ID: 3 / PL18

Clinical Assessments of Muscle Hypertonicity in Adults With and Without Chronic Intermittent Neck-Shoulder Pain

Background / Purpose: Muscular hypertonicity in the upper trapezius (UT) and levator scapulae (LS) muscles is common in computer users with chronic, intermittent neck-shoulder pain. Clinically, muscle tone often is assessed using palpation, but no grading system has yet been reported for palpation assessment. In addition, myotonometric measurements have not yet been used to assess muscle tone in this patient population. The purposes of the study were to compare the muscle tone of the UT and LS muscles between individuals with chronic, intermittent neck-shoulder pain and asymptomatic controls using palpation and myotonometry. If a significance difference was found between groups, cut-off scores were calculated. In addition, the relationship between muscle tone measurements collected using palpation and myotonometry was examined.

Methods: Fifty participants completed the study, including 30 individuals who had intermittent neck-shoulder pain for a minimum of three months and 20 asymptomatic controls. Muscle tone of the UT and LS muscles was assessed by palpation using a scale of 0-10, 0 being normal, and 10 being considerably stiff or not yieldable while the participants were in a seated position. A hand-held computerized myotonometer was used to measure muscle tone (i.e. displacement of tissue per unit of force) of the two muscles while the participants were in seated and prone positions. The peak myotonometric measurements obtained in the seated position were normalized to those obtained in the prone position.

Results: Statistical analysis revealed a significant between-group difference in muscle tone assessed using the palpation method for both muscles (p 4 were considered significant for the presence of hypertonicity in the UT muscle, and scores > 3 were considered significant for the LS muscle.

Discussion / Conclusion: The results of this study suggest that the palpation method with a 0-10 grading system may be a useful clinical assessment for hypertonicity in patients with chronic, intermittent neck-shoulder pain. Although myotonometry is intended to be an objective method for assessing muscle tone, it does not seem to be helpful for identifying hypertonicity in this patient population.

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ID: 8 / PO60
Symmetry of Resting Tone, Alignment, and Strength in the Pelvic Region

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Background / Purpose: Resting tone contributes substantially to postural alignment and stability of the spine. Muscles attached to the axial skeleton, specifically muscles crossing the SI joint such as the gluteal muscles and latissimus dorsi, could contribute to pain and dysfunction if significant differences in side-to-side resting tone exist. While studies have observed side-to-side differences in resting tone of the biceps brachii, no current studies have assessed resting tone differences across the SI joint.

Methods: Data on resting tone, pelvic asymmetry, and strength were collected using the MyotonPRO myometer, PALM palpation meter, and a strength dynamometer respectively from 30 asymptomatic subjects over a six months period.

Results: Normative data were collected for strength of the iliopsoas, rectus femoris, latissimus dorsi, gluteus maximus, gluteus medius, hamstrings, and hip adductors. The MyotonPRO tested for bilateral tone, elasticity, creep, stiffness, and relaxation of the same muscles. Measures of pelvic alignment for tilt (ranging from 2° to 17° of anteriorly) were collected as well as symmetry of PSIS, ASIS, and iliac crest height (ranging -3° to 3° of difference).

Discussion / Conclusion: Side-to-side differences in resting tone, elasticity, creep, stiffness, relaxation, strength, and pelvic symmetry were noted in asymptomatic participants for SI and low back pain. This data provides information to be used in future studies for: determining correlation among tone, alignment, strength, and dysfunction; identifying impairments associated with dysfunction and response to interventions; and guiding impairment-based treatment options.

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ID: 10 / PO29
Physical Therapy To Improve Mobility Following Surgery For Multiple Ligament Knee Injuries: A Case Report

Background / Purpose: The purpose of this case report is to provide a student physical therapist's perspective in managing a patient with multiple knee ligament injuries and the clinical decision making process used to choose the most effective physical therapy interventions to restore knee mobility following surgical reconstruction.

Case Description: The patient was a 21-year-old male, 9 weeks status post elective anterior cruciate ligament (ACL) autograft Bone-Tendon-Bone reconstruction, medial/lateral meniscal repair and debridement of multiple compartments. The patient also presented with sprain to the posterior cruciate ligament and synovitis. His chief complaints post-operatively were dull ache with motion in right knee, limited range of motion with stiffness and pain, generalized weakness of right knee as well as inability to walk or stand independently which prevented him from returning to work as a cook. Physical therapy management included joint mobilizations, patella mobilizations, contract/relax techniques, manual stretching and low load long duration stretches in order to improve knee mobility. Isometric and isotonic exercises focused on increasing quadriceps activation and hip strength. Balance and gait training was provided to improve functional mobility. Modalities were also used for palliative care.

Outcomes: The patient demonstrated improvements in knee range of motion, strength, flexibility, pain, gait and Lower Extremity Functional Scale (LEFS). At discharge, patient reported no pain. Knee flexion improved from 89 to 124 and knee extension improved from -10 to -3. Patient had fluctuations in range of motion throughout treatment but overall showed improved mobility gains in active/passive range of motion, joint mobility and muscle length. LEFS at initial visit was 25/80 and improved to 43/80 upon discharge.

Discussion / Conclusion: Patient presented with complex knee injury following ACL reconstruction and meniscal repair. This patient case required significant clinical reasoning and monitoring which proved challenging for a student physical therapist (SPT). Overall patient responded positively to a combination of knee mobility interventions. The interventions that resulted in the most gains included Proprioceptive Neuromuscular Facilitation, contract-relax to hip flexors and low load long duration stretch to hamstrings. Evidence is lacking in physical therapy management of multiple ligament knee injuries. Well-researched and established protocols should be used for guidelines. However, it is important for the SPT to complete test/retest following each intervention to asses for tissue response in order to progress patient appropriately. Further research needs to be completed to investigate effectiveness of treatments for multiple ligament knee injuries.

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ID: 11 / PO53

A multimodal approach to managing lumbar radiculopathy with use of manual therapy, neural mobilization and dry cupping: A case report.

Background / Purpose: Lumbar radiculopathy (LR) is characterized by radiating leg pain and paresthesia, including neurologic impairment such as weakness in myotome(s).1 Conservative management approaches in published literature include traction, neurodynamic mobilization (NDM) and extension-oriented strategies. Literature notes evidence for these approaches being mixed, weak or strong, respectively.2 Traction is proposed to reduce mechanical compression2, NDM to reduce intraneural edema3 and an extension oriented approach to restore functional tolerance to a lordotic posture and reduced neural compression.4 Dry Cupping (DrC) may also be appropriate and utilizes suction to create negative pressure in order to stimulate an increase in blood flow, stimulate lymphatic flow, and activate the Heme Oxygenase-1 system (HO-1).5 DrC may be valuable in the management of LR, but limited research exists to determine the potential benefits. This case study seeks to examine the effects of a multimodal approach in the management of LR, including joint mobilization (JM), NDM and DrC in a single case presentation.

Case Description: A 71 year old male presented with insidious onset of recurrent right (R) side low back and leg pain beginning 10 days prior to evaluation. Patient (pt) had symptoms consistent with R L3 LR: Numeric Pain Rating Scale (NPRS) 9/10, hypersensitivity to light touch in L3 dermatome (HSL3D), 4/5 manual muscle test (MMT) of quadriceps, adductors and psoas, (1+) patellar reflex and a reproduction of symptoms with FABER. He reported limitations in sleeping and walking, scored 30% on Oswestry Disability Index (ODI) and 5 time sit to stand test (5xSTS) of 17.13".6 Session 1 consisted of an evaluation and education. Sessions 2-5 consisted of DrC along the L3 dermatome, R sided lumbar unilateral posterior to anterior JM grade III-IV, femoral NDM flossing and progressive stabilization exercises. After re-evaluation at session 5, DrC was discontinued due to a resolution in HSL3D. Identified impairments in hip joint mobility led to hip JM for sessions 6-10. Sessions 11-13 emphasized return to function and education in an ongoing home management program.

Outcomes: At time of discontinuation, pt had resolved HSL3D, NPRS 4/10, improved MMT to greater than 4+/5, normal patellar reflex, reduction of pain with FABER test, and a 5xSTS time of 11.4 seconds. He was able to sleep through the night, ambulate at prior level of function and reported a 10% reduction in ODI. NPRS, 5xSTS and ODI scores met the MDC or MCID.

Discussion / Conclusion: This case study demonstrates good outcomes with the use of DrC in conjunction with NDM, JM and exercise. The pt demonstrated within session improvements in HSL3D immediately after DrC through session 5.This suggests that DrC in conjunction with JM and NDM contributed to the elimination of the pt's HSL3D. Therefore a multimodel approach, including DrC, should be considered when managing LR. Further research should be conducted to further determine the effectiveness of DrC in the management of LR.

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ID: 12 / PL41
Reliability of Measuring the Medial Knee Joint Space using Ultrasound Imaging

Background / Purpose: The use of ultrasound to perform quantitative musculoskeletal (MSK) measurements requires reliability among different providers with varied levels of experience and training. Recent studies have shown that physical therapists (PT) can reliably measure the glenohumeral joint space using ultrasound imaging (USI) and operator experience or well defined training protocols influences the reliability. Few studies have reported the reliability of medial knee gap measurements with USI. Purpose is to evaluate inter- and intra-rater reliability of a novel approach to measuring knee gapping using experienced and trained novice clinicians.

Methods: A total of 166 ultrasound images of two subject's medial knee joint gaps were captured in resting by a single experience researcher. Novice researchers were three upper-year Doctor of Physical Therapy students with no USI experience. Experienced researchers were two PT certified in MSK USI with eight years of USI experience. The three novice researchers underwent a three hour training protocol. All researches then measured each images. Measurements were taken using standardized bony landmarks and internal calipers. All participants were blinded to the subjects and results. Data was analyzed comparing all data to researcher one using two-way ICC mixed-model single measurement and SEM.

Results: An excellent degree of reliability was found for both intra-rater and inter-rater measurements for Novice One. and a good degree of reliability was found between Experienced One and Novice Two and Three.

Discussion / Conclusion: Both experienced and novice clinicians attained a clinically significant ICC when compared to Experienced One. An accurate and reliable measurement of the medial knee joint gap may be useful for further studies and help with diagnosis of joint pathologies.

Conclusion / Significance:

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ID: 13 / PL23
Transferring Weekend Continuing Education to Monday Morning Patient Care: A Pilot Study for Quality Improvement

Background / Purpose: Ultimately, the goal of all education is for the learner to transfer the new knowledge from the classroom and apply the new skills. Continuing education (CE) is described as a 'systematic attempt to facilitate change in practice'. While the majority of physical therapy (PT) licensure boards value CE for maintaining and enhancing clinical competency, the literature has shown mixed results on the effectiveness of the single weekend course format to change clinical behaviors. Furthermore, while current best practices emphasize the use of outcome measures to assess the overall quality of care, many PTs are still not using these tools routinely. Because a more comprehensive approach may be needed, we developed the MUSC Manual Therapy Course Series. This 1-year series that includes four hands-on courses (72 total contact hours with lecture and lab content), written and practical examinations, and between course patient case assignments to encourage transfer of new knowledge directly into clinical care. The course content emphasizes the importance of using standardized outcome measures to guide patient care. The objectives of this study were to determine if there were changes in 1) attitudes (i.e., comfort and confidence in working with patients with spinal dysfunctions) and 2) behaviors (i.e., utilization of outcome measures) among PTs attending the continuing education course series.

Methods: Subjects: 24 PTs with 1 to 20+ years of clinical experience and employed by the Mercy Hospital System in Cincinnati, Ohio Data: A pre- and post-survey were administered to the participants. The survey included questions related to the PT's comfort and confidence in working with patients with spinal dysfunctions. We also tracked the use of outcome measures for the 6 months prior to the initiation of the course series (April to September 2016) and 6 months after the last course of the series (May-October 2017).

Results: Pre-survey (N=14): 21.43% (3): very comfortable, 50% (7): comfortable and 28.57% (4): not comfortable, 71.43% (10): confident and 28.57% (4): not confident. Post-survey (N=14): 57.14% (8): very comfortable, 42.86% (6): comfortable, 35.61% (5): very confident and 64.29% (9): confident. In the 6-month time period pre-course series only 6 of the PTs utilized outcomes and in the 6 months post-series, 19 routinely completed outcomes on patients with spinal dysfunction. This was an increase of 79.2% over the 6 months post course series in the use of standardized outcomes.

Discussion / Conclusion: This pilot study for quality improvement demonstrates that a continuing education course series with related patient case assignments can change therapist confidence and comfort in the treatment of patients with spinal disorders and impact clinician behaviors in the utilization of standardized outcome measures.

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ID: 15 / PL11
May Physical Therapists Order Diagnostic Imaging? A Preliminary Survey of the World Confederation for Physical Therapy Member Nations

Background / Purpose: The Physical Therapy profession has undergone a significant evolution in education and scope of practice over the last 4 decades. Multiple studies have shown physical therapists (PTs) to have superior knowledge of orthopedic diagnosis and treatment when compared to other health care professions. Despite this, health care policy within the United States (US) typically restricts PTs from ordering imaging; however, it is unknown how this compares to other World Confederation for Physical Therapy (WCPT) member nations (MN). We aimed to investigate the rights of PTs to order imaging studies and to search for associations within WCPT MNs.

Methods: All 111 WCPT MNs were electronically polled on the health care policy of PTs ordering diagnostic imaging within their nation. A secondary analysis was performed to see if multiple variables were associated with diagnostic imaging privileges. A binary logistic regression model was developed to determine if there were any independent variables which were associated with a country's policy regarding physical therapists ordering diagnostic imaging procedures. Data were entered into the model with a forward stepwise regression procedure, using the likelihood ratio method. The Hosmer-Lemeshow goodness-of-fit test was used to evaluate the fit of the model.

Results: 81 MNs provided information on their diagnostic imaging policies. 31 (39.2%) of MNs reported having some level of diagnostic imaging authority while 48 (60.8%) denied such authority. 39 countries had a complete data set for all possible variables included in the stepwise analysis. Completion of the regression found two variables to be significant predictors for diagnostic imaging rights. Using 67 countries which contained the full data-set for these predictors, it was found that per capital healthcare costs, ($p < .05$, Exp(?) 0.683, 95% C.I. 0.495, 0.941) and direct access rights ($p < .05$, Exp(?) 7.397, 95% C.I. 1.928, 28.379) were both significant predictors of diagnostic imaging authority.

Discussion / Conclusion: These results represent the first report of a substantial international mapping of imaging rights to PTs. While lower health care expenditures were significantly associated in MNs that allowed PTs to order diagnostic imaging, it is unclear why this association exists. Similarly, direct access privileges and diagnostic imaging privileges showed a significant association, though it is unclear which privilege might be a catalyst for the other. Looking within the MNs that have both of these privileges and the order in which they were authorized may give better perspective on how to advance physical therapy practice. Our study shows that PTs in many WCPT MNs are unable to order diagnostic imaging, despite overwhelming evidence to show the superiority of the PT profession in managing orthopedic conditions. We recommend the WCPT begins tracking diagnostic imaging health policy within their MNs so a better understanding of the healthcare imaging authorization can be achieved

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ID: 16 / PO45
Dangers of Upper Cervical Extension in a Patient with Congenital Partial Aplasia of the Atlas

Background / Purpose: Patients with potentially serious underlying pathologies or anomalies can present to physical therapy even within a referral-based practice. This article is intended to convey a patient with an upper cervical anomaly that was referred to physical therapy.

