rate post TKA but ranging as high as 50% in some reports. Pain is noted as being the most common reason for dissatisfaction indicating a need for treatment options as clinical practice guidelines (CPG) don't support the use of manual therapy for this population.

**Case Description:**

The patient was a 61 y/o very active female presented 6 months following TKA with complaints of R posterolateral knee pain after unsuccessful bout of PT following clinical practice guidelines and many sessions of dry needling. Pre-surgery, the patient had a significant R knee valgus and many pain related functional limitations. At the onset of care the patient could not walk 1 mile due to pain, and her greatest pain was straightening her knee upon waking each morning. MRI at 4 months post-op showed tendonitis of the biceps femoris, strain of the proximal popliteus and possible popliteal cyst.

The patient demonstrated -2' knee extension, gait compensations, straight leg raise (SLR) of 40' (which recreated her pain) compared to 100' on the unaffected side. During each test which challenged tissue extensibility about her R posterior leg, a significant pulling was noted into her R posterior lateral knee region which would correlate with structures implicated in MR imaging.

Based on principles from the Institute of Physical Art's (IPA) Functional Manual Therapy (FMT) and Stecco Fascial Manipulation (FM), sustained soft tissue mobilization (SSTM) was provided for 2-10 minutes (determined by tissue response) to medial and lateral gastroc, popliteus, biceps femoris, semimembranosus and tendinosis, soleus, vastus lateralis, posterior tibialis, TFL, VMO, fibularis longus and brevis, in addition to soft tissues passing bony contours of the femur, tibia and fibula. Mobilization was continued until the "hard end feel" of the tissues resolved in all directions.

**Outcomes:**

Within 5 sessions, SLR improved from 40’ to 100’, matching her contralateral side and walking tolerance increased to 3 miles. By session 10 the patient no longer was limited by R knee pain for walking/hiking, ice skating, or skiing. LEFS improved from 45 to 61 with her L knee (which a TKA is planned for 2022) being her greatest functional limiting factor.

**Discussion / Conclusion:**

This case shows addressing soft tissue dysfunction after TKA was helpful in eliminating pain during functional activities post TKA and improving tissue excursion when conventional PT and dry needling were unsuccessful. Kelly et al. showed 24-hour improvements in tissue stiffness which mirrored temporary improvements during her initial PT. FM, which is similar to SSTM, has shown prolonged connective tissue changes (3-6 months) which may be a reason for the prolonged effects seen in this case.

**ID:** 33 (poster)

Anthony J. Tomaselli, Institute of Physical Art

Gregory Johnson, Institute of Physical Art
Brent Yamashita, Johnson & Johnson Physical Therapy

**Title:**

IMPACT OF MANUAL THERAPY AND POSTURAL TRAINING ON ELITE HORSE-RIDER HARMONY

**Background / Purpose :**

Important components of elite dressage equestrianism are alignment and the rider's control of the horse. Postural and movement asymmetries affect pressure (cue) transfer to the horse. Research has revealed that mobility of the trunk and pelvis within the saddle is essential for horse-rider harmony and success.

This case report presents the rapid impact that Functional Manual Therapy (FMT) treatment protocol had upon the alignment and performance of an elite dressage rider.

**Case Description:**

Subject is a 20-year-old female dressage competitor with 14 year's experience. A year into her training, she suffered a serious injury crossing a river on her horse. The horse landed on her left rib cage pinning her underwater on a rock for about 1 minute. For the past 13 years her instructors consistently noted she was collapsing on the left side of her trunk, and she felt unbalanced in her saddle. This postural asymmetry affected her competition scores and confidence. Despite extensive exercise training, traditional PT, and chiropractic care this problem persisted. She self-referred to our clinic to enhance her athletic dressage performance. She received FMT protocol interventions aimed at improving her posture, enhancing mechanical capacity and neuromuscular connections between her core, pelvic floor, and lower extremities. Additional treatment was provided to improve visceral, trunk, and pelvic girdle mobility, and CoreFirst® Strategies training was given to improve postural awareness and responses while on the dressage saddle. Outcomes measurements included photographic postural analysis and load transfer assessment pre- and post- 2 FMT treatment sessions with use of electronic handheld dynamometers in static mounted dressage saddle stirrups.

**Outcomes:**

After 2 sessions, the subject reported feeling balanced and able to bear weight more effectively through the right side of her pelvis. Her next 2 dressage competitions demonstrated a 15% improvement between her pre- and post-FMT competition scores. Post-intervention postures yielded more symmetry of coronal plane alignment and force distribution through her lower

extremities (average loading into the left stirrup dynamometer increased from 68% to 96% of the right; equality of weight distribution increased an average of 15%) during dressage simulations on a static mounted saddle.

**Discussion / Conclusion:**

This case report demonstrates the success of Functional Manual Therapy to assist an equestrian athlete in improving her posture and load distribution, enhancing the effectiveness of her competition. More research is needed with larger sample sizes to show a higher level of evidence between FMT treatments and improvements with equestrian postural/riding efficiency, and the potential impact upon injury and/or chronic pain preventive measures for this and all sports.

**ID:** 34 (poster)

Dave Bender, Institute of Manipulative Physiotherapy and Clinical Training
Matthew Ventimiglia, Institute of Manipulative Physiotherapy and Clinical Training
Paul Thomas, NAIOMPT

**Title:**

MANUAL THERAPY INTERVENTIONS OF THE THORACOLUMBAR JUNCTION IN A PATIENT WITH ACUTE LOW BACK PAIN AND LATERAL SHIFT: A CASE REPORT

**Background / Purpose :**

The presentation of a lateral shift with acute low back pain is common in clinical practice. Causes vary, but some opinions attribute the presence of a lateral shift to disc pathology. There is little evidence to suggest a consistent treatment approach in the management of patients with this presentation. Documented successful treatment approaches include McKenzie protocols and/or direct manual shift correction. The purpose of this case report was to present a perspective on the assessment and treatment of the thoracolumbar junction in a patient with acute low back pain and lateral shift.

**Case Description:**

The patient was a 31-year-old male presenting with acute low back pain following golf practice. Injury onset was 2 weeks prior. Patient presented with primary pain in the right mid-lumbar spine, worsened with sit-to-stand transfers, transferring from bed, sitting, and walking. Patient also noted that he felt “crooked” when walking. Patient presented with an apparent left lateral shift. Left trunk rotation was limited approximately 50% in sitting and standing. Lumbar AROM was painfully limited as follows: extension and right side-bend 50%; flexion and left side-bend 25%. Remarkable hypertonicity noted in the right lumbar paraspinals. Patient presented with no clinical findings of neurological involvement. SLR and compressive tests were negative, decreasing likelihood of disc involvement. Segmental hypermobility with subsequent pain found at L3-L4 with torsion and lateral shear tests. TL junction assessment produced segmental hypomobility with biomechanical end-feel of left lateral translation at T10-T11. Patient was seen for 12 sessions over 5 weeks. Treatment included direct thoracolumbar manipulation, graded lumbar joint mobilization, and inhibitory techniques to reduce muscular hypertonicity. Neuromuscular re-education and stabilization program prescribed to address motor control.

**Outcomes:**

Reduction of the lateral shift sustained by the 3$^{rd}$ session following TL junction manipulation. Symmetrical and pain-free thoracolumbar AROM obtained within 6 sessions. Patient returned to golf without pain after 6 sessions. Outcome data was assessed using FOTO, numeric pain scales, and Modified Oswestry Low Back Disability. FOTO score improved from 33/100 to 83/100. Pain rating for worse pain improved from 8-9/10 to 1/10 at discharge. Modified Oswestry Low Back Disability score improved from 59 to 2 at discharge .

**Discussion / Conclusion:**

Although primary pain was in the lumbar spine, detailed TL junction assessment was warranted due to limited trunk rotation and rotational mechanism of injury. Acute management in patients with this presentation is documented, however there is little evidence examining the TL junction as a contributor. Mechanical dysfunction can contribute to local and multi-segmental hypertonicity, irritation of non-contractile tissues, and increased stress accommodations on other segments. Manipulation of the TL junction was chosen as treatment intervention to reduce rotational and shear stress to lumbar spine by normalizing thoracolumbar movement and provide neurophysiologic input to reduce local muscular tone.

**ID:** 35 (poster)

Marlowe Montana Banatao, Kaiser Permanente Northern California Orthopaedic Manual Physical Therapy Fellowship

**Title:**

A Biopsychosocial Rehabilitation Approach Using Cognitive Restructuring And Imagery In A Recreational Basketball Player 8-weeks After A Lateral Ankle Sprain

**Background / Purpose :**

Lateral ankle sprains are common amongst physically active populations in the U.S. Nearly all treatment approaches for lateral ankle sprains are based on the biomedical model despite emerging evidence that a biopsychosocial model of care enables rehabilitation from a whole-person perspective. In a biopsychosocial framework, personal factors are important and may impact function. Rehabilitation programs that include psychological skills-training to address personal factors enable faster recovery. There is limited evidence utilizing a biopsychosocial rehabilitation framework for an athlete following ankle sprain. The purpose of this case report is to share clinical reasoning utilizing a biopsychosocial framework and describe novel treatments for personal factors.

**Case Description:**

19-year-old male college student with a history of two resolved lateral ankle sprains over previous two years playing basketball after physical therapy (PT) rehabilitation. Initial PT assessment of his third lateral ankle sprain was conducted 8-weeks after injury. At initial assessment key findings were: 0/10 pain at rest and during daily activities and reported fear prevented him from attempting sport activities, Tampa Scale of Kinesiophobia-11(TSK-11) was 19/44, Foot and Ankle Ability Measure (FAAM) sport subscale was 22/28 (79%), and moderate limitation in ankle dorsiflexion on involved ankle. His performance on the single leg side hop test was poorer on the involved side compared to noninvolved side. The involved side performed better on the Y balance, single leg hop, single leg triple hop, and single leg vertical jump tests compared to the noninvolved side. He reported the involved leg felt ‘weaker’ than the noninvolved side. Manual therapy and exercise were provided for dorsiflexion impairment. Cognitive restructuring, positive self-talk, and informative teaching was provided to address maladaptive fear beliefs. Targeted imagery techniques were implemented prior to exercise to improve performance and confidence.

**Outcomes:**

Patient was seen for 1 telehealth visit; 4 in-person visits over 7 weeks. Targeted imagery led to intra-session improvements in single leg side hop performance. At discharge, dorsiflexion during squat improved 8 degrees, modified lunge test improved 2 cm, single leg side hop improved by 5.7 reps, the FAAM sports subscale improved 21%, the TSK-11 improved 8 points. The patient reported no fears and was highly confident in his ankle at discharge.

**Discussion / Conclusion:**

This case report highlights clinical reasoning in a patient with elevated fear avoidance beliefs following ankle sprain who responded well to multi-modal care using a biopsychosocial approach including manual therapy, exercise, imagery, and education. Cognitive restructuring focused on personal factors and may have led to improvement in fear avoidance beliefs. Targeted imagery techniques before exercise may have contributed to improvements in exercise performance and confidence. Further research is needed to investigate effectiveness of cognitive restructuring and the use of imagery in athletes with ankle injury and elevated fear beliefs.

**ID:** 36 (platform)

Joseph B Leech, Bellin College

William Owen, Bellin College
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**Title:**

Incomplete reporting of manual therapy interventions and a lack of clinician and setting diversity in clinical trials for neck pain limits replication and real-world translation. A scoping review

**Background / Purpose:**

Neck pain is one of the leading causes of musculoskeletal disability and manual therapy (MT) is a common intervention used to treat neck pain by providers within different disciplines and a variety of settings. Despite broad, consistent support for the use of MT across clinical practice guidelines for managing neck pain, there is insufficient description of the intervention parameters and contextual characteristics reported in MT trials. This presents a challenge to clinical application and replication of research. The purpose of this scoping review was to identify the clinicians and settings utilized in MT trials for neck pain and assess if adequate descriptions of key trial features were consistently reported.

**Methods:**

Medline (via PubMed), CINAHL, PEDRo, and the Cochrane Central Registry for Controlled Trials were searched for clinical trials published from January 2010 to June 2020. Provider types, subclassifications of neck pain, clinical settings and definitions of MT interventions were extracted. Treatment descriptions for each study were analyzed using a 10-item tool based on the Consensus on Exercise Reporting Template that includes elements of the clinical encounter deemed to be important for study replication.

**Results:**

Ninety-seven trials met the final inclusion criteria. Approximately half of all trials included a minimal description of the MT (47.4%), provider's qualifications (54.6%), dosage (53.6%) and adjunct interventions (58.8%). Few studies described the screening procedures for the appropriateness of MT (33.0%), adverse events (46.4%), home exercises (29.9%), and patient education (19.6%). The most common clinicians delivering MT were physical therapists (77.3%), chiropractors (11.3%), and osteopathic physicians (2.1%) with 6.2% not clearly described. Neck pain was classified most often as non-specific (67.0%) followed by cervical radiculopathy (14.0%), cervicogenic headache (12.4%), and whiplash (1.0%). The settings where most trials took place were universities (26.8%), private practices (18.6%), hospitals (17.5%), and research labs (4.1%), while 33.0% were not reported.

**Discussion / Conclusion:**

These results reveal inconsistencies or lack of reporting essential treatment parameters that allow for replication and a lack of diversity in providers delivering MT in clinical trials for neck pain. The absence of standardized reporting of treatment descriptions and homogeneity of practitioners likely limits the reproducibility and generalizability of this current body of literature. Few studies report tracking of adverse events, a mandatory CONSORT checklist item, which limits further understanding of any risk involved with the intervention. To improve generalizability, future research should incorporate a wider variety of MT practitioners. To foster reproducibility of treatment and implementation of findings from MT trials for neck pain, researchers should consistently include these variables when reporting their results.

**ID:** 37 (platform)

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**Title:**

# POSTERIOR-ANTERIOR JOINT MOBILIZATIONS CHANGE CERVICAL INTRADISCAL PRESSURE: IMPLICATIONS FOR DISC NUTRITION

## Background / Purpose :

Human cervical intervertebral discs (IVD) undergo age related changes and can become pain generators. Causes for age-related degeneration include lack of IVD nutrition, prolonged intradiscal pressure stagnation, and accumulation of degraded molecules and matrix fatigue failure. Performing joint mobilization for cervical spine pain management helps improve pain and function in patients with cervical spine conditions. While studies have shown changes in cervical intradiscal pressure (CIDP) with cervical range of motion (ROM), traction and manipulation, no study has evaluated the effect of cervical spine joint mobilizations on CIDP. Such CIDP changes could be beneficial for IVD health. The objective of the study was to investigate in cadaveric specimens if cervical PA mobilizations produce changes in CIDP.

## Methods :

Cervical PA mobilizations were performed on the spinous processes of seven cadaveric specimens using a servo-controlled linear actuator to provide 25 and 45 N forces. Measurements of CIDP were conducted using fiberoptic catheter systems at C4-5, C5-6, C6-7, and C7-T1 IVD levels. The FISO system recorded CIDP for each IVD cervical level. The CIDP was measured before, during and immediately following

mobilization. Descriptive statistics were calculated for (1) demographic variables and (2) CIDP before, during and following PA mobilizations. To assess CIDP measurement reliability, intraclass correlation coefficient [ICC (3,k)] was calculated. To assess the effect of cervical mobilizations on CIDP at different time intervals, four separate 3 (TIME: before/during/immediately following mobilization) X 2 (25 N and 45 N) repeated measures ANOVAs (Friedman) were used for each cervical level.

**Results:**

Reliability coefficients for CIDP measurements during, immediately after the mobilization were ICC(3,k)>.98, 95% CI .96-.99. The mean CIDP varied from -7.3±18.8 to 11±37.9 mmHg and from -6.5±16 to 22.8±84.5 mmHg during 25 and 45N PA mobilizations (p>.4), respectively. There was no CIDP changes during and following PA mobilizations, except for C5-6 CIDP at 25N or 45N (p=.05 and .018, respectively).