Case Description: A 50 year old female with left anterior shoulder pain referring through the upper scapular region and into the mid posterior neck was referred to physical therapy. The patient had a past medical history of chronic intermittent neck pain with concomitant paresthesias of the left forearm and palm. The patient previously had physical therapy and subacromial decompression surgery, but chronic symptoms remained. The patient rated her resting pain at 5/10 in her left upper scapular region and 3/10 in her anterior left shoulder. She had mild hypomobility with all cervical motions with left rotation having a 50% restriction and a 25% upper cervical extension restriction. Brachioradialis deep tendon reflexes were absent bilaterally, but biceps brachii and triceps reflexes were normal. Hoffmann's, wrist clonus, and inverted supinator sign were absent. No gross muscular weakness was observed in the upper extremities. Active and passive shoulder range of motion were full without reproduction of symptoms. Due to the chronicity of symptoms, cervical radiographs were obtained which identified Type C partial aplasia of the C1 posterior arch. A computed tomography scan was performed which confirmed the defect.

Outcomes: The patient underwent 3 months of physical therapy to include targeted mid-grade mobilizations of the lower cervical spine, thrust mobilizations of the mid and upper thoracic spine, shoulder stabilization exercises, and continuous 3MHz phonophoresis targeting the anterior subacromial space. Mobilization of the upper cervical spine and therapeutic activities aimed at increasing upper cervical extension were purposely avoided given radiographic findings. At discharge, the patient retained a 25% restriction of upper cervical extension, but was otherwise asymptomatic with a normal neurologic examination.

Discussion / Conclusion: Partial aplasia of C1 is rare, occurring in approximately 3% of the population. Types C and D aplasia are exceedingly rare, accounting for >0.1% of the population. In Type C and D, the anterior and posterior arch are connected only by fibrous tissue allowing for dissociated movements between the fragments. In upper cervical extension, the posterior arch can deviate anteriorly, abutting the spinal fragments. In upper cervical extension, the posterior arch can deviate anteriorly, abutting the spinal cord and inducing myelopathy. Patients with type C or D aplasia have reported ataxia, paresthesias, Lhermitte's sign, syncope, and even intermittent quadraparesis. Due to the inherent risk of C1 posterior arch movement, caution is advised when implementing conservative interventions to aiming to improve upper cervical extension. It is also advisable that patients avoid activities that could promote repetitive or prolonged u

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ID: 17 / PL45
Thoracic spine exercise prescription in sport: a narrative review

Background / Purpose: More than 80% of physiotherapists use exercises to manage thoracic spine pain & dysfunction in athletes, yet this region is lacking evidenced based rehabilitation. The thoracic spine is a central component of an athletes' kinetic chain, contributing 80% of trunk axial rotation & to overall functional upper limb force generation. Optimal thoracic spine mobility, motor control & strength are therefore required to minimise excessive load/stress on other kinetic chain components, for example the shoulder. Given the potential impact on performance & wider socioeconomic burden of managing sports injuries, knowledge of exercises targeting the thoracic spine is required to inform personalised exercise prescription. The purpose of this study is to review exercise prescription in the thoracic spine, specifically to 1) synthesise & classify thoracic spine exercises according to outcome (mobility, motor control, work capacity & strength), 2) inform research priorities for thoracic spine exercise prescription

Methods: A systematic review & narrative synthesis was conducted according to a pre-defined protocol. Informed by scoping searches, 2 reviewers (musculoskeletal rehabilitation experts) searched information sources (empirical, social media), & assessed identified sources for eligibility. Inclusion criteria: athletic population (Sample); exercises & descriptions of exercises targeting the thoracic spine (Phenomenon of interest); any empirical study, guideline, video or image describing thoracic exercises (Design), exercises evaluated based on their purpose i.e. mobility, motor control, work capacity & strength (Evaluation). A third reviewer mediated disagreement at each stage. The search employed sensitive topic-based strategies designed for each information source up to 31 January 2018. An established expert-informed spinal classification provided a framework for data synthesis. Additional requirements for the synthesis included, exercises suitable to more than one sport; functional (weight bearing or sport specific) & non-functional exercises & exercises of differing intensity.

Results: From 2368 sources, 38 exercises (with variants) were eligible (20 from e-journals & 18 from social media). Sources include images, video clips, & detailed descriptions of exercises. Exercises targeting all axes of motion, with & without equipment were categorised & mapped to the classification. Exercises comprised functional & non-functional exercises for, mobility (n=9), work capacity including pillar & segmental conditioning (n=15), motor control including dissociation, segmental movement control & whole-body coordination (n=7) & strength including pillar strength, stiffness & power development (n=7). Beyond a description of position & technique further details of exercise prescription e.g. repetitions, hold times etc. varied.

Discussion / Conclusion: In the absence of existing evidence this review has provided the first synthesis of thoracic spine exercises for use in athletes, placing a spotlight on the thoracic spine & specifically outcome-focused exercise prescription. Notwithstanding the lack of empirical evidence & quality assessment of included sources findings can be used to inform clinical reasoning in practice & underpin further research. Research is now needed to investigate optimising exercise prescription dosage for the included thoracic spine mobility, motor control, work capacity & strength exercises.

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ID: 19 / PL19
Endogenous pain modulation is impaired in tennis elbow: A case control study

Background / Purpose: Tennis elbow (also known as lateral epicondylalgia) is characterised by both local tissue pathology as well as features indicative of central sensitisation, such as widespread mechanical hyperalgesia. Impairments in endogenous pain modulation processes have been attributed to chronicity in other musculoskeletal conditions, but have not been thoroughly explored in people with chronic tennis elbow. Therefore, the aim of this study was to evaluate dynamic pain modulation characteristics in people with chronic tennis elbow, and to investigate the relationship between dynamic pain modulation and clinical characteristics.

Case Description: Twenty-five participants (mean age 50.4 ±8.7 years) with unilateral tennis elbow of at least 6 weeks' duration, and 15 age-matched healthy control participants (mean age 49.3 ±6.5 years) were each evaluated in a single session. Quantitative sensory tests were used to assess pain modulation characteristics, and included pressure pain threshold, cold pain threshold, conditioned pain modulation (cold water bath to 5°C) and temporal summation (pin prick stimuli, 0-100 pain visual analogue scale). Clinical characteristics of pain and disability were assessed using the Patient-Rated Tennis Elbow Evaluation and pain-free grip strength. Linear mixed models were used to compare group differences for pain modulation and Pearson correlation coefficients were used to assess the relationship between clinical and pain modulation characteristics.

Outcomes: Pressure ($p=0.049$) and cold ($p=0.002$) pain thresholds were significantly impaired on the affected side compared to the unaffected side in the tennis elbow group. Pressure (bilaterally) and cold pain thresholds (affected side) were significantly impaired in the tennis elbow group compared to controls. There was no significant difference between groups for conditioned pain modulation ($F1,75 = 193.2$, $p=0.07$), however the tennis elbow group exhibited significantly increased temporal summation (between-group difference in change pain score 9.6, 95% confidence intervals 3.4 to 15.8). The tennis elbow group exhibited significantly lower pain-free grip strength and pressure pain threshold bilaterally compared to the control group. However, clinical characteristics were not significantly correlated with measures of pain modulation.

Discussion / Conclusion: Individuals with tennis elbow demonstrated increased dynamic facilitation of pain, as measured by temporal summation, but not conditioned pain modulation. In addition, impairment in pain modulation was not associated with the severity of pain and disability. Targeting specific impairment in pain modulation may improve outcomes for those suffering with chronic pain associated with tennis elbow.

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ID: 20 / PO64
Management of a Patient Training for her First Marathon with an Orthopaedic Manual Physical Therapy Approach: A Case Report

Background / Purpose: Repetitive overuse injuries are common among long distance runners during a training cycle. In many cases these athletes refuse to discontinue running, making impementation of effective intervention(s) challenging. The purpose of this case report is to describe an Orthopaedic Manual Physical Therapy (OMPT) management approach to a patient with posterior tibialis and gastrocnemius tendinopathy secondary to distance running while remaining in training.

Case Description: Pt. was a 35 y.o. female with left lower extremity (LE) pain related to distance running. Within the last year she had completed four half marathons without any LE symptoms. However, she developed gradual onset of left LE pain while training for her first full marathon. The symptoms had been present for three weeks prior to commencing Physical Therapist management. At baseline she was unable to run for more than three miles at her usual pace due to leg pain. Physical examination revealed pain with palpation and resisted testing of the left posterior tibialis and soft tissue hypomobility was noted at the left gastroncnemius. Arthrokinematic limitations were noted with talocrural dorsiflexion. Ankle AROM (in degrees) was: DF= 7, PF= 55, Inv= 33, Ever= 12. Manual Muscle Testing (MMT) was 4+/5 in all planes except posterior tibialis was 4-/5 and painful. Initially management focused on improving posterior tibialis and gastrocnemius function with instrument assisted soft tissue mobilization (IASTM), foam rolling, eccentric strengthening, and talocrural thrust manipulation for two visits. The initial treatment plan did not change her injury status so Dry Needling (DN) was introduced in place of IASTM on visit three. We performed DN with electrical stimulation on her left posterior tibialis and gastroncnemius muscles on the subsequent five visits. Three days after DN was initiated she was able to run five miles at her training pace without pain. We noted intra-session and inter-session improvements in AROM, strength, and running distance tolerance each visit. Advice regarding hydration, sleep, and nutrition was provided to ensure maintenance of her training schedule.

Outcomes: The patient was managed for a total of seven visits over eight weeks. Ankle AROM, MMT, and arthrokinematic limitations all returned to within normal limits and were symmetrical to the unaffected LE. Significant improvements were noted in all outcome measures: Numerical Pain Rating Scale improved from 5/10 to 0/10 and Lower Extremity Functional Score improved from 63/80 to 80/80. She was able to finish her first full marathon at her intended pace without any problems. All improvements were maintained at six month follow up.

Discussion / Conclusion: An OMPT management approach incorporating DN was effective in treating a distance runner while remaining in training. Although the inclusion of DN resulted in significant improvement in pain and function in this case, further research is recommended to identify which patient populations may respond better to DN interventions.

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ID: 22 / PL43
Factors associated with systems of clinical reasoning in physical therapists: a pilot study

Background / Purpose: Dual Systems Theory (DST) is a contemporary model of clinical reasoning; dichotomizing reasoning processes into heuristic and hypo-deductive. Traditionally, experience was thought to be the primary driver of heuristic tendencies. The Quantitative Diagnostic Thinking Inventory-ATC (DTI-ATC) is a measure used to look at domains of reasoning associated with clinical reasoning processes, validated among Athletic Trainers, that is proposed to demonstrate preferences in clinical reasoning as defined by DST. Lower scores on the DTI-ATC is proported to be associated with more deductive reasoning processes where as higher scores are associoated with heuristic, inductive, or pattern recognition processes. This study aims to identify additional factors associated with the two systems in the DST among physical therapists as measured by the DTI-ATC; particularly in a private, outpatient practice setting.

Methods: A 55-item online survey was developed to capture demographic information and the DTI-ATC for physical therapists. Physical therapists were separately grouped by years of experience (0-2, 3-5, 6-10, and >11) and advanced clinical training (manual therapy) and specialization (residency/fellowship) for comparison. A one way ANOVA was used to compare total score and the 2 subscale scores (flexibility in thinking, structure in memory) between groups. Post hoc t-tests were used to analyze differences in DTI-ATC scores between groups

Results: Fifty-five surveys were completed (53% female) with a mean age of 34.8 years (± 8.04). Total scores and subscales demonstrated significantly lower scores between clinicians with 0-2 years of experience compared to all other groups ($P = 0.014$). For clinicians with 3-5 and 5-10 years of experience there was a mean difference of 8.67 and 19.5 points ($P = 0.001$) in total score between those who were enrolled in or had completed a residency against those who did not. There were no other statistical differences ($P>0.05$).

Discussion / Conclusion: The DTI-ATC has been shown to capture aspects of clinical reasoning associated with expertise. This pilot study suggests clinicians in their first two years of practice demonstrate characteristics of clinical reasoning more associated with hypo-deductive reasoning. Clinicians with more than 2 years of experience consistently demonstrated characteristics associated with heuristic reasoning. Additionally, residency training appeared to increase traits of heuristic reasoning. This is a pilot study that has several limitations, including sample size. These limitations may explain the lack of observed difference in scores among those enrolled in or completed fellowship-level training. Future studies should investigate the influence of clinical reasoning patterns on patient outcomes.

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ID: 23 / PO54
Regional Interdependence approach to treating chronic cervical spine pain and esophageal spasm

Background / Purpose: A correlation between acute neck pain with dysphagia and calcific tendonitis of the longus colli, cervical osteophytes, and esophageal injuries due to fracture following cervical spine trauma and cervical spine surgery has been established. This case report describes the clinical reasoning of a multimodal treatment approach for a patient with chronic cervical spine pain with esophageal spasms.

Case Description: The patient was a 40-year-old female with a history of chronic cervical spine pain with esophageal spasm following a fall from a horse in June 1996. The patient complained of constant bilateral cervical spine pain, daily esophageal spasms described as tightness, belching and gagging, and intermittent numbness and tingling in her extremities bilaterally (L>R). Upon evaluation, her Numeric Pain Rating Scale (NPRS) was 10/10 at its worst. Symptoms increased with sitting and working on the computer, lying supine, stress, looking in all directions, reading, driving, and lifting. Symptoms decreased with exercise. At rest she demonstrated a forward head posture. Cervical active range of motion (AROM) was painful and limited with all movements. Upper extremity reflexes, sensation, strength, and special test were within normal limits (WNL). Deep cervical flexor endurance test was 8 seconds. Soft tissue restrictions were present in cervical and periscapular musculature. Bilateral atlanto-occipital (AO) joints, cervicothoracic junction (CTJ), and thoracic spine were hypomobile. Esophageal spasm was not reproduced during the initial session. Immediate within session improvements in cervical AROM were demonstrated following mobilizations to CTJ and thoracic spine. The addition of soft tissue mobilization (STM) resulted in normal cervical AROM. Exercise consisted of deep cervical flexor (DCF) and scapulothoracic strengthening, cervical and thoracic mobility, and aerobic activity. Education consisted of pain education, strategies to manage stress, and a home exercise program. Subsequent treatment sessions consisted of DCF training that began in sitting. The addition of AO mobilizations demonstrated improved activation of DCFs and diminution of symptoms in the supine position. Prone and supine positions were gradually reintroduced and the patient was able to tolerate all manual therapy and exercise without onset of esophageal spasm.

Outcomes: The patient was seen for a total of 12 sessions over 10 weeks. NPRS improved to 3/10 at its worst. Her Neck Disability Index decreased to 12% from 48% at intake. Cervical AROM was WNL and pain-free for all movements. DCF endurance test: was 21 seconds. Patient had not experienced esophageal spasm for over a month, which is the longest since onset over 20 years ago.

Discussion / Conclusion: This case report describes a regional interdependence approach for the treatment of a patient with chronic cervical spine pain and esophageal spasm. Further research is needed to identify if a correlation between esophageal spasm and musculoskeletal dysfunction exists.

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ID: 24 / PL5
Changes in Trigger Point Area on Diagnostic Ultrasound in Response to Dry Needling

Background / Purpose: Myofascial pain (MFP), characterized by hyperirritable trigger points (TrPs) within tight muscles which lead to symptoms of localized or referred pain when the TrPs are aroused, has demonstrated 100% prevalence in certain patients with non-specific neck pain. However, the most commonly accepted and practiced diagnostic criteria for TrPs, which rely on palpation, have not demonstrated consistent reliability in the literature. Diagnostic ultrasound (US), has been suggested as a means of identifying TrPs, but more studies are needed to standardize ultrasonic characteristics of TrPs . No particular intervention for TrPs has emerged as optimal. Dry needling (DN) has shown good promise in the treatment of TrPs, but more evidence regarding its efficacy is needed. The purpose of this study was two-fold: 1. to determine if TrPs were visible on diagnostic US using the visual characteristics most often reported in the literature, thereby contributing to the consensus of ultrasonic characteristics of TrPs, and compare the size of the TrP on US before and after a single session of dry needling to assess change. 2. to determine if patients with TrPs, diagnosed with manual exam and US, demonstrated a decrease in pain and increase in neck function following a single dry needling treatment.

Methods: Thirty-four participants (41 observations) underwent manual identification of an active TrP in one or both upper trapezii, followed by diagnostic US of the identified region. A hypoechoic area was confirmed and measured on US by a single investigator, the participants were treated with DN in the same area, and a follow-up US image was immediately taken of the region. The Neck Disability Index (NDI) and Numeric Pain Rating Scale (NPRS) were completed by each participant at the start of the study and three days later.

Results: Following a single DN treatment, the longitudinal ellipse area decreased by 11.86 mm ($P < 0.001$) and the transverse ellipse area reduced by 10.08 mm ($P < 0.006$). Participants reported a mean decrease in their NDI and NPRS scores of 0.09 ($P < 0.00001$) and 2.37 ($P < 0.00001$), respectively, 3 days after a single DN treatment.

Discussion / Conclusion: Our data demonstrate a reduction in size of the TrPs visualized on US after a single DN treatment. Additionally, a reduction in clinical outcomes was evident in the short-term following treatment. This study corroborates commonly reported visual characteristics of TrPs on US, which can be measured and possibly used to document change with treatment. Furthermore, DN shows promise as a treatment for MPS in that echogenic and clinical outcomes demonstrated improvement following administration of the technique. Larger sample sizes are needed to better understand the role of diagnostic US in diagnosis and documentation of TrPs, as well as, the role of DN in treating MPS.

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ID: 25 / PO44

The use of intramuscular electric stimulation to hip lateral rotators and extensors in a patient with patellofemoral pain syndrome after initial failed localized treatment: a case report.

Background / Purpose: Patellofemoral pain syndrome (PFPS) is a common musculoskeletal disorder affecting adolescents and young adults. Common complaints include anterior knee pain during running, squatting, stair negotiation, and with prolonged sitting. Excessive hip internal rotation and hip adduction is believed to cause increased patellofemoral joint (PFJ) stress resulting in PFPS. A recent systematic review, found evidence that hip abductor, lateral rotator, and extensor strengthening is superior to knee strengthening alone for decreasing pain and improving activity in people with PFPS. Intramuscular electric stimulation (IES) provides an opportunity to deliver ES through dry needling (DN) to further enhance hip lateral rotators and extensor muscle recruitment and reduce PFJ stress by minimizing hip medial rotation and adduction. This case examines the effect of adding IES to hip lateral rotators and extensors after initial failed local treatment for a patient with chronic PFPS.

Case Description: 34-year-old male with chronic, intermittent right (R) anterio-medial knee pain for a year, worsening 6 weeks prior to initial evaluation (IE). Patient (pt) had R anterior cruciate reconstruction using patella tendon autograft. At IE, pt presented with signs and symptoms of PFPS including (4/10) pain with lateral step-down (LSD), painful squat, painful hopping, and resting anterio-medial knee pain. Pain with manual muscle test (MMT) of hamstrings (4/10), quadriceps (1/10). Numerical pain rating scale (NPRS) worse (6/10) and best (2/10). Lower extremity functional scale (LEFS) was (56/80). Pt with tenderness to R vastus medialis (VMO), vastus lateralis (VL), and rectus femoris (RF). Pt reported pain with soccer and stair negotiation. Pt's goals were to return to sport (RTS). Session 1 consisted of DN to VMO, VI, and RF, with intrasession pain resolution noted with LSD. Sessions 2-3 consisted of DN to VMO, VL, and RF, MT and TE with no positive intersession change in LSD. Since there was poor intersession change in the first 2 weeks of PT, treatment was modified, adding IES to hamstrings to help further reduce PFJ stress. Sessions 4-9 consisted of TE, MT, and IES to hamstrings using low frequency and intensity to patient's tolerance. Subsequently, pt able to resume running up to 2 miles and squat without anterior knee pain afterwards. Session 9, patient re-evaluated, patient performed LSD and squatting pain-free. Patient improved LEFS score (68/80), NPRS worse (3/10) and best (0/10), and (5/5) MMT R hip and knee pain-free. Sessions 10-14 consisted of further proximal strengthening, IES to hamstrings, and RTS activities. Session 15, patient re-evaluated and reported RTS successfully.

Outcomes: At the time of discontinuation, patient had (5/5) MMT R hip and knee, LEFS score (77/80), pain free squat, and RTS.

Discussion / Conclusion: This case study demonstrates positive outcome with adding IES for the treatment of patient with PFPS. Further research needs to be completed to determine the effects of IES in the management of PFPS.

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ID: 26 / PL28
Combining manual therapy and vestibular therapy in the diagnosis of a patient with multifactorial dizziness: A case report.

Background / Purpose: Managing patients with dizziness can be challenging given the complex connections between the cervical spine, vestibular system and visual system. Cervicogenic dizziness can be even more challenging as it is a diagnosis of exclusion. The cervical spine is the only non-cranial region that has direct communication to the visual and vestibular systems via its role in providing information about the head's position in space. Research highlighting the diagnostic utility of clinical tests for cervicogenic dizziness is limited, and the cervical spine, as a potential contributor to dizziness, is often overlooked in these patients. The purpose of this case is to describe the differential diagnosis of a patient presenting with multiple causes of dizziness and new neck pain.

Case Description: A 44-year-old female was treated in the emergency room for benign paroxysmal positional vertigo and referred to physical therapy with nausea and continued dizziness. Her history included migraines and a resected right acoustic schwannoma with resultant right vestibular hypofunction. At initial evaluation, her Dizziness Handicap Inventory (DHI) was 66/100, and she reported feeling “off” more than spinning. Her neurological screen was negative (-) except for her known positive (+) right head thrust. Her cervical spine was examined due to the concurrent onset of new neck pain which she noted as 5/10 on the Numeric Pain Rating Scale (NPRS) . She had active cervical spine rotation of 30° right and 70° left with dizziness reproduced in right rotation. Right Cervical Flexion Rotation Test was +. Her dizziness was reproduced with manual upper cervical compression, and resolved with upper cervical distraction in supine. Right C0-3 joint mobility was limited with noted trigger points in the right sternocleidomastoid. Joint Position Error (JPE) was only 2 out of 5 within 4.5° of neutral into bilateral rotation. Vestibuloccular reflex (VOR) training was limited by dizziness. Manual therapy was used to treat the trigger points and limitations in joint mobility noted in the cervical spine. After 4 session of manual therapy (11 days), she no longer had reproduction of dizziness with cervical spine rotation. Her tolerance to vestibular therapy improved and she was progressed through advanced VOR training for the remaining 2 sessions.

Outcomes: After 6 sessions, over 8 weeks, the patient noted a Global Rating of Change of +6, exceeding the MCIC of 2 out of 11 points. Her DHI score was 4/100. There was no reproduction of dizziness with cervical spine rotation and measured >70° bilaterally. Her JPE was 4 out of 5 within 4.5° of neutral for bilateral rotation, demonstrating improved relocation accuracy of the head and neck.

Discussion / Conclusion: Early identification of cervicogenic dizziness, is important to allow timely correction of altered cervical inputs. This allows for progression to vestibular and sensory integration training and clinically meaningful improvements in key outcome measures.

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ID: 27 / PL37
Correlation of movement evoked versus resting pain with common back pain outcome measures.

Background / Purpose: Measurement of pain is commonly recorded by manual therapists (MTs) using numeric rating scales on intake forms. These measures are valid, reliable for assessing resting pain (RP). Movement evoked pain (MEP) is pain experienced with specified movement tasks and is often used by clinicians for test-retest assessment of response to treatment but this methodology lacks standardization and therefore reliability. MEP is, however, more highly associated with activity and participation limitations than RP. A third valid and reliable clinical measurement of pain experience is outcome measures (OMs). The association between RP and OMs with a reliable performance measure of MEP is unknown. The purpose of this post-hoc analysis of pilot data is to consider the association between the Back Performance Scale (BPS) as a measure of MEP and RP, disability, as well as key psychological factors known to influence pain. The BPS was previously designed to assess the effect of 5 physical performance activities on patient pain ratings, consistent with real-time measurement of MEP.

Methods: Part of a larger IRB approved study analyzing the impact of therapeutic alliance on manual therapy outcomes in a back pain population, a post-hoc analysis of pilot data (n = 20) was conducted to compare correlation between baseline OM scores with RP and MEP scores. The OMs assessed were the Oswestry Disability Index (ODI), the Fear Avoidance Beliefs Questionnaire Physical Activity (FABQpa) and Work (FABQw), the Fear of Daily Activities Questionnaire (FDAQ), the Pain Anxiety Symptoms Scale (PASS), the Pain Catastrophization Scale (PCS), and the Tampa Scale of Kinesiophobia (TKS). Statistical testing included Pearson correlations.

Results: MEP was highly associated with the ODI (r= 0.76*) while RP demonstrated low to moderate associations. (r=0.41 to 0.61*) MEP was moderately associated with the FABQ-w (r=0.67*) with RP demonstrating low, non- significant associations (r= 0.37 to 0.38). MEP and RP were both moderately associated with the PASS and PCS . Additionally, RP was highly associated (r= 0.78*) with the TSK while MEP was moderately associated with the TSK (r= 0.58*). All other OM associations were low and/or insignificant. Interestingly, MEP and RP were moderately correlated with each other (r= 0.57*).

Discussion / Conclusion: We find that MEP and RP demonstrate significant moderate to high correlation to different OMs. Data suggests both MEP and RP can assist MTs in developing greater insight into pain experience as they associate to different levels on varied OMs.

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ID: 28 / PO19
Treatment for an Acute Occupational Knee Injury Utilizing a Manual Therapy and Biopsychosocial Approach: A Case Report

Background / Purpose: Peripheral nerve injuries can result from many different causes including trauma, altered movement patterns, and instability. The most commonly injured peripheral nerve in the lower extremity is the sciatic nerve, followed by the peroneal and tibial/femoral nerves. Crush injury is the most prevalent cause of peripheral nerve damage in patients sustaining an acute trauma to the lower extremity. Injury to the saphenous nerve, a branch of the femoral nerve, is a common complication of total knee arthroplasty and coronary artery bypass surgery when the saphenous vein is used. In an occupational setting, the prevalence of direct damage to saphenous nerve as a result of blunt force trauma is uncommon. Adverse neural tension is a common impairment following an injury to the peripheral nervous system and can lead to movement dysfunction, and fear avoidance behaviors. The purpose of this case report is to demonstrate the effectiveness of manual therapy in the treatment of a patient who sustained an acute, occupational lower extremity injury that resulted in adverse neural tension of the saphenous nerve.

Case Description: The patient was a 46-year-old female who sustained a blunt force injury to her left knee after smashing her knee into filing cabinet while at work. Impairments included joint hypomobility, decreased muscle function and movement system dysfunction. The patient was treated four times over a two-week period. Manual therapy is an effective treatment for reducing neural tension and relieving pain in patients with musculoskeletal injuries. Grade V joint mobilizations were applied to the spine, tibiofemoral, and proximal and distal tibiofibular joints. This treatment approach was supported by neural excursion exercises and neuromuscular reeducation exercises. Physical therapy was focused on improving function during work-based activities to promote return to full-time occupational duties.

Outcomes: Outcome measures include the Numeric Pain Rating Scale (NPRS), Fear Avoidance and Belief Questionnaire of Work and Physical Activities (FABQ-W and FAQ-PA, respectively), Lower Extremity Functional Scale (LEFS), and the Patient Specific Functional Scale (PSFS). After four PT visits, the ratings were NPRS of 0/10 with rest and activity; FABQ-W improved from 17/42 to 6/42; the FABQ-PA improved from 12/24 to 0/24; LEFS improved from 31/80 to 80/80; PSFS improved from 4/10 to 10/10. The patient was able to return to part-time, limited-functions within the first week of PT treatment, and was able to return to full-time occupational duties by the third treatment session.

Discussion / Conclusion: The utilization of Grade V mobilizations and neuromuscular reeducation exercises following a movement systems approach were determined to be effective in decreasing pain and decreasing fear avoidance in a patient with an acute occupational injury to the saphenous nerve.

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ID: 29 / PL15
The Effects of an Audible Cavitation Following Thoracic Spine Thrust Manipulation in Individuals with Subacromial Pain Syndrome: A Randomized Clinical Trial

Background / Purpose: Thoracic spine thrust manipulation (TSTM) is effective in reducing pain and improving function in individuals with subacromial pain syndrome (SPS), yet the explanatory mechanisms have yet to be elucidated. Secondary analysis of data from a randomized trial was completed to determine the immediate effects of an audible cavitation achieved with TSTM on shoulder impairments and self-reported pain and function in individuals with SPS.

Methods: Subjects with SPS were randomly assigned to receive a seated (n=20) or supine (n=20) TSTM technique. The manipulation was delivered twice regardless of cavitation. Baseline impairment measures were obtained by a single examiner and reassessed, blinded to baseline values, immediately after treatment. Scapular upward rotation and posterior tilt active and passive range of motion (ROM) during maximal arm elevation were assessed using a modified digital inclinometer. Force generation was assessed in the manual muscle test positions for the middle trapezius, lower trapezius, and serratus anterior using a handheld dynamometer (kg) and normalized by body weight. Pectoralis minor muscle length was assessed with a tape measure (cm) in relaxed standing posture as previously described and validated. Self-reported pain, satisfaction, and function were assessed using the Penn Shoulder Score (PSS) at baseline and 48 hours after treatment. Mann Whitney U tests were used to assess for group differences in the change in dependent variables based on whether or not an audible cavitation was achieved during the TSTM technique.

Results: An audible cavitation was achieved in 50% (20/40) of individuals. Individuals who experienced an audible cavitation had greater improvements in the self-reported outcomes of function (p=.006; median difference=2.0; Interquartile range [IQR]=0.2, 8.0), satisfaction (p=.021; median difference=2.0; IQR=0.0, 4.0) and total PSS score (p=.005; median difference=7.8; IQR=-0.1, 13.0) than individuals without cavitation. There was a greater increase in serratus anterior strength testing in the cavitation group (p=.043; median difference=0.51% of body weight; IQR=-0.09, 1.22), but no other significant differences in the change in scapular impairments between groups (p>.05).

Discussion / Conclusion: An audible cavitation achieved with TSTM in individuals with SPS resulted in greater short-term improvements in patient-reported outcomes which was concurrent with a greater increase in only one shoulder impairment. The results suggest that biomechanical mechanisms likely do not explain the therapeutic benefit associated with an audible cavitation achieved with TSTM. However, improvements in self-reported outcomes that can be influenced by psychosocial factors, patient perception, or other centrally mediated mechanisms warrant further investigation as a plausible mechanism to explain the effectiveness of manual therapy.

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ID: 30 / PO52
CONSIDERING VITAMIN D3 DEFICIENCY AS A POTENTIAL PAIN AND DISABILITY GENERATOR FOR A PATIENT WITH NONARTHRITIC HIP JOINT PAIN: A CASE REPORT

Background / Purpose: Nonarthritic hip joint pain can be a challenging diagnosis to treat. When patients do not respond to traditional forms of treatment, it is important to consider differential diagnoses and to reevaluate. Vitamin D3 deficiency can present clinically in various forms. Although current research links nonspecific musculoskeletal pain to vitamin D3 deficiency, there is little evidence available supporting the use of vitamin D3 supplements to specifically help improve nonarthritic hip pain and dysfunction. When included in a multimodal treatment plan for patients with vitamin D3 deficiency, taking vitamin D3 supplements may be a key component to decreasing pain and advancing function. The purpose of this case report is to demonstrate the value of considering vitamin D3 deficiency as a contributing factor to pain and disability in a patient with nonarthritic hip pain and, in collaboration with their primary care physician, incorporating vitamin D3 supplements to advance recovery and function.