**Discussion / Conclusion:**

There was high CIDP variability between cadavers during and after mobilization. Mobilizations of one cervical vertebra resulted in both CIDP increase or decrease at adjacent and remote cervical IVD segments that were not consistent. In conclusion, cervical PA mobilizations produced substantial CIDP changes at adjacent and remote cervical segments. In vivo investigations are warranted.

**ID:** 38 (platform)

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**Title:**

HEADACHE AND NECK PAIN: VALIDATION OF A PATTERN OF MUSCULOSKELETAL SIGNS TO DIFFERENTIATE A CERVICAL SOURCE OF NECK PAIN

**Background / Purpose :**

Neck pain is a common symptom of frequent benign headache types. Neck pain may be a referred headache symptom, or directly associated with a local source within the neck. A specific pattern of cervical musculoskeletal signs has previously been found to predict the presence of cervicogenic headache. This study evaluated the validity of this pattern of cervical musculoskeletal signs to identify a cervical source of headache and neck pain arising from C2/C3-C3/C4 among participants with frequent headache types, by comparing against the current gold standard, controlled anesthetic nerve blocks.

**Methods :**

Participants with diagnosed migraine, tension-type, or cervicogenic headache with associated neck pain that a neurologist considered warranted investigation, underwent a clinical examination, including active cervical extension, manual examination, craniocervical flexion test, and the flexion-rotation test. Controlled diagnostic nerve blocks were performed to anesthetize the C2/C3 and C3/C4 facet joints. Penalized logistic regression identified the combination of musculoskeletal signs that best predicted response to the blocks.

**Results:**

Ten of thirty participants had >70% headache reduction after blocks. Inclusion of all four musculoskeletal signs accounted for 65% of the variance and yielded the strongest prediction of participant responses to the blocks (expected prediction error = 0.57).

**Discussion / Conclusion:**

This study confirmed the validity of a cervical musculoskeletal pattern to identify a local source of headache and neck pain among those with frequent headache types. Use of this pattern of cervical musculoskeletal signs may strengthen the ability to rule in or out a cervicogenic cause to headache.

**ID:** 39 (poster)

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**Title:**

THE LUMBAR SPINE: SYMPTOM SOURCE OR TREATMENT TARGET

**Background / Purpose :**

Individuals with knee pain who present with limited examination findings locally warrant an investigation proximally at the lumbar spine. While uncommon, the lumbar spine may refer symptoms in the form of radiculopathy or peripheral sensitization to the knee, with or without symptoms at the lumbar spine. The purpose of this case report is to highlight the regional interdependence model and biopsychosocial approach that seemingly unrelated impairments in a remote anatomical region may contribute to symptom presentation, and that intervention strategies with a person-centered approach create successful outcomes.

**Case Description:**

A 47-year-old caucasian male referred to physical therapy with a 3 week history of left lateral knee burning and shooting pain, extending to mid lateral fibula. He had an inconclusive knee x-ray showing mild osteoarthritis and worked as an IT professional. Examination of the knee was unremarkable with the patient's symptoms reproduced only during kneeling, therefore further investigation at the lumbar spine was performed. Repeated lumbar spine extension and manual therapy targeting the lumbar spine immediately reduced concordant sign of knee pain and apprehension with kneeling, and diagnosis of referred knee pain from lumbar spine was made. The course of treatment consisted of 10 sessions that took place over 5 weeks.

**Outcomes:**
A significant improvement in left knee pain during kneeling tasks (NPRS 10/10 to 0/10) and overall function (LEFS 84% to 95%, PSFS 2.33/10 to 9.6/10) was observed. The patient achieved his goals of performing all work tasks, including kneeling and squatting, without compensatory measures, and walking his dog without symptoms at discharge. The patient reported high satisfaction with treatment received and self-reported return to full functional capacity.

**Discussion / Conclusion:**

Initial treatment strategies included manual therapy (posterior to anterior lumbar spine mobilizations) and standing and prone repeated lumbar extension. Treatment progressed to graded exposure to kneeling position with external load and daily walking program, with tapered repeated lumbar extensions and manual therapy towards discharge. This case report highlights the importance of screening the lumbar spine with all presentations of extremity symptoms. This case also warrants reflection on an important discussion point: was the lumbar spine the source

of symptoms or does treatment directed at the spine positively influence extremity pain? Clearly, further evidence is required to answer this question and support the findings of this unique case.

**ID:** 41 (poster)

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**Title:**

THE MANAGEMENT OF LUMBAR SPINAL STENOSIS USING ORTHOPEDIC MANUAL THERAPY AND BLOOD FLOW RESTRICTION STRENGTHENING INTERVENTIONS: A CASE REPORT

**Background / Purpose :**

Lumbar spinal stenosis (LSS) is a degenerative spinal condition resulting in significant buttock and/or lower extremity pain and functional limitations in older adults. It is the most common indication for spinal surgery in patients over the age of 65 with a subsequent annual expenditure of over 1.5 billion dollars. Neurogenic claudication is the cardinal symptom of LSS and is the result of degenerative spinal canal narrowing that occludes neurovascular structures leading to ischemia. The resultant sequalae of lower extremity pain, numbness and weakness often makes standing or walking intolerable, thus impairing functional mobility. Poor tolerance of weight-bearing activity is common with LSS, thus limiting engagement in lower extremity strengthening via traditional methods. The dearth of strength training options with this population points to a need for a novel method of intervention. To that end, blood flow restriction (BFR) presents a method for increasing muscular strength and hypertrophy without the excessive spinal loading in traditional resistance training. The purpose of this case report is to describe the successful implementation of manual therapy and BFR in the management of lateral lumbar spinal stenosis sequalae in a patient with LSS.

**Case Description:**

A 48-year-old male with a recent exacerbation of low back pain presented to an outpatient physical therapy clinic. He had a prior diagnosis of multi-level LSS and reported injuring his back while moving one month prior. His primary complaint was low back and bilateral leg pain with limited full weight-bearing activities. Patient reported 9/10 pain on the numerical pain rating scale (NPRS), 50% on the Oswestry Disability Index (ODI), 57% on the Swiss Spinal Stenosis Questionnaire (SSS) and 11 on the 30 second Chair Stand Test (30CST). Observation revealed a flattened lumbar spine and bilateral quadricep and gluteal muscle atrophy. Physical examination revealed multi-segmental hypomobility in the thoracolumbar spine and in bilateral hip joints. Slump test was positive bilaterally. Lastly, dermatome and myotome testing revealed impairments in the left L4-5 and L5-S1 distributions. Treatment included joint mobilization/manipulation of the thoracolumbar spine, stretching/joint mobilization of hips, neurodynamic mobilizations and BFR strengthening of the lower extremities. Tourniquets

applied at the groin level to invoke restricted blood flow in the extremities. Lumbopelvic motor control interventions were provided to address trunk coordination deficits.

**Outcomes:**

The patient completed 14 visits over 8 weeks. Clinical improvements included a decrease in the following: NPRS 1/10, ODI 30%, SSS 31% and an improvement on the 30CST to 16. The patient was able to return to all recreational activities without restrictions.

**Discussion / Conclusion:**

This case demonstrates the successful outcomes of an impairment based orthopedic manual therapy treatment coupled with a novel strengthening intervention in the management of LSS.

**ID:** 42 (poster)
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**Title:**

NEUROGENIC FROZEN SHOULDER: STRUCTURAL DIFFERENTIATION AND CLINICAL REASONING - A CLINICAL PEARL

**Background / Purpose :**

Adhesive Capsulitis (AC) is associated with Glenohumeral Joint (GHJ) fibrosis and synovitis presenting with pain, stiffness, and limited mobility. Some have suggested mechanically sensitized neural tissue (MSNT) can contribute to AC. A less common cause of shoulder pain, limited mobility and loss of function has been referred to as Neurogenic Frozen Shoulder (NFS) which can masquerade as AC without hallmark GHJ fibrosis and synovitis. The purpose is to describe a clinical pearl tissue differentiation assessment and clinical reasoning between AC and NFS.

**Case Description:**

Both AC and NFS will have moderate to severe limited GHJ active range of motion (AROM) and passive range of motion (PROM) in a characteristic capsular pattern. The structural differentiation described here appears to be unique to NFS and not present with traditional AC. Three distinct components include AROM, PROM, and Palpation. The AROM assessment involves three steps. In sitting the patient first elevates their arm in the scapular plane. This is repeated a second time with the addition of wrist extension and a third time with both wrist extension and contralateral cervical side flexion/rotation. PROM assessment involves progressive addition of neural tension with the GHJ prepositioned into pain free abduction with the patient supine. Gentle passive scapular depression is added assessing for symptoms and protective muscle spasm of the upper trapezius. If no symptoms or muscle spasm are noted the process is repeated with the arm in progressively more pain free abduction until symptoms or muscle spasm noted. Finally, palpation for neural sensitivity includes the brachial plexus in the cervical spine, inferior to the coracoid process and radial, median, and ulnar nerves at the elbow with the patient in supine.

**Outcomes:**

NFS is considered present when at least 2 of the 3 portions of this assessment are positive when clustered with normal GHJ articular glides.

**Discussion / Conclusion:**

Similarities between AC and NFS include progressively worsening shoulder pain, limited range of motion, loss of function of the arm, demographics such as females between 40-60 years old, and comorbidities such as Type II Diabetes Mellitus and hypothyroidism. The goal of the tissue differentiation assessment is clearly identifying the cause of the limited ROM. During AROM assessment the GHJ motion is constant. If there is progressive ROM loss or increased pain as more neural tension is added with wrist extension and cervical side flexion/rotation (MSNT) is suspected as the cause. During PROM assessment the GHJ is prepositioned in pain-free abduction. If the addition of scapular depression causes symptoms or muscle spasm, MSNT is further suspected from tension through the brachial plexus. Finally, palpation of neural structures with the GHJ in a neutral, pain free position further implicates MSNT. When clustered with normal GHJ articular glides, this tissue differentiation may assist differentiating NFS from AC.

**ID:** 43 (platform)

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**Title:**

A CALL FOR LEADERSHIP IN PHYSICAL THERAPY: DEVELOPING RESILIENT LEADERS IN POST-PROFESSIONAL ORTHOPAEDIC PROGRAMS

**Background / Purpose :**

"Leaders transforming healthcare" is the American Academy of Orthopaedic Manual Physical Therapists vision statement. Fellow and/or residency trained individuals have reportedly improved patient outcomes and leadership and communication skills than counterparts. There is limited evidence on leadership development in physical therapist education. This study aims to investigate leadership profiles across Fellows-in-training (FiTs) in an orthopaedic manual PT program, residents in an orthopaedic PT program and entry level DPT students.

**Methods :**

A mixed methods exploratory design was employed including 48 FiTs and 20 orthopaedic residents (2 cohorts). The Leadership Practices Inventory® (LPI) 360 and Self (self-LPI); valid and reliable assessments of observer and self-perceived 30 leadership behaviors was utilized. FiT and Resident LPI scores for the Five Practices of Exemplary Leadership®: Model the Way (MTW), Inspire a Shared Vision (ISV) Challenge the Process (CTP), Enable Others to Act (EOA) and Encourage the Heart (ETH), were compared to data from 210 DPT entry level students using a one way ANOVA and descriptive statistics. The Wilcoxon Signed Rank test was used to compare within group changes in cohort 2 resident LPI scores. Qualitative data was also obtained via an online demographic leadership survey completed by 22 FiTs.

**Results:**

LPI: There were no significant differences between FiT and resident scores in any of the five LPI practices. FiTs had significantly higher LPI scores than second year DPT students in the LPI practice of CTP ($P<0.05$). Residents had significantly higher scores than second year DPT students in the LPI practices of MTW, CTP and ISV ($P<0.05$). FiT observer scores were significantly ($p>.05$) higher than FiT Self scores in 4 of the 5 exemplary practices. There was a significant difference ($P<0.05$) in resident cohort 2 LPI observer scores over time for the

practices of CTP and EOA. There was a significant difference in resident cohort 2 self vs observer LPI change scores for the practices of MTW and ISV ($P<0.05$).

Qualitative data: Eighty-six percent of FiTs reported leadership development was an essential component of training, 71% percent felt they would experience greater job satisfaction without an increase in financial compensation, 62% expected to expand their role in academic and professional contributions and 57% expected an increase in leadership roles within their clinical and professional practice.

**Discussion / Conclusion:**

Leadership development is an ongoing systematic process that should include comprehensive assessment and targeted development of leadership competencies. FiTs in this study found leadership development to be an important component in their fellowship education. Observer scores were higher than self-scores for both FiT and resident groups.

Future research is needed to investigate the impact of leadership training in post professional physical therapist education.

**ID:** 44 (poster)

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**Title:**

DIFFERENTIAL DIAGNOSIS AND THERAPEUTIC MANAGEMENT OF A 14-YEAR-OLD DANCER WITH THORACOLUMBAR PAIN

**Background / Purpose :**

Spondylolysis is a common cause of low back pain in adolescent athletes, primarily occurring at the levels of L4-5. Spondylolysis is characterized by an anatomical defect or fracture of the pars interarticularis because of sporting activities that require repetitive hyperextension movements. Spondylolysis has been reported to have an incidence of 32% in adolescent dancers and should be considered in the differential diagnosis of dancers with low back pain. The purpose of this case study is to describe the differential diagnosis and physical therapy management of an adolescent dancer with thoracolumbar pain.

**Case Description:**

A 14-year-old female dancer presented to physical therapy with right sided low back pain of insidious onset that began 2 months prior reported pain as 9/10 at worst, 4/10 currently, and 3/10 at best using Numeric Pain Rating Scale (NPRS). Patient complained of occasional numbness along her anterior thigh that has been progressively worsening. Patient reported the ability to complete most of her dance routines without pain but had difficulty getting out of bed the following day after dancing with Modified Oswestry Disability Index (ODI) of 20%. Patient danced for approximately 2 hours a day and was training for an upcoming recital a week following initial evaluation. Patient complained of pain and difficulty with extension-based dance movements. X-rays were negative and the patient was awaiting results of an MRI. Patient was managing the pain with Aleve and flexion-based stretches. Examination noted decreased right lumbar rotation and lumbar extension ROM, decreased glute strength, positive FADIR of right hip, and hypersensitivity with PAIVMs along right T12-L2. Neurodynamic, lower extremity reflex, sensory, and lumbar instability testing negative. Anterior thigh numbness was not elicited throughout testing. Patient was classified as mechanical back pain due to negative imaging and neurological testing. Management consisted of activity modification, thoracolumbar PA joint mobilizations, motor control exercises, core and glute strengthening, and progressive re-introduction to lumbar extension-based exercises.

**Outcomes:**

Patient completed 15 visits of physical therapy over the course of 7 weeks. The NPRS improved to 0/10 and Modified ODI to 0%. Patient demonstrated full lumbar ROM in all directions and

was asymptomatic with PAIVMs to the thoracolumbar spine. Patient was able to repetitively perform grand jete and straddle jumps without reports of pain.

**Discussion / Conclusion:**

This case study demonstrates the successful management of an adolescent dancer with thoracolumbar pain and suspected spondylolysis through extension-based activities. Patient responded positively to a multimodal approach consisting of manual therapy for pain modulation, progressive loading program, and re-introduction to extension-based activities.

**ID:** 45 (poster)

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**Title:**

CONSIDERING OCCAM'S RAZOR: DIFFERENTIAL DIAGNOSIS AND CLINICAL REASONING IN A COMPLEX CASE WITH MULTISYSTEM IMPAIRMENTS AND SYMPTOMS OF MAST CELL ACTIVATION SYNDROME IN A HYPERMOBILE BALLERINA

**Background / Purpose :**
Mast Cell Activation Syndrome (MCAS) is a rare but underdiagnosed condition that can lead to sequelae of inflammatory multisystem impairments. MCAS and dysautonomia have been found in subsets of patients on the hypermobility spectrum, especially those with Ehlers-Danlos Syndrome (EDS). This complexity can often lead to separate referrals to numerous providers and treatment of isolated symptoms that do not address the root cause of the issues, leading patients to feel frustrated, unheard, and hopeless. The purpose of this case report is to examine common signs and symptoms of MCAS in the hypermobile patient and demonstrate how physical therapists are capable of effective differential diagnosis of a complex patient’s multisystemic symptoms and generating appropriate referrals.