Case Description: A 47-year old female telemetry CNA with a one year insidious onset of "all joints aching" and hips that "seized up in the last six months" described sharp, grabbing deep pain in the inner groin and lateral hips. Significant findings included limited hip range of motion, weak hip rotators, positive special tests, and hypomobile hip joints and lumbar spine. Palpatory signs over the groin and greater trochanters were negative. Seven physical therapy sessions in seven weeks integrated manual therapy to the hips and spine, stretches, education, and a progressive strengthening program. Vitamin D3 supplements were incorporated mid-rehab.

Outcomes: By visit #3, the patient was not making meaningful functional changes and was subsequently asked to return to her doctor for blood and lab work, including testing for vitamin D3. By visit #5, lab results revealed a significantly low level of vitamin D3, and the patient was advised by her doctor to take supplements and to schedule an MRI. By visit #6, daily Numeric Pain Rating Scale score decreased from 8/10 to 5/10 and the average Patient Specific Functional Scale score increased from 2.5 to 7.16. By this time, the patient had been consistent with her HEP and had been taking her vitamin D3 supplements for at least 13 days. The patient decided to cancel her MRI due to the significant improvement in her symptoms.

Discussion / Conclusion: The multimodal treatment plan used in this case study makes it difficult to determine the full effect Vitamin D3 supplements have on the patient's recovery. The sudden improvement in outcome measure scores after taking supplements within the treatment plan seems to suggest a potential short-term benefit. Larger studies with controls need to be done to determine the impact vitamin D3 supplements have on advancing recovery and function in patients with nonarthritic hip pain.

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ID: 31 / PO30
The Immediate Effect of Thoracic Manipulation on Pressure Pain Threshold in Acute Lateral Ankle Sprains an Exploratory Investigation

Background / Purpose: Lateral ankle sprains (LAS) are a common injury that occurs in the United States (2.5 per 1000 persons/year) and are especially prevalent in athletic populations. Most commonly, the anterior talofibular ligament (ATFL) is affected. During the acute phase of LAS, pain can alter participation in a rehabilitation program, perception of improvement, and functional ability. Thus, interventions that modify the pain experience must be considered a cornerstone in successful rehabilitation. Based on the described neurophysiological effects in the regional interdependence model, it is possible that acute LAS pain can be lessened by thoracic spinal manipulative therapy (TSMT). However, no studies were identified that examined the hypoalgesic effects of TSMT on pain associated with acute LAS. The selection of TSMT, over other spinal regions, was founded on evidence supporting its ability to modulate distal pain, its widespread use in physical therapy practice, and its mainstream acceptance as a safe and effective technique. The goal of this study was to evaluate the effect of TSMT on pressure pain threshold (PPT) at the ATFL in grade I-II acute LAS. It was hypothesized that following TSMT, PPT would increase.

Methods: A single-group, pre-test post-test, quasi-experimental design was employed. Eleven participants (6M, 19-29 years) with grade I or II LAS were assessed 2-21 days post-injury. The outcome of a supine posterior to anterior high velocity low amplitude thrust at T-4, PPT was measured by a computerized pressure algometer over the ATFL pre- and immediately post-intervention. The PPT investigator was blinded to the participants' scores. The result of the intervention on PPT was examined by calculating a paired t-test, percent change, and Cohen's D effect size (ES).

Results: Following the intervention, mean PPT increased 0.49 kg/cm2 (95% CI: -0.20, 1.18) for a 23.8% increase, signifying clinical importance (> 15%). An ES of 0.7 was calculated, indicating a moderate magnitude of change following the intervention. Statistical significance was not obtained ($P = 0.142$).

Discussion / Conclusion: Although a statistically significant difference was not observed, the moderate ES and > than 15% increase in PPT support that a clinically important change occurred immediately following TSMT. Our findings are comparable to or surpass the results of other investigations reporting ES and percent change in PPT as a result of spinal manipulative therapy (SMT) or local passive mobilization techniques. This exploratory study provides new evidence that TSMT is useful for immediately decreasing hypersensitivity at the ATFL in grade I-II acute LAS. Future studies should explore the long term hypoalgesic effects, optimal dosage and sites of SMT application, and combined benefits of SMT with other interventions. When managing pain associated with acute LAS, clinicians should weigh all pain modulation avenues and consider the immediate benefits of TSMT in reducing ATFL hyperalgesia.

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Direct Access Management, Differential Diagnosis, and OMPT Intervention of Acute Onset of Hip Pain in a 14-year old Male.

Background / Purpose: 1) To describe the direct access management and differential diagnosis of acute onset of hip pain in an adolescent male in a rural setting. 2) To describe orthopaedic manual physical therapy intervention and management of acute onset of hip pain in an adolescent male.

Case Description: A 14 year-old high school male presented to physical therapy via direct access with primary complaints of significant right hip pain, inability to bear weight, and ambulate On physical therapy examination, the patient demonstrated difficulty in walking, with gross antalgia and aversion to any active or passive hip testing. Additionally, significant local pain with palpation at the right anterior inferior iliac spine (AIIS) was noted. Given the focal area of pain, selective tissue tensioning of the right rectus femoris (RF) was completed. Examination results included painful weakness in all three positions, suggestive of significant bony pathology. A non-capsular pattern was also noted. The physical therapist consulted literature to assist in appropriate differential diagnosis, locating an article describing a similar mechanism of injury and patient reaction. The physical therapist consulted a pediatric nurse practitioner with a request for diagnostic imaging. Subsequently, the patient was found to have an avulsion fracture of the right RF from the AIIS. Following the positive imaging, the pediatric nurse practitioner consulted an orthopedic surgeon who referred back to the evaluating PT for conservative treatment. In turn, the PT accessed the literature again to assist in evidence-based intervention including exercise prescription and OMPT.

Outcomes: NPRS and LEFS were taken at baseline, and every two weeks thereafter until discharge. The patient returned to pain-free prior level of function (PLOF).

Discussion / Conclusion: This case highlights evidence-informed practice in physical therapy. The case demonstrates the benefits of being able to access and interpret evidence to assist in the differential diagnosis and management of adolescent hip pain in a direct-access rural setting. The case also highlights the clinical utility of selective tissue tensioning and knowledge of capsular patterns in orthopaedic PT. Additionally, this case highlights the benefits of interdisciplinary teamwork and respect necessary to deliver quality care to patients in a direct access rural setting. On two separate occasions for the same patient, the PT accessed, interpreted, and utilized literature to conservatively manage a condition not commonly encountered in this setting. Through the use OMPT and progressive exercise, the patient was able to return to a pain-free PLOF. Moreover, by engaging other healthcare professionals in consultation and reducing potentially non-useful office visits and additional imaging, point of care and intervention were maximized

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ID: 33 / PO1

Adapting regional interdependence to address movement system impairments of the thoracic cage, diaphragm, and phrenic nerve to resolve shoulder pain in a competitive cyclist: a case report

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Background / Purpose: Paradoxical breathing is characterized as reversed diaphragmatic control during inhalation and exhalation. Increased accessory muscle use during this pattern can limit thoracic spine and rib mobility, which can lead to impaired shoulder function and pain. Currently, there is minimal research that speaks to the retraining of breathing dynamics to address these impairments and potentially improve shoulder function. This case report describes an expanded view of regional interdependence to include diaphragmatic mobilization and neural retraining to improve the shoulder function.

Case Description: The patient is a male 14-year-old competitive cyclist with immediate onset of right shoulder pain after crashing and hitting his middle back on a tree, one and a half years ago. Examination findings included painful arc during right shoulder active abduction, pain with resisted glenohumeral external rotation, accessory and paradoxical breathing pattern, and pain at the thoracolumbar junction with active spinal extension. He demonstrated diaphragmatic inhalation restriction in the lower thoracic and rib region that was alleviated with contralateral cervical rotation, suggesting possible phrenic nerve entrapment. Initial QuickDASH score was 27/100 and NPRS was 5/10, with greatest limitation during functional reaching and mountain biking. After failure to improve during the first three session with standard of care treatment for shoulder pathology, including manual therapy to cervicothoracic and upper rib impairments; the patient participated in diaphragmatic retraining. Interventions included manual therapy to the thoracolumbar junction and lower ribs as well as manual diaphragmatic facilitation with phrenic nerve flossing to improve neuromuscular control and reduce mechanical restrictions. Flossing consisted of repeated contralateral to neutral cervical rotation partnered with inhalation and exhalation, respectively.

Outcomes: The patient was seen for a total of six sessions. The patient reported 0/10 pain on NPRS as well as improvement to 0/100 on QuickDASH. He demonstrated normalized breathing mechanics at rest on visual observation and palpation. He returned to competitive cycling pain free and demonstrated no mechanical shoulder impairments.

Discussion / Conclusion: This case report describes an expanded regional interdependence approach including diaphragmatic neural re-education, phrenic nerve flossing and lower thoracic/rib mobilization in order to improve upper thoracic/rib and shoulder function. Further research is needed to determine a cause and effect relationship between diaphragmatic retraining and shoulder pain.

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ID: 34 / PO61
Manual therapy: rebalancing the law of conservation of energy

Background/Hypothesis: The human body, like in all living organisms, finds the most energy-efficient means to perform all activities (4). For this to happen it must find the most efficient structural base. One structural base is seen throughout nature, both at the micro and macro organism level (5); this structure is the icosahedron pattern, which is comprised of 20 triangles (4). This icosahedron patterning allows for greater ability to move and transfer loads across the body (2, 4). This has lead to the theory of the intra-triangular unit (ITU), which allows for increased stability, mobility, and transfer of energy across body regions facilitating the least amount of energy expended with activity (1, 4). For the orthopedic manual therapist (OMT), being able to identify dysfunction within an ITU can consist of treating one part or the entire triangle. This would restore force distribution across the ITU and restore biomechanical integrity (3, 4). Compression from a single point is distributed to a larger base reducing the single point compression to a larger surface area, and compression and distraction equalizes the forces being put onto it, allowing the region to be inherently stable from all directions of force (4). A example of this relationship is the sternoclavicular joint (SC), cervicothoracic junction (CTJ), and acromioclavicular joint (AC); when viewing cranial to caudal it is easy to see these three regions form a triangle (4, 6). Integrity of these three regions is vital for normal biomechanics. Joint dysfunction within any or all of these joints can lead to dysfunction across the entire region and often the OMT needs to address several, if not all, of the biomechanical dysfunctions within the triangular pattern in order to have success in treatment. Interestingly, when the ITU is expanded and observed in relation to other ITUs in the body, the point-to-point interaction correlates to areas designed for higher degrees of ROM, whereas regions where the ITUs interface base to base, there is a higher correlation of this region to be designed for transferring load. This would suggest that the triangular interaction is designed specifically based on the requirement of the functional needs of the region. For the OMT, being able to identify biomechanical dysfunctions within the ITU and restoring appropriate force distribution is absolutely imperative for treatment and movement.

Summary of Findings: Often when treating in the clinic there are common patterns an OMT sees, and when addressing biomechanical dysfunction the OMT needs to treat several areas in order to achieve beneficial results. Examples of ITU treatment would consist of improving mobility of T2 and C2 for patients with cervical or thoracic dysfunction. Simarliary in the lumbar spine correcting joint dysfunction of T12 and L5 for individuals with low back pain. Often, an astute OMT will treat multiple regions intuitively; some areas include AC/SC/CTJ, atlanto-occipital joint/atlanto-axial joint/C2-3, C2-3/ AC to AC, hip/pubic symphys

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ID: 35 / PO48
Effectiveness of a Standing Workstation on Perceived Pain and Function: A Case Series

Background / Purpose: Cervical and lumbar spine impairments are considered two major causes of decreased productivity and lost work days. Sustained and unsupported sitting positions have been related to increased spinal pain and disability. Adoption of adjustable workstations has been found to increase standing time, which may lessen the negative effects associated with prolonged siting. The purpose of this case series was to investigate the effects of an adjustable workstation on neck and low back pain and disability in four patients.

Case Description: Patients were 4 full time faculty, 1 male and 3 females. Their ages ranged from 37 years old to 51 years old. One had both neck and low back pain, one had neck pain only and two had low back pain only. Subjects used a standing workstation for 8 weeks (intervention). Perceived pain was assessed pre, during and post intervention using a Visual Analog Scale (VAS). Function was assessed pre and post intervention using the Oswestry Disability Index (ODI) and/or Neck Disability Index (NDI).

Outcomes: Three of the 4 patients' VAS scores improved from pre intervention to week 8 of the intervention. The NDI and ODI scores improved from pre to post and fell within or below normative data. The symptoms reported by one patient suggest that spending 100% time in one position in either sitting or standing may not be well tolerated and may impact function.

Discussion / Conclusion: This case series supports the use of an adjustable work station that allows people to change their positions from sitting to standing throughout the work day. Patients' complaints of low back and neck pain as measured by the VAS decreased, while function, as measured by the ODI and/or NDI, increased with the use of an adjustable work station. Patients'' ODI and NDI scores improved from pre to post intervention and when compared with normative data. Increased evidence to support the use of an adjustable workstation may provide evidence for financial support for use of adjustable work stations. Limitations of this study include the small number of patients which limited the ability to generalize the results and apply statistical analysis. However, the results seen in this limited sample may provide a foundation for future research investigating cost savings in musculoskeletal injury with relation to use of an adjustable workstation.

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ID: 37 / PL44
Examining the impact of learning culture on clinical reasoning skills in postgraduate physical therapy education: a mixed methods study

Background / Purpose: Advanced clinical reasoning (CR) skills are a characteristic of expertise in orthopaedic manipulative physical therapy (OMPT) and an outcome of postgraduate educational programs Studies have retrospectively evaluated outcomes and impact of OMPT programs e.g. career development. In the absence of existing evidence knowledge and understanding how curriculum and teaching methods facilitate CR development would inform program design/delivery. In line with international research priorities, this study explored how postgraduate OMPT education advances CR skills through an examination of learning culture.

Methods: A mixed methods longitudinal case study design of a University based postgraduate IFOMPT approved OMPT program in the UK employed purposive sampling. Student participants (n=6) completed a modified-Diagnostic Thinking Inventory (DTI) and Script Concordance Test (SCT) (quantitative) to assess CR skills, and semi-structured interviews and focus groups (qualitative). Semi-structured interviews with program educators (n=6). Document analysis, researcher observations and a literature review informed topic guide development. Data were collected at enrolment, half way and program completion. Change scores for and DTI and SCT were presented descriptively. Inductive data analysis using a constructivist version of Grounded Theory identified the educational activities, features and context of the program that facilitated change. Ethical approval: University of Birmingham ERN_14-0747 7/07/14.

Results: SCT and DTI scores increased from enrolment to program completion by 28.8% and 9.4% respectively to reflect changes in knowledge, memory and flexibility in thinking. From the qualitative data, 4 themes were constructed to illustrate how learning was an outcome of students' critical social interactions with specific program practices 1) Creating collaborative and interactive learning environment 2) Challenging learners' biography 3) Ensuring relevance and authenticity 4) Context informed development The iterative process of data collection and analysis enabled construction of a 'Model of Culture of Convergence and Synergy' involving four conceptual dimensions: reflective practice, authenticity, motivation, and identity reconciliation with each existing at the individual (mico-), program (macro-) and wider organisational (meso-) level.