**Case Description:**

A 33-year-old female ballerina was referred to outpatient physical therapy (PT) by her orthopedic surgeon with a diagnosis of right lateral ankle sprain while dancing. Although referred for a local musculoskeletal complaint, she reported severe global burning pains (PainDETECT 31/38), considerable psychological distress, and difficulty with many daily activities especially walking, driving, and sleeping. She had a history of joint dislocations, asthma, carpal tunnel syndrome, and headaches; however, in late 2020 she had a sudden insidious onset of multisystemic complaints beginning with trigeminal neuralgia, worsening headaches, syncopal episodes, and diagnosis of celiac disease. Additionally, she developed daily urticaria, lightheadedness, and anxiety episodes. Imaging of the brain and spine, routine blood tests, punch biopsies, and electromyography results were unremarkable. Notable examination findings included gross hypermobility (Beighton Score 7/9), hypotension, tachycardia, and

neurological deficits of global hyperreflexia, bilateral upper and lower extremity sensory deficits, and bilateral lower extremity motor deficits.

**Outcomes:**

The patient had seen 27 practitioners from various disciplines over eight months prior to beginning PT. She was deemed appropriate for care; however, due to the complex nature of her condition, further referral was deemed necessary. After researching potential differential diagnoses, MCAS needed to be ruled out as it could explain the majority of her multisystemic symptoms. The patient was referred to an allergy and immunology specialist familiar with MCAS. She was ultimately diagnosed with MCAS, hypermobile EDS, and postural orthostatic tachycardia syndrome. In PT she was successfully treated with improvements in lumbar and ankle deficits and returned to ballet.

**Discussion / Conclusion:**

While impairments of the lumbar spine and ankle were found and successfully treated, the focus of this case study was the differential diagnosis and referral process. Typical medical training often emphasizes managing isolated disease states, but disorders such as MCAS can account for widespread seemingly unrelated multisystemic dysfunction. It is important as direct access clinicians to be aware of MCAS and dysautonomia symptoms in the hypermobile patient and to be able to know when and where to refer appropriately.

**ID:** 46 (platform)

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Erik Martinez, Edward-Elmhurst Health

**Title:**

CERVICAL SPINE MANUAL AND NEUROMUSCULAR RETRAINING INTERVENTIONS IMPROVING COORDINATION, FACIAL PAIN, AND HYPOESTHESIA IN PROFESSIONAL FLAUTIST WITH SYMPTOMS OF EMBOUCHURE DYSTONIA

**Background / Purpose :**

Embouchure Dystonia (ED) is a rare type of focal task-specific dystonia found in wind instrument musicians that affects coordination of facial, jaw, and tongue muscles. There is a paucity of evidence for physical therapy, especially manual therapy interventions. The purpose of this case report is to demonstrate how multimodal physical therapy interventions consisting of manual therapy, dry needling, neuromuscular reeducation, and functional training were used to improve ED symptoms.

**Case Description:**

A 52-year-old female, professional flautist presented to outpatient physical therapy (PT) with diagnosis of chronic bilateral (B) temporomandibular joint (TMJ) dysfunction. Her primary complaint was an acute worsening of chronic facial muscle fatigue and tremors that occurred only while playing the flute. She also noted B jaw pain, frontal headache, neck pain, and tinnitus. On examination she demonstrated TMJ hypomobility with passive joint accessory motion assessment, TMJ deviation coordination impairments with jaw tremoring especially right lateral deviation, and limited cervical active range of motion, especially rotation. Palpation revealed pericranial tenderness, especially at masseters. Passive joint accessory motion assessment of the upper cervical spine revealed painful hypomobility at C1-2 and C2-3 levels, left > right . Remarkable neurological findings included facial and jaw tremoring with embouchure test, diminished static cutaneous sensation along the trigeminal nerve distribution (V2 and V3), and B arm and leg hypoesthesia. A light pressure “sensory trick” to the sternocleidomastoid transiently improved her jaw tremoring with active movement. The PT made a diagnosis of ED based on these collective findings.

**Outcomes:**

In the first treatment to the cervical spine, B unilateral C2-3 posterior-anterior glides, she experienced improvements in jaw deviation tremoring, V3 sensation, rotation by 5° each direction, and significantly improved subjective arm and leg sensation in the following visit.

Further manual interventions included upper cervical mobilization, dry needling to suboccipital and jaw musculature, and upper thoracic manipulation. Overall impairment on the TMJ Disability Index improved from 20% to 5%. On the Patient-Specific Functional Scale her flute specific average improved from 1.3 to 4.3. Finally, her Global Rating of Change score was (+3). Furthermore, the patient reported tremor duration with playing decreasing from over forty-five to five minutes.

**Discussion / Conclusion:**

ED may occur due to increased afferent input to the trigeminal sensory nuclear complex, and in this instance, may have been exacerbated by concordant musculoskeletal impairments at the cervical spine and TMJ. Additionally, her improvements in bilateral arm and leg sensation could be attributed to reduction of neuroplastic changes at the spinal level which caused widespread impaired sensory processing. This case report offers preliminary evidence of how PT intervention could be a potential treatment for musicians diagnosed with symptoms of ED.

**ID:** 47 (poster)

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**Title:**

Differential diagnosis of Multiple Sclerosis (MS) in a patient with neck pain

**Background / Purpose :**

MS is an autoimmune neurodegenerative disease of the central nervous system (CNS) and the leading cause of nontraumatic neurological disability in young adults. Diagnosis usually occurs between the ages of 20-40 years and is 2-3x more common in women. Early MS symptoms vary based upon location and severity of lesions within the CNS. The purpose of this case report is to describe the clinical reasoning process in the management of an individual with undiagnosed MS to demonstrate the importance of medical screening and differential diagnosis in physical therapy (PT).

**Case Description:**

A 36-year-old female presented to the emergency department with a new onset of slurred speech, numbness/tingling in the head, and visual disturbances. Neurological examination, brain magnetic resonance imaging (MRI), and medical workup were negative. The patient consulted a neurologist three months later due to ongoing visual disturbances and numbness/tingling in the head. Further testing including magnetic resonance angiogram of the cerebral, vertebral, and carotid arteries, and MRI of the cervical spine were unremarkable, and she was referred to PT for migraines without aura. The patient presented to PT one month later. She reported a 10-year history of intermittent right sided neck pain without migraines or headaches. She described ongoing visual disturbances as constant “white lines” and “flashing light” in her visual field, intermittent blurred vision, and changes in visual acuity. She reported continued numbness/tingling in the head, unsteadiness on her feet, excessive fatigue, and brain fog over the past four months. Remarkable objective findings were limited right cervical rotation active and passive range of motion to 50 degrees and hypomobility of 0-C1, left C1-2, C7-T1 spinal segments with passive joint accessory examination. Her cranial nerve exam, upper extremity myotomes, dermatomes, and reflexes, Hoffman’s, and Babinski tests were unremarkable. Despite recent evaluation by a neurologist, the PT examination did not support a migraine diagnosis and there was a suspicion for a non-musculoskeletal source of ongoing visual disturbances, changes in speech and gait, and numbness/tingling in the head. The PT collaborated with the patient on plan of care for mechanical neck pain and communicated concerning findings directly with her neurologist.

**Outcomes:**

The neurologist ordered a brain MRI four days later. Imaging showed nonspecific sub centimeter white matter demyelinating lesions in the bilateral cerebral hemispheres consistent with a diagnosis of Multiple Sclerosis. This was confirmed with the presence of oligoclonal immunoglobulin bands in her cerebrospinal fluid. The patient began treatment for relapsing-remitting MS immediately with Solumedrol and Ocrevus. She was discharged from PT after 10 visits with an NDI of 4%.

**Discussion / Conclusion:**

This case demonstrates the importance of physical therapists' ability to identify and treat musculoskeletal pathologies and to screen and refer out for potential non-musculoskeletal pathologies, even in those patients recently evaluated by other health care providers.

**ID:** 48 (poster)

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**Title:**

Management of cuboid syndrome including manual therapy, exercise and body weight supported treadmill training: A Case Report

**Background / Purpose :**

Cuboid syndrome is a term used to describe lateral foot pain hypothesized to be a result of subtle disruption of the calcaneocuboid articulation related to altered joint kinematics or joint incongruency. The purpose of this case report is to describe the multimodal management of a 34-year-old female with left cuboid syndrome using a combination of manual therapy, body weight supported treadmill walking, proprioceptive retraining, and lower extremity strengthening exercises.

**Case Description:**

The patient presented to physical therapy with a 5-month history of ongoing foot pain despite taking 2 oral steroid tapers, receiving a steroidal foot injection, and 3 months of

wearing a rocker boot. She reported limitations in ascending and descending stairs, walking, and standing. MRI findings revealed swelling of the calcaneocuboid joint. During the physical therapy initial evaluation, she presented with tenderness along the joint line of the left calcaneocuboid joint, mildly impaired left lower extremity balance, and weakness of the left triceps surae.

Intervention strategies included: 1) walking on an AlterG® Anti-gravity Treadmill® (model M/F 320) at 50 – 85% weightbearing, 2) manual therapy, 3) proprioceptive retraining, and 4) lower extremity strength training. The manual therapy was directed at areas that the patient reported as being the most painful the day of treatment. Manual techniques included cuboid manipulation, distal tibiofibular glides, talocrural distraction, and leg myofascial release. The clinical rationale for the exercise progression and neuromuscular reeducation was to gradually improve loading response through the affected extremity, improve activation of intrinsic foot muscles, increase proprioception in single limb stance, and improve function with squatting and stair climbing.

**Outcomes:**

Over the course of 11 weeks (12 visits), she was able to increase the time she walked her dog from 10 minutes to 25-30 minutes daily. She reported regaining the ability to ascend and descend

stairs without difficulty. Her Lower Extremity Functional Scale score improved from 54/80 to 71/80. Her initial numeric pain rating was 2/10. It fluctuated over the course of treatment depending on how active she was or what footwear she used but was 0/10 at discharge.

**Discussion / Conclusion:**

Research is scarce on cuboid syndrome. A literature search revealed 7 case reports on cuboid syndrome. Full symptom resolution was achieved in all cases. In all but one case, treatment was multimodal with significant variations in the interventions used. None of the published cases used proprioceptive retraining or body weight supported walking. The current case is unique in combining manual therapy, body weight supported treadmill training, lower extremity strengthening, and balance exercises to improve patient-reported pain and function.

**ID:** 50 (poster)

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**Title:**

FOCAL TREMOR FOLLOWING FUNCTIONAL RESTORATION OF MOTION IN A PATIENT WITH CHRONIC POST-TRAUMATIC ELBOW STIFFNESS: A CASE REPORT

**Background / Purpose :**

Post-traumatic elbow stiffness can occur after fractures, malunion injuries, FOOSH injuries, and prolonged joint immobilization. Conservative treatment is most effective within the first 6 months after injury. Early joint mobilization within the first week post-injury or cast removal contributes to the best outcomes. However, when early intervention is significantly delayed, outcomes are uncertain and less favorable. The purpose of this case report is to describe the clinical reasoning process and management of a patient with chronic post-traumatic elbow stiffness who did not receive physical therapy (PT) intervention for a decade after her initial injury. After receiving manual PT, she regained functional motion, but developed a significant focal tremor with supination. This is the first case to report the onset of a tremor following restoration of functional movement using manual PT in a patient with post-traumatic elbow stiffness.

**Case Description:**

The patient was a 24-year-old female with post-traumatic left elbow stiffness and loss of supination following a radial head fracture at age 14. She received initial medical management for her condition but did not receive any initial PT rehabilitation. Her primary limitation was active supination, which was measured at 4 degrees. All other elbow ranges of motion were normal. Her functional impairments included turning a steering wheel, accepting coin money, carrying dinner plates, and eating with the left hand. Her Patient Specific Functional Scale (PSFS) for the average of these four activities was 4.5/10. The patient had no other orthopaedic injuries to the upper extremity or spine and denied any history of genetic or neurological impairments. She received manual therapy intervention consisting of Grade III and IV physiological mid- and end-range supination mobilizations as well as accessory anterior-to-posterior radial head mobilizations. Following the fourth treatment session, the patient gained 30 degrees of motion but developed a large amplitude, high velocity focal tremor triggered by active supination and relieved by pronation. PT intervention was discontinued, and the patient underwent an examination by a physician for peripheral and central neurological conditions, which did not reveal the cause of the tremor. The patient chose to continue receiving manual therapy and exercise intervention.

**Outcomes:**

At the 1-year mark, the patient had achieved 60 degrees of supination and her PSFS score improved to 6.25/10. Her reported global rating of change scale was 3+ (Somewhat Better). The patient continues to experience consistent focal tremors only with active supination and has been referred to a movement disorders specialist.

**Discussion / Conclusion:**

Focal tremors following restoration of movement from chronic hypomobility are rare. The authors hypothesize that the onset of this tremor was due to the rapid improvement in motion with impaired motor control due to chronic, biomechanical constraints. More reporting is needed on this condition as well as research on its underlying cause.

**ID:** 51 (platform)

Gretchen Seif, Medical University of South Carolina

Alan Phipps, The Medical University of South Carolina
Michelle McLeod, The Medical University of South Carolina
Joseph Donnolly, The University of Saint Augustine
César Fernández-de-las-Peñas, University Rey Juan Carlos, Madrid, Spain Anna Zuloaga, The Medical University of South Carolina
Rachel McLaughlin, The Medical University of South Carolina
Blair Dellenbach, The Medical University of South Carolina
Aiko Thompson, The Medical University of South Carolina

**Title:**

Neurophysiological Effects of Dry Needling on Latent Trigger Points

**Background / Purpose :**

To determine the clinical effectiveness of dry needling, it is essential to understand its neurophysiological impact on CNS pathways involved in sensorimotor function. The underlying mechanisms are somewhat understood. Mechanistically, DN that targets trigger points (TrP) can restore muscle fiber length by disrupting dysfunctional motor end plates and stretch the shortened sarcomeres which can affect the firing of group II muscle spindle through spinal stretch reflex pathways. DN stimulates nociceptors influencing the excitability of multiple spinal pathways which may explain pain reduction after DN. DN can activate serotonergic and noradrenergic systems and influence the impact of sensory inputs in the spinal dorsal horn. DN increases the local muscle blood flow and oxygen saturation. This may reduce pain-producing substances that are accumulated at/around TrPs and can create a self-sustaining vicious cycle of sarcomere contraction. To date, the neurophysiological effects on spinal and supraspinal somatosensory processing after DN are not yet fully understood.

**Methods :**

Participants: 14 adults ages 22-57 years old (median 37.5) without known neurological conditions. Before, 0, 90 minutes, and 72 hours after a single bout of DN of a latent TrP in the medial gastrocnemius (MG), we examined the H-reflex (electric analog of the stretch reflex); reciprocal inhibition of the soleus, MG and lateral gastrocnemius (LG) (collectively triceps surae); and the perceptual threshold (PT) of cutaneous distal tibial nerve (DTN) and superficial peroneal nerve (SP) stimulation while the participant stood and maintained standing posture and triceps surae muscle activity. We also measured passive ankle dorsiflexion (DF) range of motion (ROM) in supine.

**Results:**

Compared to before DN, at 72 hours after DN the MG maximum H-reflex amplitude was significantly smaller (-13%, p=0.003 by paired t-test); reciprocal inhibition of the soleus was increased, (+68%, p=0.019); cutaneous sensation threshold for the DTN stimulation (i.e., DTN PT) was decreased (19%, p=0.009); and ankle DF ROM was increased (+4 deg, p=0.003). The MG H-reflex latency was 1-2 ms prolonged at 0- and 90-minutes post but returned to the before DN level by 72 hours post.