Discussion / Conclusion: This study provides preliminary evidence that CR skills can be advanced in a critical collaborative learning culture which considers the environment (professional socialisation), learner biography (reflection on experiences), authenticity (problem solving and clinical relevance) and context (collaborative working including mentored clinical practice). Findings can be used to inform planning and delivery of postgraduate OMPT education. Further evaluation and refinement of the 'Model of Culture of Convergence and Synergy' in other practice settings and professional groups is now needed.

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ID: 38 / PO11

Are the outcomes for adolescents with low back pain better when they receive a spinal manipulation? A retrospective review.

Background / Purpose: Background Context: The current evidence for manipulative rehabilitation treatments of adolescent patients demonstrates that it is a safe treatment, but there is little evidence to support manipulation for this patient population. Purpose: Examine the outcomes of adolescent patients treated in physical therapy with low back pain who received a spinal manipulation compared to those who received no spinal manipulation.

Methods: Study Design/Setting: Retrospective review of clinical database. Patient Sample: Patients with low back pain ages 12 to 17 referred to physical therapy between 2012 and 2017 at Intermountain Physical Therapy clinics in the Sale Lake City area. Outcome Measures: Self-report measures: numeric pain rating scale and the Modified Oswestry Disability Questionnaire. Functional Measures: Number of visits and cost of physical therapy. Methods: Physical Therapy notes were examined. Patients were categorized as having received a thrust manipulation to the spine or no thrust manipulation. Pain intensity and disability were recorded at each treatment session. The number of visits and costs were recorded. Comparisons were made between patients receiving thrust manipulation versus no manipulation.

Results: Results: One hundred twenty-one patients were included (mean age 15 [±1.7], 68.5% female). Thrust manipulation to the spine was received by 62 (51%) patients and 59 (49%) received no manipulation to the spine. Patients receiving thrust manipulation had on average 0.68 more visits and $158 more in total cost, but experienced significantly greater reductions in disability (p=.003) and pain (p=.02) with treatment than patients not receiving a manipulation.

Discussion / Conclusion: Conclusions: The outcomes for adolescents with low back pain in this retrospective review were significantly better statistically when receiving a spine manipulation compared to those adolescents who received no spine manipulation. Implications: For adolescents experiencing low back pain, receiving a spine thrust manipulation by a physical therapist may help in decreasing levels of pain and disability.

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ID: 39 / PO57

The use of manual therapy, pain neuroscience education, and exercise management in an individual presenting with neck and jaw pain following Rhytidectomy with Platysmaplasty: A case report

Background / Purpose: Rhytidectomy and Platysmaplasty (RP) are cosmetic procedures commonly referred to as face and neck lifts. Over 125,000 RP procedures are performed annually, and it is estimated that 16-32% of individuals experience cervical/temporomandibular joint (TMJ) stiffness/pain or altered sensation following surgery. To date, literature pertaining to physical therapy management has been limited to peripheral nerve injuries following RP, and no data exists regarding management of cervical/TMJ complaints. This case study details the use of manual therapy, pain neuroscience education (PNE), and exercise in the management of an individual status-post RP.

Case Description: A sixty-two-year-old female presented with a four-month history of limited cervical and TMJ active range of motion (AROM), pain, altered sensation, and fear of damaging the surgical outcome. No complaints of neck/jaw pain or significant past medical history were noted prior to RP. Subjective reports at initial evaluation included reported sharp pain along the inferior border of the mandible. Cervical AROM was guarded in all planes, resulting in a global limitation of cervical AROM to 10%. Average Numerical Pain Rating Score (NPRS) at rest was 4/10, Neck Disability Index (NDI) = 46%, and Pain Catastrophizing Scale (PCS) = 40.38 (Rumination 9, Magnification 4, Helplessness 8). Initially, management included PNE regarding her fear and rumination. This was combined with graded, oscillatory, non-thrust mobilizations and contact-relax techniques to the upper and middle cervical spine to reduce guarding and improve the cervical AROM. Manual interventions were followed up with, pain free rotation AROM, isometrics, and supine craniocervical flexion. Persistent impairments in mouth opening ROM and altered sensation around the mandible led to more specific consideration for the TMJ during visits 3-6. Measurement during the third session revealed immediate, within session gains in mouth opening ROM (25 mm to 45 mm) following intra and extra oral mobilization. As mouth opening AROM improved, the patient became concerned with damaging cosmetic benefits of the surgery. Mouth opening with visual feedback was used to re-assure the patient that cosmesis was not altered.

Outcomes: After 10 visits over 6 weeks the individual reported 1/10 on the NPRS, NDI = 30%, and PCS = 13.46. The individual reported 70% improvement in reports of altered sensation, with 100% resolution of fear of damaging the surgery. Cervical AROM = 100%, and mouth ROM = 45mm.

Discussion / Conclusion: Individuals may experience musculoskeletal impairments including cervical and TMJ pain/disability and psychosocial impairments following RP. These symptoms may be successfully treated using a combination of PNE, manual therapy, and exercise. To our knowledge, this is the first case report outlining physical therapy management for an individual with cervical and TMJ pain/disability status-post RP. Further research into the use of physical therapy intervention with this population is warranted.

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ID: 40 / PL32
Dry Needling in the Treatment of a Patient with Stroke-like Symptoms: A Case Report

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Background / Purpose: Sternocleidomastoid (SCM) dysfunction has been described to cause pain throughout the head and neck and may also produce autonomic disturbances, such as nausea, dizziness, blurred vision, and ptosis.1-5 These symptoms are commonly associated with stroke, which affects 795,000 people in the United States every year, though there is currently no data to suggest the prevalence of SCM dysfunction.6 The purpose of this case report is to describe a presentation of SCM dysfunction not previously reported in the literature and to introduce dry needling as a treatment option for this patient population.

Case Description: A 53-year-old woman presented to physical therapy with neck pain four months after the left side of her face and arm spontaneously went numb. All advanced imaging performed was exhaustive and unremarkable. At evaluation, looking up brought on nausea and sensation of imminent syncope. She also reported daily occipital headaches described as “burning,” intermittent facial numbness, transient ptosis, and a numeric pain rating scale (NPRS) score of 7.5-8/10 in her neck. All cervical motion tested was restricted and reproduced her familiar neck pain, though she was unwilling to attempt left cervical rotation or extension. There were no symptoms in her extremities. Palpation of the left SCM reproduced familiar facial symptoms, bilateral suboccipitals reproduced occipital headaches, and lower cervical paraspinals reproduced her neck pain. The patient was subsequently treated with a combination of dry needling and myofascial release (MFR) to the left SCM, bilateral suboccipitals, and lower cervical paraspinals, and a home exercise program emphasizing self-MFR, cervical extension isometrics, and craniocervical flexion training.

Outcomes: The patient was seen for four visits over the course of 5 weeks. Subjectively, her facial symptoms improved each visit to the point where she no longer was experiencing ptosis and only rarely experienced a minimal amount of facial numbness. At discharge, her Neck Disability Index score had improved from 52% to 10%, exceeding the minimal clinically important difference.7 Her cervical active range of motion into left rotation and extension had improved from 0 to 80 degrees and 0 to 45 degrees, respectively. She rated her overall and facial numbness improvement each as a +7, or "A very great deal better" on the Global Rating of Change.

Discussion / Conclusion: This case describes the successful resolution of facial numbness, ptosis, neck pain, and occipital headaches with treatment directed at the SCM and other cervical paraspinal musculature. Though causation cannot be determined, this case report demonstrates the use of manual therapy, particularly dry needling, and exercise in the treatment of a patient with stroke-like symptoms. Further research is necessary to both determine timing and efficacy of soft tissue management strategies for SCM dysfunction in the presence of autonomic and neurologic symptoms.

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ID: 41 / PO16
Spinal Manipulation in an Adult with Multiple Spinal Fusion due to Scoliosis: A Case Report

Background / Purpose: Spinal fusion is a common surgical intervention for individuals with adolescent idiopathic scoliosis (AIS) when Cobb angle curve magnitudes exceed 45 degrees. Evidence is limited on long term outcomes related to pain and disability in individuals receiving multilevel spinal fusions. It is hypothesized that segments inferior and superior to the fusion incur more stress due to the inherent stiffness of the fusion producing increased degeneration. This phenomenon has been well documented in post-lumbar fusion literature, and fusion length is a potential risk factor for higher incidences of adjacent segment disease. Mechanical impairments in peripheral body sements may compound stress to these levels due to regional interdependence as defined by Wainner et al. Ultimately, this may cause adjacent segments to be vulnerable to degenerative hypomobility resulting in mechanical dysfunction. Manipulation based interventions have not been studied in individuals with scoliosis post spinal fusion and there are no clinical practice guidelines to help guide management. The purpose of this case report is to describe a plan of care including specific thrust manipuluation as part of the comprehensive rehabilitation in an adult with AIS post fusions.

Case Description: The purpose of this case report is to demonstrate how specific manipulation may be safely and effectively used to treat a patient with scoliosis following multilevel spinal fusion. The patient was a 24-year-old female with left sided pain in the rib, thoracic, lumbar and sacroiliac joint aggravated by trail running. At the age of 12, the patient underwent an anterior spinal fusion spanning T6-T12, with a harvesting of the left 6th rib for bone graft. At the age of 15, the patient had a second fusion with a posteriolateral approach from T2-T8. After clearance from her surgeon, physical therapy examination revealed presentation consistent with mechanical dysfunction of the left 4th rib, right lumbar spine and sacroiliac joint, and left hip. Manual physical therapy was initatied for rib, lumbar and hip mobility, in addition to a home exercises program. Specific thrust manipulations were directed to the left 4th rib, and right L5/S1, with modification, due to the extent of the fusion. Grade IV caudal glides were performed to the left hip for hypomobility in the supine 90/90 position.

Outcomes: After 8 visits over a 4-month period of specific thrust manipulation, movement analysis and physiotherapeutic scoliosis specific exercises, the patient's pain and function improved as evidenced by the numeric pain scale (NPRS), trunk appearance perception scale (TAPS), and Scoliosis Research Society Questionnaire (SRS-22).

Discussion / Conclusion: This case report suggests specific manipulation to areas peripheral to the spinal fusion may improve patient outcomes by decreasing pain and improving functional activities and participation levels. However, such assumptions cannot be based on a single case report. Future research is needed in this area.

Complete Status: Complete

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ID: 42 / PL6
Safety issues associated with licensed physical therapists dry needling the Suboccipital Region: A Cadaveric Investigation

Background / Purpose: Dry needling myofascial trigger points in the suboccipital musculature is advocated for conservative management of cervicogenic and tension-type headaches. To date, there is no investigation of different techniques or influence of clinical experience on safety and potential adverse events dry needling the suboccipital region. The purpose of this investigation was to use Real Time Ultrasound Imaging (RUSI) to compare the incidence of potential dry needling adverse events when licensed physical therapists targeted the Obliquus Capitus Inferior muscle (1) using a Cranial-Medial (CrM) versus Caudal-Medial (CaM) approach; and (2) between a novice, experienced, and expert clinician.

Methods: Using seven unembalmed human cadavers in prone, three clinicians inserted three needles per side, per approach (CrM and CaM), for a total of 6 needle insertions per side, per cadaver. For both techniques the needle was inserted halfway between the spinous process of C2 and the transverse process of C1 with either a slightly cranial-medial inclination (CrM) or slightly caudal-medial (CaM) inclination angled towards the lamina of C2. The clinicians were licensed physical therapists with (1) no experience; (2) 7 years of experience; and (3) expertise (certified instructor) in dry needling the suboccipital region. The order of each clinician, technique and side were randomized for each cadaver. Clinicians inserting needles were blinded to the (RUSI) monitor. A 0.30 x 50 mm dry needle was inserted and advanced until the posterior laminar arch of C2 was reached or until the investigator reached an estimated 5 mm of the needle shaft remaining outside of the skin. Using RUSI, a 10-second video of the needle being pistoned back and forth was recorded as would be done in clinical practice.

Results: Average incidence of potential adverse events for all three clinicians was 15% for CrM and 11% for CaM approach. There was a total of 17 cases, 11 with the CrM technique and six with the CaM technique, where the needle broached spinal canal. In five cases, one with the CrM technique and four with the CaM technique, the needle either reached or pierced the spinal cord. The total incidence of potential adverse events was 16.7%, 14.3%, and 8.3% for the novice, experienced and expert clinician, respectively, with all three reaching/piercing the spinal cord at least once. Comparison of the CrM/CaM approaches across the novice, experienced and expert clinician revealed an incidence of 21.4%/11.9%, 14.3%/14.3% and 9.5%/7.1%, respectively, for potential adverse events.

Discussion / Conclusion: The CaM technique had a slightly lower incidence of potential adverse events compared to the CrM technique, however both could result in spinal cord puncture. Clinical expertise resulted in a lower incidence of potential adverse events, but did not prevent broaching the spinal canal or spinal cord. Both techniques, regardless of clinical experience, should be used with extreme caution based on the potential of spinal cord puncture.

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ID: 43 / PL42
Lumbar Spine Dysfunction Masquerading as Foot & Ankle Pain: A Case Series

Background / Purpose: The foot and ankle are one of the most common sources of nociception in runners. Foot/ankle pain is associated with a decreased quality of life and limited ability to perform activities of daily living (ADLs). Both local and remote structures (the lumbar spine) can be a primary source of foot/ankle pain. Simultaneous combination of neurodynamics with passive accessory non-thrust mobilization can be effective in managing spinal-related extremity pain. There is a paucity of literature investigating these principles in the lower extremity, particularly the foot/ankle. The purpose of this case series is to describe the examination and treatment of the lumbar spine in three patients presenting with foot/ankle pain.

Case Description: Three female patients, ages 23, 24, and 45 years old, presented to physical therapy (PT) with complaints of foot/ankle pain: two at the anterior talocrural joint line and one at the right posterolateral heel. All patients denied low back pain (LBP) and paresthesias at the time of evaluation. Each patient was limited on the Lower Extremity Functional Scale (LEFS), Numeric Pain Rating Scale (NPRS), and Patient Specific Functional Scale (PSFS). All were unable to participate in regular workout routines and running. Specific examination of the lumbar spine revealed range of motion (ROM) deficits, joint hypomobility, and positive straight leg raise (SLR) neural provocation tests. Lumbar spine passive accessory mobility testing reproduced or reduced each patient's foot/ankle pain. The assessment involved a combination of neural provocation with simultaneous lumbar spine passive accessory mobility testing. These findings led to PT intervention directed at the lumbar spine, including non-thrust joint mobilization, neurodynamic mobilization, and exercise directed at the lower extremity chain.

Outcomes: Patients were seen for 5-10 visits. All three subjects surpassed the minimal clinically important difference (MCID) on the NPRS, PSFS, and Global Rating of Change. 2 patients achieved MCID on the LEFS, while the 3rd scored 80/80. Lumbar spine ROM, joint mobility, and neurodynamics were within normal limits. Patients reported no pain or limitation with ADLs and successfully returned to workout and running routines. Outcomes were maintained at a 2-5 month follow-up.

Discussion / Conclusion: This case series describes the careul examination of the lumbar spine in the presence of isolated foot/ankle pain for efficient patient management. It is imperative that clinicians perform ongoing assessment of patients with foot/ankle pain and consider the lumbar spine as a possible source of nociception, even in the absence of LBP and paresthesias. A simultaneous combination of lumbar spine non-thrust mobilization and lower extremity neurodynamics should be considered as a treatment option in the presence of lumbar spine joint hypomobility and positive neurodynamic testing. Future research should explore the prevalence of lumbar spine dysfunction in patients with foot/ankle pain.

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ID: 44 / PO18
Cervical Spine Thrust Manipulation for the Management of Recalcitrant C6 Paresthesias in a Cervical Radiculopathy: A Case Report

Background / Purpose: The prevalence of cervical radiculopathy (CR) is estimated to be 83 per 100,000 persons. Conservative treatment of this condition may be superior to surgical outcomes, however, the evidence varies on which non-operative interventions are the most effective. Cervical spine thrust manipulation is a technique that is controversial in CR. While sparse, there is support for its use, and other evidence that suggests this technique is a contraindication in the presence of CR. The purpose of this case report is to describe the use of a high velocity low amplitude (HVLA) cervical spine thrust manipulation in a patient with recalcitrant C6 hand paresthesias.

Case Description: A 35-year-old male presented to physical therapy with a 2-week history of severe L neck, shoulder, upper arm, and lateral hand symptoms, unchanging in status. He reported a constant, dull ache in the neck and upper L arm; L shoulder 'instability', and constant paresthesias from the distal lateral forearm to the palmar 1st and 2nd digits. Examination revealed 4/4 positive tests for Wainner's radiculopathy cluster, leading to a clinical diagnosis of cervical radiculopathy, with sensation loss and myotomal weakness consistent with the C6 nerve root. Treatment consisted of repeated movements including cervical retraction and cervical retraction with extension, non-thrust L C5/6 upslope cervical spine mobilizations, median nerve mobilizations, and thrust and non-thrust thoracic spine mobilizations, which effectively abolished neck and upper arm pain. The cutaneous sensory loss remained, and was localized to the tip of the affected thumb. A HVLA upslope thrust manipulation at the LC5/6 facet joint was implemented with immediate resolution of sensation deficits.

Outcomes: Immediately and 9 days following the cervical spine thrust manipulation, he presented with normal sensation of the L hand. The patient was seen for 10 visits over 6 weeks. His Numeric Pain Rating Scale (NPRS) reduced from a constant 7/10 to 0/10. The DASH score reduced from 40/100 to 2.3/10. Patient Specific Functional Scale (PSFS) improved from 2/10 to 9.6/10. Global Rating of Change (GROC) was reported to be a great deal better (+6).

Discussion / Conclusion: This patient presented with a clinical diagnosis of a C6 cervical radiculopathy with neurologic impairments of sensation and strength. The patient initially responded to a treatment regimen that is well supported in the literature. However, his progress plateaued, with lingering sensation loss in the L thumb. Non-thrust L C5/6 upslope mobilizations were effective in reducing upper extremity paresthias, but did not resolve them. This led to a clinical decision to progress the mobilization force to a thrust manipulation at this segment, which immediately restored sensation of the thumb that remained at a 9 days follow-up, leading to patient discharge. Further research regarding the use HVLA cervical spine thrust manipulation in the presence of distal UE paresthesias associated with CR should be considered.

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ID: 45 / PO38
THE USE OF ORTHOPEADIC MANUAL PHYSICAL THERAPY IN AN EARLY INITIATED PHYSICAL THERAPY PROGRAM FOLLOWING SINGLE-LEVEL ANTERIOR CERVICAL DISCECTOMY AND FUSION

Background / Purpose: Cervical radiculopathy (CR) is a clinical condition resulting from nerve root compression, which affects 1.79 per 1000 people annually. Without proper management, nerve root compression can lead to significant pain and disability. Anterior cervical discectomy and fusion (ACDF) is the most common cervical surgical procedure for CR after initial conservative management has failed. Despite popularity of the surgical procedure, there is little published literature concerning the post-operative management of ACDF and there are currently no evidence based guidelines or standard for treatment progression. Therefore, the purpose of this case study is to describe the use of orthopaedic manual physical therapy (OMPT) in an early initiated physical therapy (PT) program following ACDF, based on tissue healing properties and clinical reasoning, in the successful management of an individual with CR as it relates to pain, function, and quality of life.

Case Description: The patient was a 49-year-old male presenting with significant neck and right arm pain, C7 myotomal weakness, and limited cervical range of motion (ROM) negatively affecting his sleep, exercise, activities of daily living and ability to work. Upon failure of conservative management, he subsequently underwent a C6-7 ACDF and began physical therapy (PT) 2 weeks later. Post-operatively, he presented with limited cervical active ROM, neck pain and arm weakness, however, the majority of the arm pain had resolved. Treatment included patient education, OMPT, neuromuscular re-education, cryotherapy, and therapeutic exercises. OMPT included soft tissue, scar and neural mobilization (weeks 2-6) and physiological/accessory joint mobilization (weeks 7-12). Treatment prescription and progression were dictated by tissue healing timelines and patient response. Radiographic confirmation of arthrodesis was monitored at 6 weeks, 12 weeks, and 24 weeks.

Outcomes: The patient was treated in physical therapy for 1-2 visits a week over 16 weeks with outcome measures administered at initial evaluation, 6 weeks, 12 weeks and discharge. In 16 weeks, significant improvements were demonstrated concerning Focus On Therapeutic Outcomes (Physical Functional Status 55% to74%), Global Rating of Change (+7), Patient Specific Functional Scale (1.6/10 to 8/10), Neck Disability Index (14% to 0%), Numeric Pain Rating Scale (2/10 to 0/10), SF-36 (Physical Function 85% to 100 %) Patient Acceptable Symptom State questionnaire (YES) and cervical active ROM (within functional limits).

Discussion / Conclusion: Improvements in pain, functional mobility and quality of life were demonstrated, without adverse effects, following ACDF and an early initiated multimodal PT program which included OMPT. The outcomes of this case study suggest that OMPT, used in an early initiated post-operative multimodal PT treatment program based on tissue healing and clinical reasoning, may be safe and provide benefit to patient outcomes at all stages of healing after ACDF on an individual basis.

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ID: 46 / PL4
The Use of Video-Based Motion-Analysis in Orthopaedic Physical Therapy Practice

Background / Purpose: Motion analysis is a useful tool for physical therapists (PTs) to assess and optimize movement. Video-based motion-analysis (VBMA) has become increasingly available for smartphones/tablets and require little to no equipment and cost. Research in this topic is currently limited. The purpose of this study is to explore the use of VBMA in orthopaedic PT practice.

Methods: An 18-question multiple-choice online survey was taken by Orthopaedic Section members of the American Physical Therapy Association (APTA). Study sample included licensed PTs, practicing at least 4 hours/week treating primarily orthopedic injuries. The survey was vetted through a survey expert and a focus group (11 PTs). Questions included: frequency of VBMA use, reasons for use, potential facilitators/barriers, device/apps used, patients seen, weekly practice hours, time spent with patients with and without aides/assistants, certifications, and demographic information. More than one answer was allowed in some responses (e.g., device used, reasons for use, and barriers to use).

Results: 477 respondents met inclusion criteria. 228 (47.8%) use VBMA. Of those who use VBMA, 208 (91.2%) use it for 1-25% of their caseload; 132 (57.9%) use their personal device; 98 (43.0%) use a patient device; and 90 (39.5%) use a clinic-issued device. 209 (91.7%) chose visual feedback, 208 (91.2%) analysis of movement, and 118 (51.8%) assessment of progress as reasons for VBMA use. 121 (53.1%) use a camera on a tablet/phone; 103 (45.2%) use a VBMA app. Apps most frequently used: Hudl/Technique (47; 45.6%), Coach's Eye (23; 22.3%), and Dartfish (15; 14.6%). Barriers to use: lack of device/equipment (233; 48.8%), time restraint (232; 48.6%), and unfamiliarity with device/equipment (153; 32.1%). Significant differences were found with age, years of experience, certification, and post-professional training. Those younger (40.6 vs. 43.2 years old, p=0.014) and with ? 20 years of experience (52.5% with ? 20 years vs. 37.4% with > 20 years, p=0.004) were more likely to use VBMA. Orthopaedic clinical specialists (OCS) were more likely to use (113/210) vs. those who were not (115/267) (53.8% vs. 43.1%, p=.025). 24/36 (66.7%) Orthopaedic Residency graduates were more likely to use vs. 204/439 (46.5%) non-residency graduates who did not (p=.029). 26/40 (65%) Fellows of the American Academy of Orthopaedic Manual Physical Therapists were also more likely to use vs. 202/437 (46.2%) who were not (p=.035). Time spent with patients, geographic region, delegation to assistants/aides, practice setting, or terminal degree did not predict VBMA use.

Discussion / Conclusion: The majority of respondents do not use VBMA. Of those using VBMA, most use it for 25% or less of their caseload. Those younger, with less years of experience, are OCS, and are Residency or Fellowship-trained were more likely to use VBMA. Future research should explore validity/reliability of VBMA and patient outcomes with use of VBMA.

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ID: 47 / PO22
Manual Therapy for Work-Related Wrist Pain in an Orthopaedic Manual Physical Therapist

Background / Purpose: Work-related musculoskeletal disorders (WMSDs) are common in physical therapists (PTs). Outside of the lumbar spine, the wrist/hand is the most common area of injury in therapists, with 69% of wrist/hand injuries due to manual therapy (MT). Risk factors for developing wrist pain in PTs include repetitive MT, female, and having less than five years experience as a PT. Ulnar-sided wrist pain is a common complaint and often referred to as the low back pain of the wrist due to difficulty in identifying the nociceptive driver. Wrist pain in PTs can be difficult to manage due to occupational demands, particularly in the orthopaedic MT setting. Consequences of WMSDs in PTs include modifying treatment techniques, reducing use of MT, taking time off work, decreasing work hours, and changing practice setting. Objective measures to guide management are sparse in WMSDs. The purpose of this case report is to describe the successful management of an orthopaedic manual PT with work-related wrist dysfunction.

Case Description: The patient was a 28-year-old female with a 6 month history of right (R) ulnar-sided wrist pain, recently aggravated by performing non-thrust anterior to posterior (AP) glides at the thoracic/lumbar spine with her R pisiform in contact with the skin. Pertinent history included scapholunate instability and wrist injury in college gymnastics. The patient scored a 7/10 at worst on the Numeric Pain Rating Scale (NPRS), 6.67 on the Disabilities of Arm, Shoulder, and Hand Questionnaire (DASH), and 6.5/10 on the Patient Specific Functional Scale (PSFS). She performed the AP joint mobilization technique on a scale, with pain onset at 17.5 kilograms (kg) and 6/10 pain at 31.5 kg. Passive accessory mobility assessment revealed hypomobility and symptoms reproduction at the R lunotriquetral (LT) joint.

Outcomes: Following non-thrust AP glides at the triquetrum on lunate, the patient immediately improved in ability to perform non-thrust mobilizations to the thoracic/lumbar spine (29.6 kg at first onset of pain, 35.4 kg with 6/10 pain). Self-mobilization and isometric exercise were provided as part of her home exercise program. The patient was seen for 2 visits. 1 and 2 months following the initial evaluation, changes were noted on the NPRS (0/10 at worst), DASH (0), PSFS (10/10), and performance of the thoracic/lumbar non-thrust technique (39.5 kg with 0/10 pain). She scored a +7 on the Global Rating of Change.

Discussion / Conclusion: This case demonstrates the clinical reasoning used in the management of a manual PT with a WMSD at the wrist when using a non-thrust technique at the thoracic/lumbar spine. While the precise diagnosis was unclear, non-thrust joint mobilizations at the LT joint and isometric exercise assisted in improving outcomes. Future research should focus on prevention and treatment for WMSDs. This should include methods to allow for repetitive, high demanding workloads at the wrist/hand, particularly during MT.

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ID: 48 / PO69
Clinical Assessment and Treatment of T4 Syndrome

Background / Purpose: The clinical presentation of the T4 syndrome is described in current literature as a symptom complex originating from the upper thoracic spine that can produce both a generalized headache and accompanying unilateral or bilateral upper limb pain and paresthesia that is glove-like in nature that responds favorably to joint mobilization and manipulation of the T4 segment (Conroy& Schneiders, 2005; Evans, 1997; DeFranca & Levine, 1995; Grieve, 1994; McGuckin, 1986). However, little clinical information is reported about the adjacent costotransverse joint that may be implicated in the signs and symptoms of T4 syndrome. Specifically, Evans (1997) describes the sympathetic fibers joining the sympathetic chain, synapsing in a ganglion, and leaving the chain to join a peripheral nerve that is mixed with somatic and sympathetic fibers. Though sympathetic nerves are motor, "they do contain afferent (sensory) nerve filaments which synapse in the dorsal root ganglion and enter the spinal column with the somatic afferent nerves" which is hypothesized to result in upper extremity paresthesia from noxious input at the upper thoracic spine, including the T4 segment and its adjacent costotransverse joint (Bogduk, 1988). The purpose of this study is to describe the clinical presentation and treatment of T4 syndrome.

Case Description: A 50 year old male was initially seen in physical therapy three weeks after shoveling snow with a subjective report of right scapular pain and intermittent numbness and tingling into his right dominant upper extremity and palmar surface of the right hand, especially the thumb and index finger without strength changes into his bilateral upper extremities. These symptoms worsened while lying up in bed and reading a newspaper, sitting at his computer for 8 hours per day as an Industrial Analyst and performing his Kendo workouts.

Outcomes: In conclusion, this patient's symptoms were reduced with the original treatment of gapping at T4 followed by postural education exercises but did not resolve until the costotransverse and costovertebral joints at rib 4 were manipulated with a progression of the home program to include proper breathing exercises. In this clinical case study, the entire thoracic ring needs to be a consideration in treatment of T4 syndrome in order to alleviate the upper extremity symptoms and reduce the chance of symptom return.

Discussion / Conclusion: Clinical palpation and biomechanical assessment of the thoracic spine is a critical factor in providing conclusive evidence to guide treatment of T4 syndrome. In this clinical case study, the patient presented with hypomobility T1-T4 posterior-anterior pressure at the right transverse process, costotransverse and costoverterbal joints of T4 and T5 with right hand paresthesia reproduced at the right T4 transverse process leading the clinician to believe a T4 syndrome was present. Further clinical studies are warranted in the differential diagnosis, treatments and mechanisms of T4 syndrome involving the thoracic ring.

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ID: 49 / PL20

Accuracy of Bony Land Mark Palpation Guided and Ultrasound Guided Coracohumeral Ligament Injections by a Physiotherapist and Physician - A cadaveric case series.

Background / Purpose: Coracohumeral ligament (CHL) thickening with fibroplasia and associated limitation in range of motion (ROM) are characteristic of glenohumeral idiopathic adhesive capsulitis (GHIAC). Corticosteroid injections are frequently utilized in the treatment of GHIAC. There is no consensus on the site of injection. Intra-articular glenohumeral joint injections have been advocated. With its key role in GHIAC pathology and ROM restriction it would seem imperative to assess the feasibility of targeting the CHL with periligamentous corticosteroid Injections. Aim: To investigate whether the CHL could be accurately targeted with a periligamentous injections.

Methods: This was an exploratory double factor cadaveric (bony landmark palpation and ultrasound (US) guided) case series. A convenience sample of 12 unembalmed cadaver shoulders were utilized. Two clinicians trained in musculoskeletal injection techniques carried out the injection on each shoulder with colored latex. A physiotherapist injected using palpation of bony landmarks for guidance, while a physician injected with US-guidance. The injecting clinicians were blinded to the others injection procedure and the injection order was randomized. An anatomist blinded to the injection order performed a shoulder dissection and recorded the location of the injected bolus. Analysis: Percentage calculation for injection accuracy and a chi-square evaluation of the difference between bony landmark palpation guided and US-guided injections was applied

Results: An accuracy of 75% was achieved for bony landmark palpation guided injection and 80% for US-guided injection techniques. Chi-squared indicated there was no significant difference ($p=0.82$) between the bony landmark palpation guided and US-guided techniques.