**Discussion / Conclusion:**

To our knowledge, this is the first study to examine effects of DN on spinal somatosensory reflexes. DN produces statistically significant neurophysiological effects in multiple spinal pathways that are clearly present at 72 hours post. Decreased MG H-reflex size and increased soleus inhibition may partially explain increased ankle ROM post DN. Understanding the neurophysiological effects of DN will help clinicians determine optimal timing for implementation of interventions post-DN. Whether and to what extent the present findings in individuals with latent TrP are applicable to the ones with active TrP are yet to be examined in future studies.

**ID:** 52 (platform)

Elayna Ann Theiss, University Hospitals Cleveland Medical Center

**Title:**

Application of Mechanical Diagnosis and Therapy (MDT) for the Treatment of Hip Pain: A Case Series

**Background / Purpose :**

Hip pain is commonly reported as a symptom which leads to dysfunction and disability. Conservative measures recommended in the treatment of patients with hip pain include medications, injections, and physical therapy. Mechanical diagnosis and therapy (MDT) are a classification-based musculoskeletal examination and treatment system that utilizes repeated end-range and/or sustained movement to classify patients into mechanical subgroups. While research has described the use and efficacy of the MDT approach for other extremity disorders, specific description of the application of the MDT approach for the treatment of pain originating from the hip is lacking. The purpose of this case series is to describe the application of the MDT approach for the treatment of hip pain.

**Case Description:**

This case series describes the clinical presentations, physical therapy interventions, and outcomes of three patients (one male, two female) aged 64-80yo presenting to physical therapy for the treatment of hip pain. One patient was diagnosed with peri trochanteric tendinitis, while the other two were diagnosed with hip osteoarthritis. Patients received a mechanical examination of both the lumbar spine and hip and were subsequently treated with MDT assessment and treatment principles. All three conditions were classified as hip derangements. Management included repeated end-range movements matched to the patient's directional preference.

**Outcomes:**

Immediate improvements in pain, hip ROM, and function were found in all patients within and between PT sessions. Resolution of symptoms and restoration of function as measured by the Lower Extremity Functional Scale (LEFS), in tandem the patients' adherence to the MDT exercise programs, lead to discharges from physical therapy. Average plan of care was 4 sessions, and average length of care was 3.67 weeks. Each patient-maintained improvement in symptoms subjectively and objectively in function at 2 month follow-up as measured by the LEFS, and demonstrated understanding in the ability to prevent and manage recurrence of symptoms.

**Discussion / Conclusion:**

Patient responses to repeated end-range movements of the hip allowed for classification and treatment with the prescription of exercise matched to the patients' directional preference. This

led to rapid, lasting improvements in symptoms and function in three patients referred to PT diagnosed with hip pathology. An additional advantage to the MDT approach, seen in this case series, is that patients were able to independently treat their pain and manage their conditions without the utilization of medications, injections, or other more passive modalities and treatment strategies. Physical therapists may consider the application of the MDT system as an efficient means to improve pain in function in the short and long-term for patients presenting with a chief complaint of hip pain.

**ID:** 53 (poster)

Michael Griggs, Integrated Physical Therapy

Mary Beth Geiser, SCORE Advantage

**Title:**

LATENT TUBERCULOSIS: AN ONGOING BARRIER TO ADVANCING PROFESSIONAL CLINICAL EDUCATION AND EMPLOYMENT? TIMELINE AND CHALLENGES FROM ENTRY LEVEL EDUCATION THROUGH FELLOWSHIP TRAINING

**Background / Purpose :**

The Centers for Disease Control and Prevention (CDC) present clear guidelines for tuberculosis (TB) screening of all healthcare personnel, however the implementation of these guidelines appear varied when put into practical application. All healthcare students and individuals seeking healthcare-related employment must provide negative TB testing before acceptance into a program or being hired by an employer. Latent TB occurs after exposure to live TB, but the bacteria are present in very small numbers. Individuals with latent TB are asymptomatic and are not infectious. Individuals working among high-risk populations (mission work, pro-bono clinics) or living in areas with high levels of TB are more likely to have latent TB. When a positive test occurs during the admissions or hiring process, the lack of understanding about latent TB can cause unnecessary confusion, delays, and even alarm. A person with latent TB may endure complex postponements and/or scrutiny of their health condition that can give rise to years of frustration. This presentation contrasts the CDC guidelines with the main author's experiences from initial diagnosis and treatment for latent TB through a variety of academic and employment screening processes.

**Case Description:**

The main author first tested positive for TB during a 2012 health screening for a DPT program. TB exposure presumably occurred while volunteering at a free health clinic. A negative chest x-ray and signed physician note were required to satisfy the DPT admissions requirements. The author underwent 9 months of latent TB treatment with Isoniazid during 2014. Subsequently, each clinical internship director required additional clarification how to proceed with a latent TB diagnosis. Some required additional chest x-rays or updated letters from a physician. Others would not accept negative imaging and required lab testing at direct cost to the author. One site required repeat lab testing assuming the test would turn negative after treatment. Recent hospital-based employment and fellowship mentoring opportunities (2021) presented various requirements with one hospital requesting additional repeated lab testing in conjunction with negative imaging. In the author's experience, each screening process required additional imaging, despite completing treatment for latent TB and contrary to CDC's explicit guidance that those with prior positive tests should only need individual risk assessments and symptom screening and do not require repeated testing.

**Outcomes:**

Not one screening process was the same out of multiple hospital systems, outpatient clinics, and educational programs. Further, some programs required additional redundant and/or costly testing that is not recommended under CDC guidelines.

**Discussion / Conclusion:**

There appears to be a lack of adherence to CDC guidelines and no standardization for TB screening of physical therapists or students with latent TB. This can create an undue burden on the individual.

**ID:** 54 (poster)

August Winter, Northwestern University Fellowship in Advanced Orthopaedic Physical Therapy Practice, Research and Education

Ted Kurlinkus, Northwestern University Fellowship in Advanced Orthopaedic Physical Therapy Practice, Research and Education.

**Title:**

A PROPOSED RETURN TO SPORT PROTOCOL FOLLOWING TOTAL KNEE ARTHROPLASTY

**Background / Purpose :**

Knee osteoarthritis (OA) is a prevalent condition which contributes to a high burden of disability. A total knee arthroplasty (TKA) is a common surgery which can provide pain relief as well as improve function for patients with knee OA. The use of TKAs is expected to increase 855% between 2012 to 2050. Outcomes for TKAs are good with high patient satisfaction. As younger patients undergo knee replacement, however, there is a greater expectation to return to high level sports. Currently there is no consensus on return to sport (RTS) recommendations following TKA. While many orthopedic surgeons advise against returning to moderate or high impact sports activities following TKA, up to 43% of patients do return to high impact sports including judo, tennis, and ultra-marathons. The purpose of this paper is to describe the formulation and implementation of a novel RTS criteria with a patient case report.

**Case Description:**

The patient was a 60-year-old female 21-weeks following right TKA, with history-of left TKA 8-months prior. Her goal was to return to golf and softball. At time of testing, she demonstrated no joint effusion, full and symmetrical knee range of motion, and no quad lag with active straight leg raise. Highest level of knee pain in the previous week was 3/10. A literature review was performed to determine appropriate testing criteria for the active TKA population, with no RTS protocols following TKA found in the research literature. Because of this a novel protocol was established. Isometric quadriceps strength was assessed with a handheld dynamometer at 90 and 60 degrees of knee flexion. Functional lower extremity strength was tested using the Single-Step Test (SST) in place of a single leg rise test. Multidirectional movement was tested using a T-test. The patient completed a Lower Extremity Functional Scale (LEFS), UCLA Activity Scale, and Anterior Cruciate Ligament Return to Sport After Injury Scale (ACL-RSI).

**Outcomes:**

The patient was seen for eighteen visits over a 4-month period and underwent RTS testing. The patient was within 10% of limb symmetry for the isometric strength testing, which was performed at 60 and 90 degrees, as well as SST. Her average T-test was 20.57 seconds. For her

UCLA activity score she rated her previous activity at a 10/10 with her current level at 8/10. Her LEFS was 71/80 and ACL-RSI was 93.4%.

**Discussion / Conclusion:**

This case demonstrates the feasibility of RTS testing for an active individual following TKA. This protocol will allow other clinicians to test and retest their patients to better guide RTS decisions using objective data. RTS following TKA is still a controversial topic and decision making should be made in conjunction with the patient and surgeon.

**ID:** 55 (poster)

Nancy F Mulligan, Regis University

**Title:**

Management of an Individual With a Maisonneuve Fracture

**Background / Purpose :**

Maisonneuve fractures (MF) are caused by a traumatic injury of the ankle with a forceful external rotation of the talus which results in a sequence of injuries consisting of medial ligament rupture or medial malleolar fracture, a disruption of the syndesmosis membrane followed by a spiral fracture of the proximal fibula resulting in ankle instability. The accurate diagnosis and timely surgical fixation are critical to prevent chronic ankle instability and arthritis. The incidence of MF ranges from 0.7% to 10% of ankle fractures and misdiagnosis is common since patients may present with localized ankle findings with ankle radiographs that exclude the asymptomatic proximal fibula fracture leading to the misdiagnosis of ankle sprain. Patients can present with pain at the proximal fibula fracture but not present with pain and symptoms at the ankle joint also leading to the misdiagnosis of an isolated fibula fracture. Despite the prevalence and misdiagnosis of MF there is minimal guidance for physical therapists in physical therapy (PT) literature regarding the accurate diagnosis and rehabilitation recommendations.

**Case Description:**

A 58-year-old female fell snow skiing, and landed in bilateral lower extremity external rotation, and felt an immediate pain in her proximal fibula. She was diagnosed with a right proximal fibula fracture in the emergency department. Due to concern of a Maisonneuve fracture, a F elbow American Academy Orthopaedic Manual Physical Therapist (FAAOMPT) referred the patient to a fellowship trained foot and ankle trauma surgeon. The patient was unable to weight bear and presented with no ankle pain or significant swelling.

Weightbearing radiographs of the ankle were negative. Due to patient's mechanism of injury and tenderness at the interosseous membrane, the patient underwent an ankle external rotation manual stress test under fluoroscopy which indicated a significant disruption of the deltoid and syndesmosis ligaments. Damage to the deltoid ligament and syndesmosis results in an unstable mortise joint, and therefore, a correct diagnosis is critical to good long-term outcomes. Patient underwent TightRope$^{TM}$ fixation of the syndesmosis.

With the syndesmosis stable, the deltoid ligament can scar in and heal without operative management. The patient was initially immobilized in a post-operative cast for five weeks, and she was seen in PT for 2-3 times per month for 4 months for mid and forefoot joint and soft mobilization, gait retraining and exercise.

**Outcomes:**

Status post-surgery Lower Extremity Functional Scale (LEFS) scores were as follows: 4/80 at 10 weeks, 21/80 at 15 weeks, 45/80 at 19 weeks, 63/80 at 28 weeks and 79/80 at 15 months.

**Discussion / Conclusion:**

Physical therapists can play a key role in the accurate and timely diagnosis of MF and their patients' subsequent PT management that can optimize recovery. More information in PT literature regarding the diagnosis and rehabilitation of MF is necessary.

**ID:** 56 (poster)

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August Winter, Northwestern University Fellowship in Advanced Orthopaedic Physical Therapy Practice, Research and Education

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Kendra K Harris, Northwestern University Fellowship in Advanced Orthopaedic Physical Therapy Practice, Research, and Education

Kyle Anthony Denlinger, Northwestern University, Feinberg School of Medicine, Department of Physical Therapy and Human Movement Science, Fellowship in Advanced Physical Therapy Practice, Research and Education

Carol Courtney, Program in Physical Therapy, University of Illinois at Chicago

**Title:**

PRESSURE PAIN THRESHOLD TESTING IN THE CLINICAL SETTING: ANALYSIS OF A NEW METHOD OF ASSESSMENT

**Background / Purpose :**

Quantitative sensory testing (QST) is a tool for objective assessment of somatosensation across various populations. Pressure pain threshold (PPT) is a form of QST and is useful for the quantification of pain sensitivity and for determining areas of primary and secondary hyperalgesia. Traditionally PPT is assessed by performing three measurements at each location. This has been found to have good intra- and interrater reliability. However, many clinicians do not utilize PPT, citing lack of training, duration of testing, and time constraints as barriers to consistent implementation. Therefore, the purpose of this study was to investigate the effectiveness of an alternative and time efficient method of PPT assessment. A secondary goal was to assess intra-rater reliability of PPT measurements.

**Methods :**

This was a planned secondary analysis of a primary study investigating effects of interventions on PPT measures. Thirty subjects (age 30±4.7 years; 15 females) participated. Two testers were trained by the primary investigator who had extensive experience in QST. Pressure pain threshold measurements were taken at four sites at five separate instances. Both testers and subjects were blinded. The testing sites were the medial tibiofemoral joint line (TFJ), tibialis anterior (TA), vastus medialis obliquus (VMO) and the webspace of the hand (WS). This testing montage was chosen for the purpose of evaluating pain sensitivity in a patient population with knee pain, assessing TFJ for primary hyperalgesia, TA and VMO for secondary (regional) hyperalgesia and the hand for widespread hyperalgesia. Each site was tested at least twice at a steadily increasing rate of 30 kPa/second or slower using a digital algometer. A predetermined required accuracy of 20% was established. Measurements above this threshold were repeated to account for variability.

**Results:**

A total of 150 data sets with at least two PPT measurements were collected. Only two measurements were required in 55.3%, 68.0%, 69.3% and 52.0% of trials for the TFJ, TA, VMO and WS respectively. A fourth measurement was required in 5.3%, 2.7%, 4.0% and 7.3% respectively. Pearson correlation coefficients of the first two measurements demonstrated strong correlations for all data sets and both testers individually at the TFJ, TA and VMO (0.86-0.91) and slightly lower correlation at the WS (0.75-0.83).

**Discussion / Conclusion:**

Given the data, it appears feasible to attain consistent and reliable results with only two PPT measurements for most trials. Measurements taken over the large muscle venters of TA and VMO more consistently did not require additional trials. The TFJ and WS more frequently required third and fourth trials for accurate measurements. Higher variability at the WS may indicate an increased propensity to temporal sensitization at this site when performing PPT.

**ID:** 57 (platform)

Emily Marie Smith, University of Kentucky

Amber Delcourt, University of Kentucky
Hannah Little, University of Kentucky
Charles Ray Hazle, University of Kentucky Physical Therapy Program

**Title:**

A SURVEY OF CHRONIC MUSCULOSKELETAL PAIN MANAGEMENT METHODS AND PERCEIVED EFFECTIVENESS

**Background / Purpose :**

The purpose of this study was to investigate the utilization of prescribed and self-selected management methods, and their corresponding perceived effectiveness for management of the participants' chronic musculoskeletal pain.

**Methods :**

An electronic survey was created on REDCap® and made available via ResearchMatch. Statistical analyses were performed by utilizing SAS® to obtain descriptive statistics. Additionally, cross tabulations were performed to analyze trends among subgroups of respondents.

**Results:**

A total of 254 respondents completed the survey with 74 participants partially completing the survey. Most respondents (59.4%; 147/254) described currently receiving care from a medical professional for their pain, while 40.6% (101/254) were attempting only self-management. Additionally, 63.9% (46/72) of rural residents reporting being under physician care for their painful condition(s) as compared to 88% (66/75) of urban residents. The most frequently identified choices were home methods (88.6%; 225/254), over-the-counter medications (73.2%; 186/254) and alternative treatment methods (72.9%; 185/254). Home methods, including cold or heat application and Epsom salts, had low perceived effectiveness values of 9.1% (2/22) – 32.3% (48/149). Exercise for pain management was selected by 63% (159/254) of respondents with 31.7% reporting moderate to significant perceived effectiveness. Marijuana use was reported by 23.4% (56/239) with 69.6% (39/56) reporting moderate to significant effect. Similarly, 21.2% (54/254) of individuals reported use of opioids with 70.4% (38/54) of those users reporting moderate to significant effect. Among those using opioids, 83 - 98% (44-52/53) also reported use of home methods, other prescription medication, or topical/transdermal agents. Opioid users reported living in an urban area at 36.4% (36/99) more frequently than in a rural area at 20.8% (16/77). Depression was reported among 67.7% (172/254) of participants with pain with 87 –

94% (145-157/167) of those individuals describing moderate or greater difficulty with performing work and social activities.