Discussion / Conclusion: Conclusion(s): US-guided and bony landmark palpation guided injections achieved good accuracy targeting the CHL, suggesting the CHL can be specifically and accurately targeted with periligamentous injections. Implications: The good accuracy demonstrated with the bony landmark palpation guided and US- guided injections indicates the need for future in vivo studies on therapeutic treatments targeting the CHL. Periligamentous CHL injections may represent a more specific and effective treatment option for GHIAC than intraarticular injections.

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ID: 50 / PO42
Utilization of a Lateral Shift Correction for a Patient with a Non-Visual Frontal Plane Lumbar Asymmetry and Subacute Lumbar Radiculopathy: A Case Report

Background / Purpose: Low back pain (LBP) with radiculopathy is a common musculoskeletal diagnosis. McKenzie offers a conceptual treatment model for such patients, including when a visual frontal plane shift is present in their lumbar spine. He advocates manually correcting the lateral shift followed by repeated directional preference movements. However, some patients have a non-visual frontal plane asymmetry that presents similarly to patients with lumbar radiculopathy. The purpose of this case report was to report a case where assessing and treating end-range lumbar lateral shift was of value for a patient presenting with sub-acute radicular pain.

Case Description: A 25-year-old male Crossfit athlete presented with left sided LBP, buttock pain, and posterior thigh numbness. He had a 2-year history of intermittent LBP for which he'd previously sought treatment including physical therapy, chiropractic, and dry needling, none of which resolved his symptoms. Aggravating factors included sitting (>10 min), driving (>15 min) and bending forward. He was not able to perform any training activities. A neurologic screen was negative, but all symptoms were reproduced with standing lumbar flexion and with passive left straight leg raise (SLR) at 35 degrees. The right SLR also reproduced left lumbar symptoms at 50 degrees. While no visible shift was noted, he had a hard end-feel and lumbar symptom reproduction with frontal plane shift past neutral to the left side. Shift to the right was full and symptom free. Initial treatment, therefore, included therapist applied left lateral shifts with overpressure. On the last visit a repeated standing lumbar extension program was included.

Outcomes: The patient attended therapy 4 times over a 4-week period. He had improvement of sitting / driving and returned to Crossfit. The patient's Lumbar Care Connections functional score improved from an 80/100 to 100/100. Self-reported pain went from a 6/10 on the Visual Analog Scale at initial evaluation to a 0/10 at discharge. Lumbar flexion was full and non-painful and SLR was over 80 degrees without symptoms.

Discussion / Conclusion: This case report demonstrates the effectiveness of assessing and treating end range frontal plane motion for a patient with subacute lumbar radiculopathy. Assessment and treatment of non-visual lateral shift may be overlooked, but can demonstrate limitations and symptom reproduction which change quickly when addressed.

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ID: 51 / PO20
The Manubrial Test: A Novel Assessment for Regional Interdependence in Adolescent Overhead Athletes.

Background / Purpose: Overhead athletes with shoulder injuries have been thoroughly studied with evidence showing effective methods of intervention for pain. Assessment, however, has been limited to identifying limited range of motion at the glenohumeral (GH) joint. The manubrial test was presented as a screen to identify upper thoracic (T1-T6), unilateral segmental dysfunction that may influence the function of the shoulder girdle through unilateral upper thoracic hypomobility. In this case series, spinal mobility, passive range of motion (PROM) of GH internal and external rotation, the acromioclavicular (AC) and sternoclavicular (SC) joints and the manubrium were all examined. Previous work assessing shoulder pathology in overhead athletes has placed emphasis on shoulder GH internal rotation deficit (GIRD) as the primary determinant for intervention in regard to mobility of the upper quadrant. There are some foundational concepts of the upper quadrant with shoulder elevation that should also be considered by an orthopedic manual physical therapist when deciding on treatment of GIRD. Literature has been published indicating better outcomes when manual therapy plus exercise are incorporated into the plan of care for a patient with shoulder GIRD. A multi-faceted approach may allow the clinician to include other components of the upper quadrant that may have an impact on shoulder elevation for the overhead athlete.

Case Description: Six overhead athletes between the ages of 14-17 years, 3 males and 3 females, referred to physical therapy (PT) with complaints of upper extremity injuries by a sports medicine physician were examined and selected as part of the case series. The athletes' sports included gymnastics, tennis, baseball and volleyball. A detailed biomechanical examination was performed by the treating physical therapist. All of the athletes included exhibited GIRD and manubrial mobility impairments as other deficiencies showed no consistent pattern. The results were used to find components of an examination that were mostly associated with GIRD in an effort to guide the clinician in their assessment of overhead athletes.

Outcomes: In regard to assessment of movement at the manubrium for mobility of the thoracic ring, all athletes exhibited a positive result for either unilateral or bilateral extension and/or unilateral rotation. Five of the 6 athletes exhibited a positive test for limited first rib mobility. Five of the 6 athletes received treatments after their first visit, including exercise and manual therapy, such as seated first rib mobilization, cervicothoarcic junction thrust manipulation and seated or prone upper thoracic spine mobilizations . One athlete did not return for treatment. Of these 5, all reported no pain, all demonstrated improvements in manubrial mobility in which symmetry was noted, and shoulder GIRD was absent at time of discharge.

Discussion / Conclusion: The thorax is often not regarded as a priority in the course of rehabilitation for treatment in this population. The findings from this study implicating dysfunction at the manubrium allows clinicians to pursue interventions that expand beyond the GH joint and incorporate the thorax as well. Generalizing the results is limited because no standardized treatments or outcomes were associated with these impairments. Future study should explore the relationship between these impairments.

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ID: 52 / PO6

The Effectiveness of a Combination of Manual Therapy, Therapeutic Exercise, and Pain Neuroscience Education on the Risk of Disability in Chronic Low Back Pain: A Case Report

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Background / Purpose: Interventions and explanations that focus on a biomechanical or pathoanatomical model may have limited effectiveness and can increase fear and disability in patients with chronic low back pain (CLBP). Current evidence on pain neuroscience education (PNE) supports guiding the patient towards developing active coping strategies that lessen threat and improve their function and participation. In addition to education, manual therapy and therapeutic exercise based on activities of daily living and the patient's participation goals should be utilized. The purpose of this case report is to detail the effects of PNE in addition to manual therapy and functional therapeutic exercise on a patient with a history of CLBP at high risk for disabling persistent back pain.

Case Description: A 58 year old Hispanic male was referred to physical therapy (PT) with a 5 year history of CLBP and has been on disability for the last 3 years. Previous bouts of PT primarily utilized passive interventions. He takes pain medication at least twice daily to cope with his symptoms. Aggravating activities include; bending, lifting, sitting > 1 hour, standing > 30 minutes, and walking > 15 minutes. His participation limitations include work, golfing and many ADLs. At initial evaluation, his Keele Start Back Screening Tool score was 6/9 (high risk for disabling persistent back pain). Physical examination demonstrated significantly limited lumbar range of motion (ROM) in all planes, especially rotation, secondary to muscle guarding and paraspinal muscle spasm. His right straight leg raise (SLR) was 25 degrees and his left was 35 degrees, both limited by his back pain. Interventions consisted of manual therapy emphasizing lumbar mobility, therapeutic exercise to enhance mobility and PNE to shift focus to function and decrease threat of movement.

Outcomes: The patient was seen 15 times over a 10 week period. He demonstrated full active and passive lumbar ROM with symptom reproduction only at end range lumbar extension/right and left side flexion. He had a SLR of 55 degrees bilaterally on his most recent visit, limited only by hamstring tightness. Patient self reported that he was 70-80% better than at initial evaluation. Patient can now walk for 40 minutes prior to symptom onset and has also returned to golf without increase in symptoms. His Keele Start Back Screening Tool score improved to a 1/9, indicating a low risk for disabling persistent back pain. His medication usage for symptom management is approximately 1 pain pill every 4-5 days.

Discussion / Conclusion: This patient has been previously treated with primarily passive PT for his CLBP with limited success. Utilizing current evidence for combining PNE, manual therapy, and exercise for his CLBP resulted in significant improvements in the patient's lumbar ROM, pain, and participation in daily activities.

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ID: 54/ PL16
Factors associated with Cervical Arterial Dysfunction: a survey of physical therapist educators.

Background / Purpose: Cervical Arterial Dysfunction (CAD) encompasses the anatomical and pathological spectrum of events affecting arterial structures of the cervical region and potentially blood supply to the brain. The manifestation of CAD may mimic musculoskeletal complaints that are amenable to manual therapy, leading to improper management and possible adverse events. The International Federation of Orthopaedic Manual Physical Therapy (IFOMPT) standards for examination of the cervical region include a variety of patient factors related to CAD. In the absence of valid screening protocols, the guidelines recommend a high index of suspicion for patients with headache and neck pain. The purpose of this study was to identify factors associated with CAD according to Physical Therapy (PT) educators and compare these findings with the IFOMPT standards.

Methods: Credentialed PT education program directors were asked to identify eligible educators. Licensed PTs teaching cervical spine examination and management in a credentialed DPT, orthopaedic or sports residency, or fellowship program as teaching cervical spine examination and management were eligible to participate. Educators were solicited via email to participate in an electronic survey containing open-ended questions aimed at identifying the subjective and objective factors associated with CAD. Two investigators performed qualitative analysis to identify underlying items represented by the open-ended text responses. Frequency analysis and principal axis factor analysis were performed to identify overt and latent concepts represented by the responses.

Results: PT educators completed 70 of 297 surveys. Fifty items were identified with a wide response frequency; only six items reflected >70% and eight items >50% of total responses. Factor analysis revealed a four-factor solution explaining 50.7% of total variance (Kaiser-Meyer-Olkin Measure = .679). Factor 1, “Diplopia, Drop Attacks, Dysarthria, Dysphagia, Dizziness, Ataxia, Numbness, Nausea, and Nystagmus.” Factor 2, “Other Neurological Findings,” including: sensory changes, weakness, cranial nerve signs, gait abnormalities, upper motor and deep tendon reflex abnormalities, and signs of Horner’s Syndrome. Factor 3, “Signs & Symptoms in Rotation and/or Extension.” Factor 4, “General Health,” including: smoking, systemic arthritis, and diabetes.

Discussion / Conclusion: Subjective examination and patient historical findings are of primary importance in identifying patient with CAD. Objective measurement of neurological signs and the behavior of symptoms with cervical movements further support this diagnosis. The Vertebrobasilar Insufficiency Test was reported by 34% of respondents which may reflect the questionable predictive ability of end-range positional testing. These findings are consistent with the IFOMPT guidelines highlighting the need to rely upon overall patient presentation in lieu of a definitive presentation for CAD or single clinical finding.

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ID: 55 / PO43
The Effectiveness of Manual Therapy Directed at the Upper Cervical Spine and Thoracic Spine to Treat a Patient with Subacute Neck and Arm Pain: A Case Report

Background / Purpose: Evidence supports the use of thoracic mobilization or manipulation for treatment of cervical pain. However, not all individuals have lasting changes in pain and range of motion (ROM) with treatment only at the thoracic spine. Recently, research has looked at the effectiveness of manual interventions directed at both the cervical and the thoracic spine for the greatest effectiveness. Patient comorbidities also must be considered when choosing whether manual interventions should be directed at either, or both, regions. The purpose of this case study is to demonstrate the effectiveness of manual interventions directed to both the cervical spine and thoracic spine in a patient with multiple comorbidities which also impacted the techniques selected.

Case Description: A 79 year old female presented with neck and arm pain, but also had a history of diabetes, hypertension, high cholesterol, and arthritis. Onset of symptoms began following a fall, which resulted in a chin fracture, neck pain and bilateral arm pain. Neck pain was described as an ache felt with cervical rotation. Open mouth x-rays were negative, craniovertebral ligaments were intact, and neural tension testing was unremarkable. The patient presented with upper crossed posture and increased tone in upper trapezius. Hypomobility was noted throughout thoracic and upper cervical spine with left cervical rotation most limited and painful. Arm symptoms were not reproduced with cervical assessment or shoulder ROM, but shoulder flexion was limited bilaterally. Palpation through triceps was the only thing that reproduced arm pain. Intervention began by treating the thoracic spine with central posterior to anterior (PA) and rotational mobilization based on evidence supporting mobilization at the thoracic spine for treatment of cervical pain. Thrust manipulation seemed too aggressive given her comorbidities. No change was noted, however. Therefore treatment progressed to include interventions at both the upper cervical and thoracic spine. Mulligan MWM to the upper cervical spine was performed due to patient's age and demographics.

Outcomes: The patient was seen 14 times over a 7 week period. Left cervical ROM improved from 58 to 70 degrees without further symptom reproduction and shoulder ROM was full. The patient self reported 95% improvement since initial onset. Her Numeric Pain Rating Scale improved from 8/10 to 0/10, and her Neck Disability Index improved from 26% to 4%. She returned to reading and driving without symptom reproduction.

Discussion / Conclusion: Research supports the use of manual therapy, including manipulation, to the thoracic spine to treat neck pain and ROM. Not all patients are appropriate for thrust techniques based on age, demographics, and comorbidities. Thoracic techniques alone do not always show long term relief of symptoms. This case study supports utilization of both cervical and thoracic mobilization to provide long lasting changes in ROM and function for a patient with neck pain.

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ID: 56 / PO46
Using Manual Therapy and Pain Neuroscience Education in the Treatment of a Patient with Herpes Zoster affecting Lumbar Nerve Roots: A Case Report

Background / Purpose: Herpes zoster typically affects thoracic dermatomes, however, research shows 10% of cases affect the lumbar nerve roots. Motor nerves have been shown to be affected clinically in ~15% of herpes zoster cases, but EMG studies indicate muscles are affected in 50% of cases. The prognosis for segmental motor weakness is typically favorable with complete recovery in 55-75% of cases but may take anywhere from 6 months to years. Research is very limited on the use of manual therapy for impaired sensation and motor nerve function following herpes zoster in the lumbar spine. The purpose of this case study is to describe the use of manual therapy and pain neuroscience education (PNE) for a patient with herpes zoster affecting L4-S1 nerve roots.

Case Description: A 70 year old female presented to therapy 5 weeks after initial onset of left leg pain and concurrent diagnosis of herpes zoster. The rash was visible above the sacrum and along lateral left leg and dorsum of foot. Her main subjective complaint was left leg weakness and poor balance. She also complained of tingling, pain, and swelling through her left lower leg. She demonstrated impaired sensation throughout L4-S1 dermatomes and had profound weakness in associated myotomes. Active ankle dorsiflexion was -20 degrees due to weakness. Her left straight leg raise (SLR) was 35 degrees with reproduction of posterior leg symptoms, while her right SLR was 60 degrees. Lumbar forward flexion to 60 degrees reproduced left calf pain. Each treatment session began with lumbar ROM and SLR assessment, followed by lumbar PAs at L4-S1 and then a re-assessment. The first two sessions also included PNE, followed by three weeks of manual interventions to the lumbar spine and graded motor imagery including laterality and desensitization training to the left lower extremity. The remaining sessions focused on functional strengthening.

Outcomes: Full symptom-free lumbar AROM (flexion 70 degrees, extension 20 degrees) and equal bilateral SLR (60 degrees) was achieved within 8 visits. In 12 sessions over 7 weeks her leg pain decreased from 10.5/10 to 3/10, active ankle dorsiflexion ROM improved from lacking 20 degrees to lacking 3 degrees, and her area of impaired sensation decreased from 620 cm2 to 12 cm2. The patient stopped taking all pain medications and was able to return to work the next month.