**Discussion / Conclusion:**

These data suggest individuals employ a wide variety of pain management methods, many of which are not under guidance of a health care provider. A greater proportion of urban residents reported receiving treatment from a physician accompanied by more frequent opioid use when compared to rural residents. Marijuana and opioid use had the highest levels of perceived effect, although most of the opioid use was also in conjunction with other treatment methods. These data suggest persons experiencing chronic musculoskeletal pain often employ multiple self-selected approaches, even if significant effects are perceived with prescription or over-the-counter medications under the direction of health care providers. These data also suggest the association of chronic musculoskeletal pain and depression frequently impacts the ability of individuals to perform work and social activities. Physical therapists can benefit from understanding pain management patterns among those with chronic pain.

**ID:** 58 (platform)

Robert Sweet, Edward-Elmhurst Health

Christopher R. Hagan, Rush University Medical Center

**Title:**

PHYSICAL THERAPY MANAGEMENT OF A PATIENT WITH CERVICOGENIC DIZZINESS AND TEMPOROMANDIBULAR DYSFUNCTION: A CASE REPORT

**Background / Purpose :**

Cervicogenic dizziness (CGD) and temporomandibular dysfunction (TMD) are complex orthopedic conditions with multi-factorial etiologies, making patient management challenging. The upper cervical spine is known to contribute to many conditions, including local neck pain, headache, CGD, and TMD. Additionally, the temporomandibular joint (TMJ) may contribute to neck pain, headache, dizziness, and tinnitus. The TMJ and upper cervical spine share significant overlap in pain patterns, making a thorough musculoskeletal assessment imperative. The purpose of this case is to describe the utilization of upper cervical spine and TMJ examination to successfully manage a patient with CGD and TMD.

**Case Description:**

A 71-year-old female presented with a six-week history of left-sided jaw pain and

dizziness. She reported constant jaw pain exacerbated with mouth opening. Her dizziness was constant and described as unsteadiness, with 3-4 “dizzy spells” per day. Physical therapy examination revealed negative neurological, cardiovascular, vestibulo-ocular, and upper cervical instability testing. Key cervical assessment findings revealed limited right cervical flexion-rotation test (CFRT) provoking dizziness and left C1-2 and C2-3 facet joint accessory motion hypomobility provoking jaw pain. TMJ opening and left deviation were limited and left TMJ posterior-anterior accessory glide was hypomobile, each provoking jaw pain. Reproduction of each concordant symptom with upper cervical spine examination led to the initial decision to address cervical spine impairments. Treatment included upper cervical accessory mobilization and cervical rotation self-mobilization for home exercise program (HEP). This resulted in improved C1-2 and C2-3 mobility with elimination of dizzy symptoms and a significant reduction in jaw pain. When cervical spine assessment no longer reproduced jaw pain, the decision was made to directly treat the TMJ using left lateral glide accessory mobilization and self TMJ mobilization for HEP. This resulted in complete resolution of remaining jaw pain.

**Outcomes:**

Patient was seen for eight visits over 28 days. At visit four, dizziness on the numeric pain rating scale (NPRS) reduced from 8/10 to 0/10. Right CFRT improved 10 deg and measured equal with

contralateral motion. At visit seven, jaw pain on the NPRS reduced from 8/10 to 0/10. Mouth opening improved 18mm and lateral deviation measured equal bilaterally. Focus on Therapeutic Outcomes score improved from 45/100 to 72/100. Global rating of change at visit 7 was +7 for both dizziness and jaw pain. Symptom resolution was maintained at four-week follow-up.

**Discussion / Conclusion:**

This case demonstrates a thorough assessment of the upper cervical spine and TMJ in managing a patient with CGD and TMD. Upper cervical spine assessment initially reproduced concordant jaw pain and dizziness, directing initial treatment. After clearing the upper cervical spine, treatment was then directed locally at the TMJ, fully resolving all symptoms. This case supports further research investigating the effect of cervical mobilization in CGD and TMD.

**ID:** 59 (platform)

Phil Hageman, University of Illinois Hospital and Health Sciences System

Alison Duncombe, University of Illinois - Chicago

**Title:**

Upper cervical spine joint mobilization for treatment of tinnitus: a case report

**Background / Purpose :**

Tinnitus, the perception of sound without accompanying auditory stimulus, has been estimated to have a prevalence of up 42.7%. Causes of tinnitus include otologic, neurologic, infectious, and somatosensory conditions. Somatosensory tinnitus can be modulated by inputs from the somatosensory, somatomotor, and visual-motor systems. The purpose of this case report is to describe the effects of physical therapy management for a patient with the diagnosis of somatosensory tinnitus.

**Case Description:**

The patient was a 59-year-old female presenting with tinnitus in her right ear. Symptoms began insidiously three months prior with no improvement following medical and audiology evaluation and treatment. At her physical therapy exam, she described a constant right ear tinnitus that was aggravated with stress, poor sleep, loud and high-pitched noises, and working at her computer. Her baseline tinnitus intensity on a 0-10 scale was 9/10. Cranial nerve examination and cervical artery disease screening were unremarkable. Cervical spine rotation active range of motion was limited to 50 degrees bilaterally, with isolated upper cervical flexion reducing and upper cervical extension increasing her tinnitus. The flexion-rotation test was measured at 35 degrees bilaterally, and reduced tinnitus with right rotation. Palpable muscle trigger points (MTPs) in the right sternocleidomastoid, temporalis and medial pterygoid muscles increased her tinnitus. Hypomobility and increased tinnitus were noted at the right O-C1 and C1-2 joints with unilateral posterior-anterior (UPA) joint mobility testing. Initial treatment during visits 2 and 3 included grade III UPA non-thrust joint mobilizations to the right O-C1 and C1-C2 joints, reducing her tinnitus to 5/10. At visit 4, unilateral anterior-posterior (UAP) joint mobility testing at the right C1-2 facet joint revealed hypomobility and tinnitus reduction. Treatment with grade III UAP mobilizations to the right C1-2 facet reduced her tinnitus to 1/10 and maintained to her next visit. UAP mobilizations were continued at visits 5-7 and combined with soft-tissue mobilization to MTPs in her sternocleidomastoid, temporalis and medial pterygoid, upper cervical flexion exercises and postural education.

**Outcomes:**

The patient was seen for 8 visits over three months. Her baseline tinnitus intensity improved from 9/10 to 1/10. Functional impairments were measured on the Tinnitus Functional Index

(TFI). Her score on the TFI improved from 63% to 30%. She also reported improved sleep quality and quantity, ability to concentrate at work, and better control over her tinnitus. Overall, she reported feeling 70% better and a +5 on the Global Rating of Change Scale.

**Discussion / Conclusion:**

This case demonstrates the successful use of orthopedic manual therapy treatment in the management of a 59-year-old woman with somatosensory tinnitus. Research suggests that somatosensory causes of tinnitus occur through auditory and somatosensory afferent convergence in the cochlear nucleus. This may explain the mechanism underlying the patient's symptom improvement following treatment of upper cervical spine musculoskeletal impairments.

**ID: 60** (platform)
Sharon S Wang-Price, Texas Woman's University

Kristan Etibo, Texas Woman's University
Alicia Paige Short, Texas Woman's University
Jason Zafereo, UT Southwestern Medical Center
Kelli Brizzolara, Texas Woman's University

**Title:**

ULTRASONOGRAPHIC VALIDATION OF DRY NEEDLE PLACEMENT IN THE DEEP LUMBAR MULTIFIDUS MUSCLE

**Background / Purpose :**

In recent years, dry needling (DN) of the lumbar multifidus (LM), specifically the deep LM muscle, has been used as an adjunct treatment to exercise training in the management of low back pain (LBP). Several DN protocols have been proposed for needling the LM using a 60 mm long needle. However, a 60 mm long needle may not be long enough to reach the deep fibers of the LM muscles for large individuals. Further, when the needle hits the vertebra lamina, a bony drop is felt, indicating that the needle has transversed the deeper LM muscle. When a bony drop is not felt after needle insertion, it is not certain whether the needle has reached the deep LM muscle. Therefore, the purpose of this study was to use ultrasound (US) imaging to determine whether needling using two common protocols for the LM could reach the targeted deep LM and vertebra lamina for individuals with high body mass index (BMI).

**Methods :**

Twenty-one participants with a BMI higher than 25 completed the study. An

ultrasound (US) scanner with a curvilinear transducer (3–5 MHz) was used to determine the location of each needle placement after the needle was inserted in the LM at L4 and L5. A 100 mm long needle was used in the study for all participants. The needle was inserted following two commonly used DN protocols for the LM: 2 cm lateral to the spinous process at a 20° inferior-medial angle, and 4 cm lateral to the spinous process at a 45° medial angle. When a bony drop was felt with each insertion, the needle was pulled in and out slightly within the muscle so that the needle placement could be observed and confirmed on US images. Whether or not the needle reached the targeted lamina and deeper LM was recorded. In addition, the un-used length of the needle was also recorded.

**Results:**

Using both the needling protocols at both L4 and L5, the needle did not reach the vertebra lamina for 23.8% (5/21) - 33.3% (7/21) of the participants but did reach the spinous process or junction of the spinous process and vertebra lamina. However, absence of a bony drop occurred only once using the 4 cm method at L5. The needle did not reach the deep LM for 4.8% (1/21) – 14.3%

(3/21) of the participants. Further, a needle longer than 60 mm was required to have a bony drop for 28.6% (6/21) - 33.3% (8/21) of the participants, specifically, for 75% of the participants with a BMI > 30.

**Discussion / Conclusion:**

The results of the study suggest that the probability of reaching the deep LM muscle fibers using the two DN protocols is high. However, the bony drop may not indicate that the needle has reached the vertebra lamina as the protocol intended. High BMI and occurrence of anatomical variations in the lumbar spine could contribute to missing the landmark. Ultrasound-guided DN may assist clinicians in guiding the needle to the intended anatomical targets, particularly for individuals with high BMI and for considering the occurrence of anatomical variations in the lumbar spine.

**ID:** 61 (poster)

Caleb Richard Ashmore, Harris Health System

**Title:**

Why Taking Vitals is Vital

**Background / Purpose :**

Atrial fibrillation (AF) is a clinical diagnosis of an irregular and often rapid heart rate that occurs when the two superior chambers of the heart experience chaotic electrical signals. The result is a rapid and irregular heart rhythm. Many outpatient PTs do not regularly check vitals. The purpose of this case report is to demonstrate the importance of measuring vital signs at every physical therapy session.

**Case Description:**

The patient was a 69-year-old Hispanic male, referred to outpatient physical therapy for chronic knee and low back pain of insidious onset. His imaging showed moderate to severe multilevel stenotic changes between L2-S1, and grade 3 knee osteoarthritis of the lateral compartment. The patient had a known history of CHF, AF, and HTN. During the exam, the patient performed poorly with minimal squat range and decreased weight on his left leg. His gait was antalgic with a bilateral compensated Trendelenburg. He touched his knees during active lumbar flexion, and extension was nil with sharp pain. L knee ROM was lacking 8 to 104 degrees of flexion. Planned treatments included manual therapy, spine mobility, and abdominal/gluteal/quadriceps loading.

**Outcomes:**

During the first treatment, the patient performed basic knee ROM and quad activation exercises. At his second visit, he exhibited a 2-point reduction on the NPRS, but had an elevated diastolic BP reading of 98 and 99 mmHg (90 mmHg at eval). He remained asymptomatic throughout the session and was able to perform 15 minutes of aerobic exercise, seated lumbar flexion for spinal mobility, and loaded terminal knee extension. At his third visit, he used the bike and upper arm ergometer with resistance, performed lumbar flexion, and Total Gym squats with moderate resistance. He began feeling dizzy and weak. His vitals were taken again, and BP was 150/120 mmHg. A NP from the clinic was called to assess the patient. His HR range was 27 to 89 bpm while sitting, and it was determined that the patient was likely experiencing AF. It was then decided that the patient needed to be rushed to the emergency department. He was admitted to the hospital and was diagnosed with paroxysmal AF and an ejection fraction of 55%.

**Discussion / Conclusion:**

This case highlights the importance of taking vital signs at each visit, and often throughout the session, if the patient experiences any abnormal responses to exercise. If emergent actions were

not taken promptly, the patient could have come to significant harm and even a potential cerebrovascular accident. Physical therapists are more than capable of making the determination to terminate a physical therapy session and plan of care when it is necessary for the safety of the patient.

**ID:** 62 (poster)

Katherine Albert Zisk, Shirley Ryan AbilityLab

Christine Schauerte, Rush University Medical Center
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**Title:**

DIFFERENTIAL DIAGNOSIS OF UNILATERAL SHOULDER PAIN POST COVID-19 VACCINATION: A CASE REPORT

**Background / Purpose :**

Shoulder pain is a common acute symptom post-vaccination, yet some cases persist beyond expected time frames requiring medical management. The most frequent diagnoses for persistent shoulder pain post-vaccination are non-specific pain (32%), rotator cuff problems (13.9%), bursitis (11.8%), adhesive capsulitis (5.5%), and brachial neuritis (2.3%). Acute brachial neuritis (ABN) is a rare peripheral nerve disorder characterized by sudden and severe shoulder pain, weakness, and dysesthesias, occurring post-vaccination in 15% of the cases. To date, 48 cases have been reported post COVID-19 vaccination. Early and accurate diagnosis of persistent shoulder pain post COVID-19 vaccination is critical for proper management. The purpose of this case report is to describe the process of differentially diagnosing ABN post COVID-19 vaccination to optimize initial treatment and achieve functional outcomes.

**Case Description:**

Patient is a 28-year-old female with acute onset of right shoulder pain 7 days post second Pfizer-BioNtech COVID-19 vaccine ipsilaterally. Referring diagnosis from primary care physician was documented as adhesive capsulitis. Patient presented to physical therapy 4 weeks post-vaccination with anterior shoulder pain, weakness, and numbness. Right shoulder AROM flexion was 37 degrees and abduction 110 degrees with 7-8/10 pain. Right shoulder PROM flexion was 110 degrees and abduction 140 degrees with 4/10 pain, numbness, and perceived temperature change in distal upper extremity. Left shoulder AROM/PROM was full and pain free. Cervical spine screening including A/PROM with OP and passive joint accessory testing was negative. Compression and Spurling's were negative. Static cutaneous sensory testing was inconsistent, demonstrating reduced sensation after aggravating motion along anterolateral aspect of distal extremity. Strength was 3+/5 for right abduction and external rotation with 6/10 pain. Remaining upper extremity myotomal tests were strong and pain free. Neurodynamic testing was positive for right median nerve. Passive joint accessory motion of glenohumeral joint was normal bilaterally.

**Outcomes:**

Patient attended 12 physical therapy visits over three months. Thoracic thrust manipulation revealed immediate and sustained improvement with functional reach. Medical management included Medrol Dosepak. Disability of Arm, Shoulder, and Hand outcome measure improved from 63.3% to 1.7% disability at discharge. Shoulder flexion AROM improved to 165 degrees without pain, and Global Rate of Change was +7 at discharge.

**Discussion / Conclusion:**

This case reveals the importance of early and accurate diagnosis of shoulder pain post COVID-19 vaccination. The referring diagnosis, adhesive capsulitis, was ruled out by lack of capsular pattern, normal joint accessory motion, and AROM not equal to PROM indicating a muscular deficit. Negative cervical screen ruled out cervical radiculopathy. ABN was confirmed by rapid onset of severe pain, limited shoulder AROM, upper extremity paresthesias, and weakness. Studies on Shoulder Injury Related to Vaccine Administration exclude brachial neuritis, leading to limitations in the literature. Further research is needed on post-vaccination ABN to optimize early treatment.

**ID:** 63 (platform)

Sarah Hendley, Shirley Ryan AbilityLab

Kristina Griffin, Shirley Ryan Ability Lab

**Title:**

DIFFERENTIAL DIAGNOSIS OF HEADACHE IN A PATIENT WITH A COMPLEX HISTORY OF MULTIPLE CONCUSSIONS: A CASE REPORT

**Background / Purpose :**

Headaches affect approximately 46% of the general population, making them one of the most seen medical conditions in the United States. Cervicogenic headache is the most common secondary headache caused by a disorder of the cervical spine, accounting for up to 20% of chronic headaches. Conversely, concussion is a potential source of headache, typically associated with additional symptoms of nausea, dizziness, fatigue, difficulty concentrating, sleep dysregulation, and mood disruptions. Post-concussion syndrome (PCS) is defined by persistence of concussion symptoms beyond 7-10 days and occurs in 10-15% of individuals with concussion. The purpose of this case report is to describe the differential diagnosis and physical therapy management of a female with intermittent headaches and a medical diagnosis of post-concussive syndrome.

**Case Description:**
The patient was a 24-year-old female presenting to outpatient physical therapy with a history of three, fully resolved concussions between the ages of 4-22 years. She was referred by a concussion clinic with a medical diagnosis of post-concussive syndrome six months after onset of left frontal headaches secondary to bumping her left suboccipital region on her nightstand. Over the course of six months, her headaches had not resolved with rest, and she gradually returned to activity. She reported worsening symptoms with impact activities including jump roping and running. She denied any other concussive symptoms at onset or evaluation. During evaluation, the patient's cranial nerve, neurological exam and Buffalo Concussion Treadmill test were all unremarkable. Headache symptoms were produced with left upper cervical extension quadrant testing. She demonstrated asymmetrical cervical flexion-rotation testing and significant hypomobility at left O-C1 and C1-2 with passive accessory motion. Deep neck flexor endurance was 12.2 seconds. Treatment consisted of thrust and non-thrust mobilization of left O-C1 and C1-2 joints, self-directed rotational sustained natural apophyseal glides, and deep neck flexor training.

**Outcomes:**

After visit three, her global rating of change was +5. Headache Impact Test-6 reduced from 32 to 16. Left C1-2 rotary thrust mobilization resulted in symmetrical flexion-rotation testing and abolished pain with upper cervical quadrant intrasession. Headache frequency and duration

reduced from five days/week lasting several hours at a time to three days/week lasting for less than five minutes with full return to impact activity.

**Discussion / Conclusion:**

This patient had previous concussions after localized head trauma in childhood and adolescence. Given this history, she sought care specifically at a concussion clinic upon her new onset of headaches despite no other symptoms of concussion or a mechanism of injury consistent with concussion. This case highlights the importance of thorough subjective and physical examination for appropriate differential diagnosis and successful management of headaches. Further research should be conducted to provide additional diagnostic criteria of PCS versus cervicogenic headache to assist clinicians in appropriate early diagnosis and intervention.

**ID:** 64 (platform)

Alex Bengtsson, Northwestern University Fellowship in Advanced Physical Therapy Practice, Research and Education; Department of Rehabilitation Services, University of Illinois Hospital and Health Sciences System

Josiah Sault, UI Health
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**Title:**

TARGETED MANUAL THERAPY AND EXERCISE AT THE CERVICAL SPINE FOR CHRONIC SHOULDER PAIN IN A PATIENT WITH LIMITED HEALTHCARE ACCESS: A CASE REPORT

**Background / Purpose :**

The cervical spine may cause upper extremity symptoms even in the absence of spine pain. In patients with limited healthcare access, identifying the dominant driver becomes even more important to maximize available resources. The purpose of this case report was to discuss the successful treatment of a patient with spine related shoulder pain who was limited to three visits due to financial constraints.

**Case Description:**

A 72-year-old male was referred to physical therapy for left shoulder pain after falling on it eight months prior. He also sustained skin abrasions of his face and hit his head without loss of consciousness. He denied current or prior history of neck pain, headaches, and upper extremity paresthesia. Several weeks prior to the evaluation, the patient completed four physical therapy visits at a separate institution consisting of resisted shoulder exercises and hot packs without improvement resulting in self-discharge. According to the patient, the spine was neither assessed nor treated. The patient's pain was described as intermittent aching of the left anterolateral shoulder rated 7/10 at the initial evaluation. While reaching behind the back and overhead were limited and painful, sustained, and dependent positioning of the head and neck in sitting and reading also caused shoulder pain. Left shoulder active and passive range of motion (A/PROM) was limited and painful. Cervical AROM and passive accessory intervertebral mobility assessment in central and unilateral posterior-to-anterior and unilateral anterior-to-posterior directions revealed hypomobility and caused unfamiliar periscapular pain but not the patient's pain. Left C5-6 rotation passive physiological intervertebral mobility (PPIVM) assessment reproduced shoulder pain. The primary manual therapy intervention over 3 sessions was grade III cervical rotational PPIVM mobilizations which reduced pain and improved shoulder A/PROM. Exercises included seated and supine cervical rotation AROM focused on reproducing effects of manual intervention and thoracic extension mobility. Patient education focused on activity modifications and specific instructions on independent graded progression of exercises and activities based on symptoms.

**Outcomes:**

At follow-up via phone seven weeks later, patient reported complete resolution of shoulder pain and impairments. Initial scores on the patient specific functional scale were 2/10, 2/10 and 3/10 for washing his back, reaching overhead, and sleeping respectively. Patient reported improvement to 10/10 throughout, crediting the home exercise program. Quick Dash was 25% at evaluation, and at phone follow-up, the patient denied any pain or limitations during discussion of items.

**Discussion / Conclusion:**

This case report illustrates the importance of considering the spine as a potential primary driver of shoulder pain in a patient who had not responded to shoulder treatments previously but improved with interventions targeting cervical function. This facilitated the development of an effective plan of care including home exercises that allowed the patient to independently improve after he was financially unable to continue in-person sessions.

**ID:** 65 (poster)

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**Title:**

Vertebral Artery Anomaly and Possible Repercussion on Vertebral Artery Testing

**Background / Purpose :**

The vertebral arteries normally originate from the subclavian arteries and continue their course through the transverse cervical foramina into the brainstem and cerebellum (Yuan, 2016). Thus, the purpose of this report is to raise awareness to clinicians using vertebral artery testing on the possible implications of passive cervical rotation and extension when used to test for vertebral artery insufficiency since there is a lack of evidence on the effects of this maneuver on blood flow when the vertebral artery test is performed on individuals with abnormal origins of the vertebral artery.

**Case Description:**

During the dissection of cardiovascular structures, we found that the right vertebral artery originated from the aortic arch and not from its normal origin, the right subclavian artery. This aberration poses a challenge to clinicians testing for vertebrobasilar insufficiency thus the arch branch pattern of the vertebral artery must be taken into consideration before manipulative or testing maneuvers in the neck are performed to avoid unexpected outcomes in relation to aberrant vertebral artery.

**Outcomes:**

During vertebral artery testing, active range of motion is done before passive range of motion of the cervical spine is performed. After that, the patient is placed in supine and passive extension and side flexion of the head and neck is performed. Following that maneuver, passive rotation is performed on the ipsilateral side and hold for 30 seconds. The test is repeated on the opposite side. Any loss of balance, dizziness reported is considered a positive finding and the patient should be referred for further assessment. The implications that an abnormal origin of the vertebral artery is not well understood regarding the vertebral artery test. However, awareness needs to be raised so physical therapists, MDs, and other healthcare providers screen patients for these types of abnormalities.

**Discussion / Conclusion:**

This case study aims to raise awareness of the possible deleterious outcomes when performing the vertebral artery test on patients with vertebral artery abnormal origins. The current literature shows that the vertebral artery test is used by medical practitioners to test for vertebrobasilar insufficiency. However, there is a paucity of evidence on the effects of this test on patients with aberrant origin of the vertebral artery. Thus, the importance of screening patients for these types of abnormalities.

**ID:** 66 (poster)

Arie van Duijn, Florida Gulf Coast University

Kathy Swanick, Florida Gulf Coast University

**Title:**

Real-time sonographic visual feedback improves transverse abdominal muscle contraction

**Background / Purpose :**

Strengthening of the transverse abdominus (TA) muscle is widely recommended as a component of trunk stabilization exercise programs. Due to the anatomical location, it is often difficult for patients to perform an isolated contraction of this muscle. It is not known which feedback mechanisms are useful to promote TA muscle contraction. The aim of this study was to examine the effect of visual feedback using sonography on the ability to contract the TA muscle.

**Methods :**

Muscle thickness of the transverse abdominis, internal, and external abdominal oblique muscles was measured by sonographic imaging using a GE LogiQe unit during a standard abdominal drawing-in maneuver in 32 healthy subjects. The subjects were subsequently provided with real-time visual sonographic feedback during this maneuver, and the thickness of all three muscles was again measured. Differences in muscle thickness pre and post sonographic visual feedback were analyzed.

**Results:**

There was a statistically significant difference in thickness of the TA muscle (mean Pre:0.62cm, mean Post:0.80cm, $t=6.6$, $p=0.000$), but not for the internal (mean Pre: 1.06cm, mean Post:1.10cm, $t=1.53$, $p=0.134$) or external oblique muscles (mean Pre: 0.66cm, mean Post:0.63cm, $t=-1.25$, $p=0.222$).

**Discussion / Conclusion:**

Real-time sonographic visual feedback improved muscle contraction of the TA muscle without increasing contraction of the internal and external abdominal oblique muscles in healthy subjects. Sonographic visual feedback can be an additional clinical tool to promote TA muscle activation. Future research should examine this effect in symptomatic patient populations.

**ID:** 67 (platform)

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**Title:**

POSTERIOR GLIDE MOBILIZATIONS IMPROVE SHOULDER RANGE OF MOTION BUT DO NOT ALTER HUMERAL HEAD DISPLACEMENT IN SUBJECTS WITH INTERNAL ROTATION DEFICIT

**Background / Purpose :**

Cadaveric studies demonstrated that limited shoulder internal rotation range of motion (ROM) may contribute to shoulder disorders by altering humeral head translation during arm elevation. Research substantiating this association in vivo is lacking. Limited shoulder internal rotation ROM in overhead athletes is due to soft tissue and boney changes in the dominant shoulder. It is unknown how internal ROM gains after joint mobilization alter humeral head translation during arm elevation, and how altered humeral head retro-torsion in the dominant shoulder effects humeral head translation before or after joint mobilization. This study's purpose was to compare left to right humeral head displacement during arm elevation in subjects with limited internal rotation ROM and assess changes in ROM and humeral head displacement after shoulder mobilizations. We also sought to identify associations between humeral head retro-torsion and changes in humeral head displacement and

internal rotation ROM after mobilizations.

**Methods :**

Twenty-five subjects (24.6+/-5.4 years) with limited internal rotation ROM in their dominant shoulder participated. Ultrasound imaging (UI) was used to measure the bicipital forearm angle, an indirect measure of humeral head retro-torsion. Humeral head displacement before and after posterior glide mobilizations were calculated using UI to measure the acromio-humeral and posterior glenohumeral distances in 3 positions: 1) at rest; 2) in 90 degrees shoulder flexion; 3) in 60 degrees shoulder abduction with external rotation. Humeral head superior displacement during arm elevation was calculated as the difference in the acromio-humeral distance at rest and that in the flexed or abducted positions. Humeral head anterior displacement during arm

elevation was calculated as the difference between the posterior glenohumeral distance at rest and that in flexed or the abducted position.

**Results:**

No humeral head displacement differences between the dominant and non-dominant shoulders existed during shoulder flexion or abduction ($p>.092$). Mobilizations increased internal rotation ROM (8.8+/-6.5 degrees; $p=.0016$; Effect Size=0.84) but did not change displacement during arm elevation ($p>.29$). No meaningful correlations existed between the bicipital forearm angle and mobilization effects on displacement or internal rotation ROM ($r<0.26$).

**Discussion / Conclusion:**

This may be the first study to assess how joint mobilization altered humeral head displacement during arm elevation, and how humeral head retro-torsion is associated with humeral head displacement and ROM gains after joint mobilizations. Contrary to cadaveric studies, we found no difference in humeral head displacement during either shoulder flexion elevation or abduction with external rotation in subjects with limited internal rotation ROM. Additionally, the degree of humeral head retro-torsion was not associated with humeral head displacement or range of motion gains after joint mobilizations. Joint mobilization increases shoulder ROM in the short term but may not effect humeral head displacement relative to the acromion, or posterior glenoid. The neuromuscular system may have greater influence on humeral head displacement during arm elevation than either soft tissue extensibility or humeral retro-torsion.

**ID:** 68 (platform)

Arie van Duijn, Florida Gulf Coast University

Eric Shamus, Florida Gulf Coast University
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**Title:**

Measurement of force and distance during glenohumeral inferior glide accessory motion testing

**Background / Purpose :**

Inferior glide joint accessory motion testing of the glenohumeral joint is commonly used in assessing shoulder function, however there is limited research into the amount of force applied by clinicians and distance amplitude of this accessory motion. The aim of this study was to quantify the amount of force applied to attain end range during inferior glide accessory motion testing in healthy adults by a single examiner, and the inferior displacement of the humeral head attained during this testing. A secondary aim was to identify relationships between force applied and demographics of age, height, weight, and BMI.

**Methods :**

Force measurements were performed in 69 subjects using the Novel Pliance Glove Force measurements were performed in 69 subjects using the Novel Pliance Glove system, and the inferior displacement of the humeral head in relationship to the coracoid process was measured by sonography using a GE LogiQe sonography unit. Correlational analyses were performed to determine relationships with demographic data.

**Results:**

The average force applied was 14.27 N (range: 5.25-35.92N, SD:7.22N, SE:0.91N). The average inferior humeral head displacement was 0.30cm (range: 0.06-0.90cm, SD:0.19cm, SE:0.02cm). There was a weak correlation between force and age ($r=.28$, $p=.013$).

**Discussion / Conclusion:**

There was significant variability in the amount of force required to reach end range inferior glide. Mean force was lower than found in prior studies, while displacement was like prior reports. Prior studies used rigid force sensors, while the Pliance Glove sensor contour-fits to the hand. Future research should examine these parameters in a symptomatic population

**ID:** 69 (poster)

Jacqueline van Duijn, Florida Gulf Coast University

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**Title:**

Differences in balance control measurements among neck pain patients with and without cervicogenic headaches

**Background / Purpose :**

Neck pain research has identified relationships between cervical dysfunction, proprioception, and balance deficits. It is not known if these relationships exist in patients with cervicogenic headaches (CEH). The aim of this study was to identify differences in balance performance in patients with neck pain with and without CEH prior to, during, and after completion of a six-week standard physical therapy treatment consisting of manual therapy and therapeutic exercise without specific balance or proprioception training.

**Methods :**

Two groups of 20 subjects participated, one neck pain (NP) group and one neck pain with CEH (NP/CEH) group. Balance was measured with the Neurocom Sensory Organization Test (SOT). Cervical ROM, deep neck flexor endurance (NFMET), Headache Disability Index (HDI), Neck Disability Index (NDI), and Visual Analog Score (VAS) data was also collected.

**Results:**

There were no statistically significant differences in SOT scores among the two groups ($t= 0.26$, 0.21, 0.75, $p>.05$). The NP group has a significant improvement of SOT score over time ($F= 5.58$, $p=0.01$), while the NP/CEH group had not ($F=.65$, $p=.52$). Both groups had significant improvements after treatment in cervical ROM, NFMET, NDI, and VAS ($F= 5.8$-$11.9$, $p<.05$), and the NP/CEH group had significantly improved HDI scores ($F=12.0$, $p= .000$).

**Discussion / Conclusion:**

While SOT scores were similar**,** NP patients had improved balance after standard treatment, while NP/CEH patients did not. Further research should quantify effects of manual therapy and exercise combined with balance and proprioception training in both patient populations.

**ID:** 70 (platform)

Joseph Andrew Signorino, The George Washington University

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**Title:**

IDENTIFYING CONSERVATIVE INTERVENTIONS FOR INDIVIDUALS WITH SUBACROMIAL PAIN SYNDROME PRIOR TO UNDERGOING A SUBACROMIAL DECOMPRESSION: A SCOPING REVIEW

**Background / Purpose :**

Subacromial decompression (SAD) procedures remain on the rise to address subacromial pain syndrome (SAPS). Conservative care is commonly received by individuals prior to undergoing a SAD since outcomes are equal to surgical intervention but it is unclear what interventions are used and considered "failed" prior to recommending surgery. Clinical practice guidelines (CPG) and available literature recommend individuals with SAPS receive physical therapy including exercise and manual therapy, steroid injections, non-steroidal medications, and a guided home exercise program. The purpose of this scoping review was to describe conservative interventions received by individuals with SAPS prior to undergoing a SAD.

**Methods :**

Four databases were searched for studies incorporating subjects who received and "failed" conservative interventions before undergoing a SAD. Two reviewers extracted all conservative care interventions in addition to length of time conservative interventions were deployed and treatment parameters (i.e. number of repetitions, frequency per week, etc.). Then, the most common combinations of interventions provided to subjects were grouped (i.e. physical therapy and injections; injections and a home exercise program, etc.) and compared to the CPG recommended interventions. Furthermore, physical therapy was classified as specific (i.e., including manual therapy) or non-specific (i.e. excluding manual therapy) depending on the description provided in the study, and compliance to a prescribed home exercise program was identified.

**Results:**

An electronic search identified 1,099 studies and 44 studies were included after full text review. Physical therapy was the most common intervention (n=38, 86.4%) received prior to undergoing a SAD; only five studies (11.3%) included manual therapy. A multi-modal treatment approach (n=13; 29.5%) was the second most common conservative intervention. Combined physical therapy and injections was noted in 27.3% (n=12) of the studies, and a guided home exercise

program was included in 13.6% (n=6). No studies measured compliance to the home exercise program. Three studies (6.8%) offered zero conservative

interventions. No studies incorporated the recommended interventions as highlighted in the CPG.

**Discussion / Conclusion:**

There is inconsistent conservative care offered to individuals with SAPS. Many individuals who ultimately receive surgery do not exhaust conservative care recommendations that align with CPGs. Clinicians and researchers should enhance efforts to incorporate exercise and manual therapy along with measuring exercise compliance to optimize shoulder treatment outcomes.

**ID:** 71 (poster)

Oliver Rivera, Northwestern University, Feinberg School of Medicine, Department of Physical Therapy and Human Movement Science, Fellowship in Advanced Physical Therapy Practice, Research and Education; Shirley Ryan AbilityLab

Kristina Griffin, Shirley Ryan Ability Lab

**Title:**

MANAGEMENT OF THORACIC OUTLET SYNDROME WITH A SYMPATHETIC PRESENTATION

**Background / Purpose :**

The clinical presentation of thoracic outlet syndrome (TOS) may include pain, paresthesia, color changes, and temperature changes throughout the upper quarter. Although controversial, T4 syndrome has been described in the literature with similar findings to TOS but with sympathetic origin. It has been suggested, based on proximity, that sympathetic innervation to the upper extremities (UE) originates from T2-8. Minimal research exists on the prevalence of these conditions occurring simultaneously. The purpose of this case report is to present the management of a patient with venous TOS and apparent T4 syndrome.

**Case Description:**

A 31-year-old male presented to outpatient physical therapy reporting left greater than right bilateral (B) hand paresthesia's, temperature changes, skin discoloration, and neck and shoulder pain. Initial onset was one year ago during kickboxing with two instances of symptoms in all extremities, and sensation of tachycardia. Symptoms worsened with repetitive activities, specifically push-ups. Skin discoloration and temperature changes were his main complaints primarily occurring in the left UE. He reported following up with over 15 physicians with venous ultrasonography ruling in venous TOS. Examination revealed positive B Adson's and hyperabduction TOS testing, limited thoracic extension active range of motion (AROM), hypomobile passive accessory motion in the thoracic spine and B first rib, increased left supine acromioclavicular joint height, and decreased middle and low trapezius activation. Skin temperature, measured by an infrared thermometer, decreased 6.01 and 3.81 degrees on the right and left dorsum of the hand, respectively, following a push-up task. Primary diagnosis consisted of venous TOS and T4 syndrome.

**Outcomes:**

T4 manipulation resulted in stabilization of skin temperature at B dorsal hands after a push-up task. Thoracic mobilization increased thoracic extension AROM, resulting in reversal of B Adson's testing. Left first rib caudal mobilization resulted in reversal of right hyperabduction testing. Left scapular retraction physiological mobilization resulted in reversal of left hyperabduction testing and symmetrical acromioclavicular joint height. Additional treatment and

home program included self-first rib and thoracic mobilizations, cervicothoracic and scapulothoracic posture and strength training. Subjective improvement was reported with reduced pain intensity and temperature changes with home workouts; however skin discoloration remained the same. Global Rate of Change scale improved to +2. Disabilities of the Arm, Shoulder, and Hand remained at 14.2%. Neck Disability Index changed from 10% to 12%. Tampa Kinesiophobia Scale changed from 41 to 46.

**Discussion / Conclusion:**

TOS and T4 syndrome can overlap in symptom presentation. A patient with venous TOS was treated with concurrent T4 syndrome consideration due to the sympathetic nature of the reported symptoms. Manual interventions directed at the cervicothoracic and scapulothoracic regions resulted in skin temperature stabilization and reversal of TOS testing results. With management of TOS, T4 syndrome should be considered when symptoms appear sympathetic in origin.

**ID:** 72 (poster)

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Jason Beneciuk, Brooks Rehabilitation/University of Florida

Matthew DeLang, Right to Dream Academy - Ghana
Sabrina Wang, University of Florida Health

**Title:**

UTILIZING POSTERIOR PELVIC TILT DURING PHYSICAL EXAMINATION TO GUIDE TREATMENT DECISION MAKING FOR A PATIENT DIAGNOSED WITH FEMOROACETABULAR IMPINGEMENT: A CASE STUDY

**Background / Purpose :**

Anterior hip pain management can be challenging for physical therapists with a lack of consensus on standardized care. For example, several clusters of prognostic tests have shown clinical significance in managing low back pain, allowing for physical therapists to assess the likelihood that a patient will respond to a certain intervention. However, a similar prognostic cluster or test has not been found in managing the anterior hip pain population. This case report describes how performing a posterior pelvic tilt was used to guide treatment for a patient with a medical diagnosis of femoro acetabular impingement syndrome (FAI).

**Case Description:**

A 48-year-old male was referred to physical therapy with a medical diagnosis of FAI. His symptoms began over one year ago and recently exacerbated after gardening. Symptoms were notably increased while driving, sitting for Zoom meetings, and toileting. Previous treatments included corticosteroid injection and iontophoresis, neither of which resulted in symptom improvements. Range of motion assessment revealed reduced hip flexion, adduction, and internal rotation range of motion in standardized position. Furthermore, concordant symptoms were reported with end range in those three directions. Both FADDIR and Thomas tests were positive. Such assessments were repeated with a posterior pelvic tilt and hip range of motion improved by approximately 25% compared to baseline without any symptoms. Additionally, FADDIR test was negative (i.e., no catching, apprehension, or reproduction of hip/groin pain with motion). Initial interventions utilized posterior pelvic tilts to improve lumbopelvic dissociation. This was followed by anterior core and posterior chain strengthening to promote neuromuscular control of the hip and pelvis during functional movements.

**Outcomes:**

Following 4 visits over 3 weeks, pain intensity decreased from 8/10 to 0/10 using the Numeric Pain Rating Scale (NRS) and Lower Extremity Functional Index (LEFS) score increased from 43.9% to 73.2%, indicating significant functional improvement. Upon discharge, the patient

reported an improvement in sitting tolerance while driving and gardening in a crouched position without symptoms.

**Discussion / Conclusion:**

This case report describes how posterior pelvic tilting served as a prognostic test to guide interventions for efficient outcomes. While no test should ever be used in isolation or standalone, performing FADDIR test while maintaining a posterior pelvic tilt may be useful in identifying whether patients with anterior hip pain may benefit from physical therapy interventions focusing on lumbopelvic dissociation and coordination training. Future studies are needed to validate the accuracy of this potential prognostic indicator.

**ID:** 73 (poster)

James Quinlon Curtis, UNC Health/ UNC Therapy Services

**Title:**

Manual therapy and Exercise for the Management of Notalgia Paresthetica: A Case Report

**Background / Purpose :**

Notalgia Paresthetica is a rarely reported sensory neuropathy of the T2-T6 posterior branches of the spinal nerves. It is characterized by pruritus and pain along the medial and infrascapular paravertebral region. Currently, there is limited evidence on physical therapy manual interventions for treatment of this condition. The purpose of this case report is to discuss the manual therapy and exercise management of an individual diagnosed with Notalgia Paresthetica.

**Case Description:**

A 68-year-old female presented to physical therapy with a 1-year history of numbness along the right infrascapular paravertebral region that progressed to include pruritus and pain. Capsaicin topical cream was prescribed for pruritus that provided minimal relief. Her symptoms were intermittent and worsened with sitting and walking and would take up to several hours for her symptoms to reduce. She reports relief with twisting side to side and lying flat on her back. Her goal was to be able to sit comfortably to complete puzzles.

In sitting and standing, she demonstrated a forward head posture with increased thoracic kyphosis. She had no myotome or dermatomal abnormalities in bilateral upper or lower extremities. However, she reports a patch of numbness along the right medial and infrascapular paravertebral region. Cervical, thoracic, and lumbar range of motion (ROM) produced symptom reduction with cervical extension and left side bending, thoracic extension and left side bending, and lumbar left side bending. Her symptoms were worsened with cervical retractions and with central posterior-to-anterior (CPA) and unilateral posterior-to-anterior (UPA) non-thrust mobilizations of T1-T7.

At the first visit, she reports relief with left T4-5 UPA non-thrust mobilizations. The subsequent visit, she had further relief with T2-5 CPA and UPA non-thrust mobilizations. At the 3$^{rd}$ visit, a supine thoracic extension thrust mobilization at T4 produced an immediate resolution of symptoms. Following the manual therapy interventions, she was instructed to complete repeated thoracic extensions and right thoracic rotations as these movements provided in-session improvements. Band resisted scapular retractions was also provided to further encourage thoracic extension.

**Outcomes:**

She was seen for 5 total visits. At her 4th visit, she reports 2 occasions of numbness after prolonged sitting and was abolished after completing her exercises. At her 1-month follow-up, she noted no reoccurrences of pain or numbness with prolonged sitting or walking. Secondary to a history of low back pain, a Modified Low Back Oswestry was initially completed. Her score reduced from 28% to 0% impairment. She also demonstrated full cervical, thoracic, and lumbar spine ROM that was asymptomatic.

**Discussion / Conclusion:**

This case report describes the management of Notalgia Paresthetica utilizing non-thrust and thrust mobilizations combined with exercise. To the author's knowledge, this is the first case report that discusses detailed physical therapy manual interventions utilized in the management of this condition.

**ID: 74 (platform)**

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**Title:**

ADDITIVE EFFECTS OF EXERCISE AND MANUAL THERAPY ON PAIN INHIBITION MEASURED VIA PRESSURE PAIN THRESHOLD

**Background / Purpose :**

Joint manual therapy (MT) and isometric exercise are common interventions in physical therapy practice. Previous research has suggested that analgesic effects of joint MT occur via serotonergic descending inhibitory mechanisms while exercise-induced hypoalgesia occurs via serotonergic, opioidergic and endocanabinoidergic mechanisms. We hypothesized that application of both interventions sequentially would result in additive hypoalgesic effects by activating distinct inhibitory pathways in the central nervous system. The purpose of this study was to examine sequential effects of exercise and MT on pressure pain threshold (PPT) in individuals without history of knee joint injury/disease. Preliminary results are presented.

**Methods :**

Thirty individuals (15 male, age=30±4.7 years) without history of neurological disorder or knee joint injury and not taking anti-depressant/pain medications were recruited. Maximum voluntary isometric quadriceps strength and conditioned pain modulation, via cold pressor test, were examined followed by 15-minute washout period. Participants, positioned in semi-recumbent position, were randomly assigned to receive either MT or exercise first in a sequential manner without washout. Two trials of PPT, with intertrial interval of ≥30 second, were measured ipsilaterally at medial knee joint line, tibialis anterior muscle, vastus medialis obliquus (VMO) muscle and the hand webspace at baseline, post-intervention-1 and post-intervention-2. Interventions included 6 minutes of oscillatory Grade III posterior-to-anterior joint accessory mobilization at tibiofemoral joint and 6 minutes of isometric quadriceps muscle contraction at

10% MVIC, with 30 second rest at midpoint. To address effects of sequence (MT then EX vs EX then MT), treatment (MT vs EX), and time point (Pre vs Post intervention), and their interactions, the data were subject to mixed model analysis. The random effect was subject. The fixed effects were sequence, treatment, time-point, and all 2-way and 3-way interactions. CPM response was used as a covariate. Residual diagnostics were performed to check validity of assumptions. All statistical tests used a two-sided 5% level of significance, p-values for multiple comparisons were adjusted using the Bonferroni method, and SAS9.4 was used for statistical analysis.

**Results:**

Six participants had no CPM response, operationally defined as 10% increase in PPT, measured immediately post-cold pressor test. Maximum quadriceps exercise pain was 40±27.8 (0-100) while MT was painless. While PPT increased following both interventions, post-treatment effect was significant at joint line and tibialis anterior when MT followed exercise. Additionally, MT was significantly additive to exercise with PPT at these sites only when exercise was performed first.

**Discussion / Conclusion:**

Central effects of MT may be more somatotopically organized while exercise may produce more global, widespread effects. However, exercise in this study was painful and MT not. Group IV fiber input activates spinoreticular pathways, triggering spino-bulbo-spinal loop and thereby producing analgesia. Therefore, mildly painful interventions may be more effective at producing hypoalgesia. Future research to identify interventions that facilitate pain relief are warranted.

**ID:** 75 (platform)

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**Title:**

Physical Therapy Management of Individuals with Proximal Biceps Tendinopathy: A Scoping Review

**Background / Purpose :**

Shoulder pain related to pathology of the long head of the biceps tendon (LHBT) can be debilitating and may interfere with an individual's activity and participation. Chronic tendinopathy of the LHBT is a common condition which is often difficult to treat. Little consensus exists regarding the ideal approach to treating pain and disability due to LHBT tendinopathy. The purpose of this review is to systematically scope the reported physical therapy management of individuals with LHBT tendinopathy.

**Methods :**

A scoping review of the literature was performed by searching CINAHL, EMBASE, MEDLINE and SportDiscus from inception to June 15, 2020. Quantitative and qualitative research that reported on physical therapy intervention for LHBT tendinopathy were included. A qualitative synthesis that identified themes included in physical therapy intervention was performed. The type of intervention and information on dosing (if provided) were extracted and summarized in tables. Study quality was assessed for the randomized controlled trials.

**Results:**

A total of 3066 potentially relevant records were identified, 12 articles were eligible for inclusion. Of the 12 original articles included, there were 4 randomized controlled trials (RCTs), 1 non-randomized observational intervention study, 1 case series, 2 clinical commentaries and 4 reviews. Themes included therapeutic exercise (including scapular stabilization, rotator cuff strengthening and eccentrics), biophysical agents (including ultrasound, low level laser and iontophoresis), dry needling, manual therapy interventions (including joint mobilization), activity modification and pain self-management advice and injection. Evidence from two moderate quality RCTs showed effectiveness from ultrasound and eccentrics with or without joint mobilization in one study and radial extracorporeal shock wave therapy in another. Two low quality RCTs showed effectiveness from ultrasound with low level laser in one study and iontophoresis in another. A case series (n=10) suggested utilizing dry needling to the LHBT combined with eccentric exercise.

**Discussion / Conclusion:**

Very low-level evidence suggested a diversity of physical therapy interventions may be effective for LHBT tendinopathy. Interventions recommended were variable and did not provide sufficient detail or consistency to guide practicing clinicians on ideal physical therapy interventions for treating individuals with LHBT tendinopathy. Further research is needed due to an overall lack of evidence and quality of studies available.

**ID:** 77 (platform)

Brian T Swanson, University of Hartford

**Title:**

INFLUENCE OF THORACIC MANIPULATION ON SHOULDER ROM AND EMG ACTIVITY WHEN COMBINED WITH MOBILIZATION OR STRETCHING

**Background / Purpose :**

Posterior shoulder tightness (PST), resulting from the posterior capsular and muscular tightness, is demonstrated by limited internal rotation and horizontal adduction range of motion (ROM) and is consistently associated with shoulder pathology. Interventions addressing PST include posterior glide glenohumeral mobilizations (PGM) directed towards the capsule and sleeper stretches directed towards the posterior musculature. There is conflicting evidence regarding the effectiveness of thoracic manipulation for individuals with shoulder pain, but manipulation may decrease resting tone, and case reports suggest thoracic manipulation may result in improved ROM. The purpose of this study was to assess the effects of adding thoracic manipulation to PGM and sleeper stretches on ROM, joint mobility, and electromyographic (EMG) activity in stiff shoulders.

**Methods :**

Design: Randomized repeated measures study.

A convenience sample of 40 individuals with clinically significant internal rotation loss attended two study sessions. During the first session, participants were randomized and received either 5x30 seconds grade III posterior glide mobilization or 5x30 seconds sleeper stretching. Following a 7-day washout period, all participants attended a second session and received a supine T3-4 thrust manipulation followed by the previously randomized intervention. Outcome measures included internal rotation ROM, horizontal adduction ROM, posterior glenohumeral joint translation assessed via ultrasound imaging, and EMG activity of the infraspinatus during the posterior glide normalized to MVIC. All outcome measures were collected immediately before and after each intervention.

**Results:**

There were significant within-group but no between-group differences for IR and horizontal adduction ROM following a single session of PGM or sleeper stretch.

When combined with thoracic manipulation, significantly smaller within session changes of IR ROM was observed for both GH mobilization (mean difference -4.38° , p=.019) and sleeper stretches (mean difference -6.38° , p=.0002). Horizontal adduction ROM demonstrated a similar trend although it did not reach significance. Interestingly, EMG activity of the infraspinatus

diminished following thoracic manipulation indicating that elevated infraspinatus activity was not the cause of this motion loss. While not significantly different between groups, total translation also increased following combined interventions.

**Discussion / Conclusion:**

As expected, both GH posterior mobilizations and sleeper stretches improved both IR and horizontal adduction ROM. Unexpectedly, the addition of thoracic manipulation before shoulder interventions resulted in smaller gains of both IR and horizontal adduction ROM. Considering that greater posterior translation was observed and infraspinatus activity decreased following combined interventions, the reductions in ROM appear to be extra-articular although unrelated to the infraspinatus. Likely explanations for the reduced ROM include an excitatory effect on antagonistic muscle groups or other centrally mediated effects. Clinically, if the therapeutic intent is to improve IR or horizontal adduction ROM, the addition of thoracic manipulation is counterproductive.

**ID:** 78 (poster)

Raffaele Lagonigro, Regis University

**Title:**

Managing medial gastroc strain in an 18-yo soccer player using a multi-modal approach; a case report

**Background / Purpose :**

A medial gastrocnemius strain (MGS) is an injury to the calf muscle. Symptoms can include pain behind the knee, swelling in the calf, bruising in injury and an audible pop at the time of injury. Injury typical occurs during maximal knee extension and full ankle dorsiflexion, at which point the muscle is at maximally elongation. The purpose of this case report is to present the management and findings of an 18-year-old soccer player post-gastrocnemius strain using a pragmatic, multimodal treatment approach with manual therapy and neurodynamic focus.

**Case Description:**

18-year-old male soccer player sustained an acute injury to his right, proximal, medial, gastrocnemius while at soccer practice. The patient reported he felt a “strong pull” in his calf while performing a cutting maneuver. He noted immediate pain and was unable to continue with practice. Over the next week, his pain progressively worsened resulting in difficulties with walking, using stairs, and an inability to play soccer. He noted a 5/10 on the Numeric Pain Rating Scale (NPRS) and scored a 52/80 on the Lower Extremity Functional Scale (LEFS). Physical examination revealed familiar pain with passive dorsiflexion and overpressure. Palpation revealed moderate tenderness in the proximal medial gastrocnemius. His pain was reproduced with resisted plantarflexion in full knee extension. A Straight Leg Raise test on right leg with sural and tibial nerve biases reproduced his symptoms. Treatment commenced using instrument assisted soft tissue mobilization (IASTM) to the proximal-medial aspect of his right gastrocnemius and distal medial hamstrings, passive stretch to the right medial hamstring gastroc-soleus complex and neurodynamic mobilization. Strength and movement coordination impairments were addressed with progressive exercise focused on lower leg strengthening and balance exercises.

**Outcomes:**

The patient improved significantly in 10 visits over the course of 5 weeks. The patient’s final NPRS was a 2/10 and his LEFS was scored at 74/80. The patient no longer complained of difficulty with walking or stairs and was able to return to participating in soccer practice at 4 weeks reporting himself 80-90% of full capacity.

**Discussion / Conclusion:**

The approach to treatment of a gastrocnemius strain traditionally includes soft tissue mobilization (STM) along with exercise to reduce pain and regain function. In this case, neurodynamic mobilization was included in the treatment of a muscle strain. Recent research has shown positive outcomes when using this treatment approach with hamstring strain and mobility deficits. A positive outcome was observed in this case when adding neurodynamic mobilization to the usual treatment approach of STM, stretching and exercise.

**ID:** 79 (poster)

Allison Butcher, Harris Health System

**Title:**

DIAGNOSIS AND MANAGEMENT OF BILATERAL HIP AVASCULAR NECROSIS IN A THIRTY-FOUR-YEAR-OLD FEMALE: A CASE STUDY

**Background / Purpose :**

Avascular necrosis, or bone death, can stem from traumatic or atraumatic mechanisms of injuries and can lead to untimely hip joint destruction. Risk factors include long-term use of corticosteroids, history of chemotherapy or immunosuppressants, sickle cell anemia, and alcoholism. The average age for a total hip replacement for avascular necrosis is just thirty-eight years old, which is much younger than the overall age for total hip replacements. Thus, this diagnosis is not often at the forefront of a physical therapist's mind when a young patient presents with debilitating hip or leg pain. The purpose of this study is to discuss potential interventions for bilateral hip pain and to review diagnosis and management of avascular necrosis.

**Case Description:**

A thirty-four-year-old female was evaluated for physical therapy after two years of progressively worsening lumbar and bilateral lower extremity pain, with a referral for "ambulation assistance". In the last six months, she had regressed from walking independently to relying on a wheelchair for all mobility due to pain. Her medical history included hypertension and anxiety/depression, with several suicide attempts. Her social history included chronic alcoholism, though she had been sober for six months at the time of evaluation. Her most recent hip imaging was one year old and was unremarkable; her lumbar imaging was six months old and showed mild narrowing and a small disc protrusion at L5/S1. The patient was seen for six sessions of physical therapy with a focus on chronic pain education, functional mobility tolerance, manual therapy and joint play for pain relief and lower extremity strengthening.

**Outcomes:**

After six sessions, the patient had made no significant progress with physical therapy. She continued to be extremely intolerant of all weightbearing activities and was unable to demonstrate any improvements in hip range of motion despite consistent intervention and home exercise plan compliance. At this time, the patient was referred to her physician for imaging with a strong suspicion for avascular necrosis due to the patient's age, severe pain, and history of alcoholism. Updated hip imaging found severe avascular necrosis of both femoral heads with bilateral superior migration. The patient was referred to orthopedics and has since been scheduled for bilateral hip replacements.

**Discussion / Conclusion:**

Based off patient medical and social history and objective findings (severely limited range of motion in a capsular pattern, impaired lower extremity strength, and high levels of pain without a traumatic mechanism of injury), it is surprising that a red flag diagnosis such as avascular necrosis was not discovered prior to the patient coming to physical therapy. This case study emphasizes the importance of synthesizing the social and medical history, subjective report, and objective findings to evaluate the person as whole, rather than relying on each piece individually.

**ID:** 80 (poster)

Noel Ybarra, Lourdes Medical Center

**Title:**

RESOLUTION OF CHRONIC CERVICAL AND BILATERAL SHOULDER PAIN ASSOCIATED WITH UPPER CERVICAL DYSFUNCTION USING A CONNECTTHERAPYTM APPROACH: A CASE REPORT

**Background / Purpose :**

Chronic musculoskeletal dysfunction can be associated or maintained from adjacent or distal body areas via a Regional Interdependence Model. Evidence exists for shoulder pain related with cervical referral, midcervical and thoracic mobility impairments. Yet, upper cervical dysfunction has not been described in the literature. This case reports describes a ConnectTherapy approach in identifying the primary movement dysfunction maintaining chronic neck and shoulder pain and dysfunction.

**Case Description:**

A 60-year-old, female Janitor presented with chronic bilateral shoulder and cervical pain that occurred with nontraumatic onset in 2018. Comorbidities include history of fracture (wrist, ribs), fibromyalgia, osteoarthritis, bilateral TKA, obesity and Covid-19 infection November 2020. She reported difficulty performing repetitive shoulders motions required for work and limitation in participation with family activities. Examination findings indicated limited shoulder Abduction AROM (R = 125°, L = 103°) and decreased MMT 2+ to 4-/5 for shoulder girdle. Motion analysis during shoulder abduction indicated cervical spine left translation, increased left Levator Scapulae muscle tone, and delayed scapula upward rotation. Manual correction (i.e. Symptom Alteration Test) of the scapula decreased her symptoms and improved abduction AROM but, no change in cervical left translation. Manual correction of cervical left translation significantly decreased her cervical and shoulder pain with immediate B increase in shoulder Abduction AROM.

Relationships of the relevant joints were unknown necessitating a ConnectTherapy Assessment incorporating 1. Reference Posture Screen 2. Meaningful Screening Task (MST) and 3. Drivers Diagnostic Chart. MST indicated Non-Optimal Load Transfer (NOLT) of upper cervical spine compression, mid cervical left translation, left scapula downward rotation, glenohumeral joint compression (superior anterior and medial), and upper thoracic ring dysfunction. A driver profile of primary C2/CO – C1 and secondary thoracic Ring 2/3 dysfunction was diagnosed. Her home exercise program was directed at resolving upper cervical compression, left cervical spine translation and glenohumeral joint compression followed with motor control exercises to optimize her movement patterns with upper extremity motions.

**Outcomes:**

Patient completed eight visits in four weeks. Improvement in shoulder abduction AROM > 160° bilateral, MMT 4+/5 for shoulder girdle, QDASH = 4% (Initial Evaluation (IE) = 45%), NDI = 12% (IE = 36%), Yellow Flag Risk Form = 16/130 (IE = 62/130), PSFS = 8 (IE =2), NPR = 2/10 (IE = 7/10)

**Discussion / Conclusion:**

This case report highlights shoulder and cervical symptoms associated with upper cervical and thoracic ring mobility deficits. In-depth motion analysis via manual correction (Symptom Alteration Test) or MST may be required for resolution of chronic musculoskeletal pain. Further research is required to determine a cause-and-effect relationship of upper cervical dysfunction and shoulder pain.

**ID:** 81 (poster)

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**Title:**

The Triple Crown: A Case Report Addressing Scapular, Thoracic, and Rib Dysfunction with Axillary Pain

**Background / Purpose :**

Insidious onset axillary musculoskeletal pain is uncommon; and as such, remains largely unreported in the literature. Differential diagnosis for pain in the axilla includes traumatic nerve or muscle injuries (thoracic outlet syndrome, muscle strain, blunt force trauma, surgical trauma), thoracic radiculopathy (thoracic neoplasm, degenerative spine changes), axillary web syndrome, and other pain referral patterns from multi-directional shoulder instability or the thoracic and cervical spine. However, when ruling out both trauma and sinister pathology, the combination of shoulder, thoracic, and rib dysfunction should be examined to determine the primary origin of symptoms. The purpose of this case report is to highlight a multi-joint evaluation and treatment approach for managing unique axillary pain.

**Case Description:**

A 33-year-old female equine stable worker was referred to outpatient orthopedic physical therapy with reports of axillary and anterior shoulder pain limiting work participation. The patient presented with an eight-month history of insidious onset axillary pain complicated by reports of significant scapular popping/clicking and anterior shoulder pain. The initial manifestation of her symptoms included sharp pain with dyspnea. Sinister pathology was ruled out by the emergency department and the patient reported pain free breathing for two months leading up to the initial exam. Key thoracic spine examination findings included painful and hypomobile T4-T7 segments upon mobility testing [$\kappa$ = 0.61-0.75 IRR], limited but pain free thoracic spine extension and bilateral rotation, and painful ribs 5-7 with spring testing; both stated thoracic spine and rib segments produced radicular pain to the right axilla. Key shoulder examination findings included pain free and symmetrical shoulder active range of motion in all directions, weak shoulder girdle musculature (rotator cuff muscles, lower and middle trapezius, rhomboids, serratus anterior) measured via handheld dynamometry [ICC= .89-.96], positive and obvious (classification) right loaded scapular dyskinesis test [$\kappa$ = 0.48–0.61; agreement, 75%–82%], and a right biceps tendon that was tender to palpation. Key cervical examination findings included full and pain free cervical active range of motion, negative Spurlings, negative distraction, and negative ULTTA special testing [4/4 Cervical Radiculopathy CPR: sensitivity=

.24, specificity= .99]. Based on these findings, thoracic and rib mobilizations, repeated thoracic extensions, and thoracic rotational exercises were implemented along with a progressive shoulder/scapular strengthening program.

**Outcomes:**

The patient was quickly able to return back to work in three sessions (two weeks) and noted significant decrease in pain intensity [NPRS: 6 to 2; MCID= 2.17] as well as increased function [Quick DASH: 65% to 42%; MCID= 15.91] following thoracic and rib mobilization. Following 19 sessions over a three month period, the patient was discharged based on full return to pain free function and resolution of all impairments including: Quick DASH score 65% to 2.27%; right shoulder girdle strength (HDD) external rotation (0°)= 7.2 lbs. to 13.4 lbs., internal rotation (0°)= 5.4 lbs. to 13.8 lbs., horizontal abduction (90°)= 4.0 lbs. to 10.4 lbs., horizontal abduction (145°)= 6.4 lbs. to 9.2 lbs. [Hand Held Dynamometry: MDC= 3.0-4.5]. It is also important to note that the loaded scapular dyskinesis test classification progressed from obvious to subtle and all anterior shoulder, rib, and thoracic pain has since resolved.

**Discussion / Conclusion:**

This case report demonstrates the clinical utility of a multi-modal approach to treating insidious axillary pain. The patient was able to return to work following three sessions of physical therapy over the course of two weeks, focusing on thoracic and rib mobility for pain reduction and scapular motor control. Given the patient's functional demands at work and lack of mechanism of injury, her underlying scapulothoracic and shoulder weakness was likely the primary cause of symptoms. Yet addressing the secondary causes of symptoms as above, demonstrates high value in short term return to function.