Discussion / Conclusion: While it is not possible to determine exact causation of recovery, one can note changes in active lumbar ROM and SLR both within treatment and between treatments which correlated with improved recovery of lower extremity strength and sensation. Prior to lumbar spine interventions and PNE, the patient did not improve over an initial two week period between the evaluation and first treatment session.

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ID: 57 / PL31
The Differentiation and Treatment of Neck Pain for a Patient with C5-6 Spinal Cord Injury and Multiple Amputations: A Case Report

Background / Purpose: There is an abundance of information on the use of manual therapy for assessment and treatment of musculoskeletal conditions in patients with neck pain. There is limited evidence regarding the use of manual therapy in patients with neck pain after spinal cord injury (SCI) and fusion. The purpose of this case study is to detail the differentiation and treatment of left sided neck pain for a patient with a stable C5-6 SCI and fusion, right above elbow amputation, and left above knee amputation.

Case Description: The patient is a 52 year old male with C5-6 SCI and fusion, right above elbow amputation, and left above knee amputation which occurred 20 years ago following a motor vehicle accident. He presented to therapy with left sided neck pain that began gradually 3 months previously. Symptoms were constant, rated at 6/10 in severity, aggravated by left cervical rotation, with a 10-20 minute latency before returning to baseline. Overall his symptoms were worst at the end of the day. Left upper cervical pain was reproduced with combined flexion and rotation to both right and left as well as resisted left side flexion and right rotation. He demonstrated a protracted head and shoulder posture. Hypomobility was identified through the thoracic spine. Muscular involvement seemed indicated as a result of prolonged posturing. Modified manual techniques were performed to differentiate between muscular and joint involvement due to the patient's physical limitation and inherent precautions. With the patient reclined in his tilt in space wheelchair, modified posterior to anterior (PA) assessment was performed on the cervical spine. Neural tension was assessed through modified neural tension screening due to the patients above elbow amputation. Treatment consisted of soft tissue mobilization, unilateral PA mobilizations of the upper cervical spine on the left, stretching, modified posture exercises, and proprioception retraining of the cervical musculature.

Outcomes: After seven visits the patient reported 0/10 pain at rest with all sections of the patient specific functional scale (PSFS) rated at 2/10 or lower. Initially the PSFS was 7/10 or 8/10. The patient demonstrated improved posture with decreased thoracic kyphosis and cervical extension when seated in power wheelchair.

Discussion / Conclusion: There is limited evidence regarding the use of manual therapy techniques in patients with SCI and cervical fusion. This case illustrates the importance of differentiating and applying treatments which did not compromise the SCI or fusion and incorporating the concepts of manual therapy. Additionally this case discusses the alteration of traditional manual techniques with a complex patient who has limited mobility.

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ID: 58 / PL13
Comparison of Range of Motion During the Flexion Rotation Test and the Side Bend Rotation Test in Individuals With and Without Hyperlaxity

Background / Purpose: The flexion rotation test is used clinically to help identify C1-2 involvement in individuals with neck pain and headaches. However, clinical experience suggests that generalized joint hyperlaxity may influence the results of this test, possibly because stabilization of the lower cervical spine occurs due to a soft tissue locking mechanism. An alternative means to stabilize the lower cervical spine involves side bending and contralateral rotation, resulting in lower cervical facet opposition. While the lower cervical spine is "locked", the upper cervical spine is reported to move freely in this position, which may provide an alternative test for C1-2 ROM. The purpose of this study was to examine the side-bend rotation test, which utilizes osseous locking, compared to the flexion rotation test in individuals with and without generalized joint hyperlaxity.

Methods: A total of 38 healthy individuals (25 female,13 male, mean age 26.03 years) were assessed for generalized joint hyperlaxity via the Beighton Hypermobility Index. A blinded examiner then performed the flexion rotation test and side bend rotation tests bilaterally, assessing range of motion (ROM) using a custom headpiece which contained a digital goniometer device and was validated using 3D motion capture prior to data collection. Descriptive statistics and tests of difference were utilized; independent samples t-tests were used for the dichotomous groups based on positive/negative Beighton Hypermobility scores, and a one way ANOVA with post-hoc testing used to assess results based on stratified Beighton Hypermobility Index scores.

Results: Statistically significant differences in ROM were present for the flexion rotation test between individuals with negative (0-3) and positive (4-9) Beighton Hypermobility Index(BHI) scores, (Right 46.4±3.6; 49.6±4.8, p=.031), (Left 45.5±3.5; 49.0±5.2, p=.023); no differences were observed for the side bend rotation test (Right 37.6±4.3; 38.9±3.4), (Left 37.7±4.2; 37.6±3.4). When further stratifying the groups, a one-way ANOVA and post-hoc testing revealed significant differences for flexion rotation test ROM between the BHI 7-9 group(52.4±4.4 -53.9±3.4) compared to BHI 0-3(45.4±3.6- 46.2±3.5) and 4-6 groups(46.0±3.7-46.4±2.2), p>.001; there were no significant differences between the BHI 0-3 and 4-6 groups. There were no between group differences for the side bend rotation test, BHI 0-3 (37.5±4.4-37.7±4.3), BHI 7-9 (39.9±3.7-39.2±3.5).

Discussion / Conclusion: Individuals with generalized joint hyperlaxity demonstrated significant differences in ROM during the flexion rotation test; the individuals with the highest levels of laxity demonstrated significantly greater ROM. There were no between group differences when assessed with the side bend rotation test. The side bend rotation test may be a useful alternative to the flexion rotation test for individuals with hyperlaxity. However, further research is needed to assess the diagnostic ability of this test in individuals with cervical pathology.

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ID: 60 / PL24
Perceptions of the Professional and Personal Impact of Hybrid Blended-Learning Fellowship Training: A Qualitative Study

Background / Purpose: Currently < 2% of licensed physical therapists hold the distinction of Fellow of the American Academy of Orthopedic Manual Physical Therapy. Recent literature has described the clinical outcomes of fellowship training (Rodeghero et al 2015), but little is known about the impact of post-professional training on the fellowship graduate's personal and professional development. The purpose of this study was to further explore the impact of training on both the personal and professional levels.

Methods: This qualitative study approach used semi-structured interviews and semi-directed content analysis methodology. Graduates from a credentialed, hybrid format, orthopaedic manual physical therapy fellowship program were interviewed. Each interview was recorded with the consent of the interviewee, and was transcribed and coded using grounded theory principles. Four coders were trained together in coding methods until agreement on terminology was sufficient, and then were split into two teams. Each member of coding team coded independently and met with the interviewer for coding agreement. Upon completion of coding agreement for transcriptions, files were sent to a second author-reviewer who functioned as arbitrator and provided final code for the statement.

Results: 13 graduates were interviewed. Six primary themes emerged relating to the direct impact of the program on the graduates' personal and professional development. These themes included: connectedness, professional activity, self-awareness, time management, professional satisfaction, and non-professional interactions. Positive impacts were identified, which included social and personal constructs. Within the context of social constructs, the main theme of connectedness could be subdivided into direct and indirect connections with cohort, colleagues and leaders in the physical therapy field. Active listening and improved relationships in the family structure were also identified in the social construct category. Personal impacts on the fellow were also positive, including professional development, self-awareness, and metacognition. Further positive impacts were noted in practical construct, including themes of efficiency of time management and practice satisfaction. A few graduates did report challenges during fellowship training on family dynamics, including strain on relationships and time sacrifices.

Discussion / Conclusion: The results of this study contribute to the understanding of the impact of fellowship training on individual graduates' personal and professional growth. Key factors were identified in this study that showed direct positive effects on 3 general levels, including: social constructs, personal constructs, and professional practice constructs. Additional research is needed to understand if there are any differences on the hybrid model compared to the in-residence fellowship training effects on the personal and professional domains.

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ID: 62 / PL8
Utilization of Graded Motor Imagery, Contralateral Strength Training and Aerobic Exercise in Patients with Immobilized Extremities

Background/Hypothesis: Immobilization during the healing phase of orthopedic injuries is integral in promoting tissue repair following injury or surgery. Potential adverse effects of this immobilization phase include; decreased muscle strength and range of motion, muscle atrophy, and persistent pain. These adverse effects often continue beyond the normal tissue healing time and can lead to central nervous system changes. Recent research supports the implementation of graded motor imagery, contralateral strength training and aerobic exercise in their ability to combat these cortical changes. While this evidence exists, it has focused on conditions related to specific central nervous system disorders. Currently, the implementation of these interventions for orthopedic conditions requiring immobilization has not been evaluated or integrated into clinical practice. The application of these interventions traditionally has targeted the central nervous system to reduce or counter the development of persistent pain. Additional benefits in strength, range of motion, muscle girth, have been seen in individuals with immobilized extremities utilizing these targeted central nervous system strategies. The intent of this abstract is to propose an intervention scheme directed at the central nervous system that can be applied during the immobilization phase of an orthopedic extremity injury to promote recovery and reduce development of persistent pain.

Summary of Findings: Strong evidence exists for the implementation of graded motor imagery, contralateral strength training and aerobic exercise during the immobilization phase of various orthopedic extremity injuries. Clinical application of central nervous system interventions may minimize the impairments associated with immobilization including maintenance or improvement of strength, range of motion and pain. This presentation will aim to review current literature and discuss the development and implementation strategy for these specific concepts during the immobilization phase of various orthopedic extremity injuries.

Conclusion / Significance: The adverse effects of immobilization following orthopedic extremity injury has been previously established. Interventions directed at the central nervous system, specifically, graded motor imagery, contralateral extremity strength training and aerobic exercise have the potential to minimize local tissue impairments and manage pain. These interventions should be considered an integral component of the rehabilitation process in order to maximize or expedite post-immobilization patient outcomes and decrease the risk for development of persistent pain.

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ID: 63 / PO17
Tibiofemoral Joint Mobilization in the Management of a Ballerina with an Isolated MCL Sprain: A Case Report

Background / Purpose: The incidence of musculoskeletal injury among professional dancers is estimated to be 1.24 injuries per 1000 dance hours1. The knee is the second most common site of injury in dancers2, with the medial collateral ligament (MCL) most frequently injured3. In addition to an unclear consensus on treatment, there is no evidence to date investigating the use of tibiofemoral joint mobilization in isolated MCL injuries. Fear avoidant behaviors post injury is another limiting factor in efficient return to sport.4,5 The purpose of this case is to describe the management of a ballerina with an acute MCL injury using joint mobilization to eliminate pain, reduce fearful behaviors, and a full return to sport.

Case Description: The patient was a 26-year-old female professional ballerina presenting with right (R) medial knee pain one week prior to visit. She reported a sharp pain during dance when turning from a position of hip external rotation and slight knee flexion. Her primary goal was to perform a solo piece in one month's time. She was limited on the Lower Extremity Functional Scale (LEFS) and the Fear Avoidance Beliefs Questionnaire (FABQ). Main findings included a positive valgus stress test for pain and laxity with MCL tenderness. Additional impairments included painful knee flexion and extension overpressures, 3+/5 strength of hip external rotators and hip abductors, hypermobility of R hip and tibial external rotation (ER), and limited R tibial internal rotation (IR). These findings led to a clinical diagnosis of a grade II MCL sprain6,7. Intervention consisted of education, manual therapy, therapeutic exercise, and graded exposure. Both passive Maitland style joint mobilization and Mulligan mobilization with movement (MWM) techniques at the tibiofemoral joint were effective in eliminating pain. Despite being pain-free, she remained fearful of re-injury and uncertain if she could perform her upcoming solo. A self-MWM was prescribed, allowing the patient to independently perform a pain relieving technique to address fear avoidant behaviors.

Outcomes: The patient was seen for 7 total visits over 4 weeks. At discharge, she reported 0/10 pain, negative valgus test and tenderness at MCL, improved hip strength to 5/5, improved LEFS score by 13 points, and reduced FABQ by 25 points. She performed all necessary choreography for her dance solo and fully returned to sport without using a brace. These outcomes were maintained at 4-month follow-up.

Discussion / Conclusion: This case demonstrates a comprehensive and patient focused approach to manage a MCL sprain in a professional dancer. Tibiofemoral joint mobilization techniques were effective in eliminating her pain, but did not address her fear of returning to dance. Providing a self-joint mobilization technique (MWM) allowed independent management of her symptoms and successful return to dance. Future research regarding the use tibiofemoral joint mobilization in isolated MCL injuries is warranted.

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ID: 64 / PL9

Long-Term Influences of Manual Therapy on Cortical Reorganization in Cases of Persistent Low Back Pain to Improve Function and Quality of Life: A Hypothesis Report

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Background/Hypothesis: In cases of persistent low back pain (PLBP), cortical reorganization (CR) occurs, which alters body perception.1-5 It has also been shown that manual therapy (MT) can play an important role in patient care focused on PLBP.6,7 We aim to discuss how MT may influence CR in a way that augments pain perception in cases of PLBP.

Summary of Findings: A pain experience can encourage short term changes in cortical activity.8,12 Persistent pain can encourage ongoing changes in cortical activity, which leads to plastic changes in the brain. This plastic change is the mechanism by which a pain memory is created and CR occurs. The two areas responsible for normal sensory interpretation are in the primary and secondary somatosensory cortices (S1, S2). Cortical activity disruption in these locations occur in individuals experiencing PLBP, influencing a medial shift and expansion of lower back and leg representation. These S1 and S2 area changes are correlated with an increase in pain output to the affected area as well as in remote regions.9,11 The augmented pain experience draws more attention to noxious stimuli resulting in increased brain activity and altered pain processing.4 While MT has short term effects on pain with associated short term cortical changes, it is limited in its abilities to meaningfully modulate the long term pain experience in individuals with PLBP.7,8 This limitation is potentially due to a focus on local tissues versus the neurophysiological and cortical components.10 Manual therapy can influence change to S1 and S2 cortices via increased non-noxious input to sensory receptors in the low back area, potentially overriding previous pain memories. The value of MT in impacting CR may lie in increased time with reduced pain allowing for plastic changes within the brain. Based on the evidence above, we believe a link may exist between MT and CR. A change in sensory input provided to the cortex may result in lasting CR, leading to a long-term improvement in pain perception when combined with other interventions.7

Conclusion / Significance: Previous research has shown that a summation of short term changes in cortical activity lead to CR. What has not been established is the long term results of cumulative cortical changes from MT on CR, and how that might augment the pain-state to result in improved overall function and quality of life. This could allow the manual therapist to shift focus away from treating the local tissue and expand the application of MT to include not just local tissue changes but cortical changes in patients with PLBP.

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ID: 65 / PL14
CERVICAL MUSCULOSKELETAL IMPAIREMENT IN INDIVIDUALS WITH SINUS HEADACHES

Background / Purpose: Individuals with chronic headaches often exhibit signs and symptoms of multiple headache types, challenging diagnosis and intervention. Sinus headaches (SH) are associated with rhinosinusitis; however, the diagnosis of SH is often given erroneously to people with migraine or tension-type (TTH) headaches. Confusion arises from common symptoms associated with these headaches for example patients with migraine can report nasal symptoms such as congestion or rhinorrhea. Neck pain is another symptom that commonly overlaps in recurrent headache types. The possibility that people with SH may have neck dysfunction has not been investigated. The purpose of this study was to determine if individuals with SH demonstrated impairments in neck range of motion (ROM), muscle function and/or cervical joint function.

Methods: This was an observational study. Sixty-one subjects with and without SH participated. Subjects attended one session to complete questionnaires and to undergo a neck examination by a physical therapist. Questionnaires included the Sino-Nasal Outcome Test (SNOT-22), the Headache Impact Test (HIT-6), and subjects answered questions about headache behavior. The primary measure was neck ROM measured using a CROM. Secondary measures were neck flexor endurance, segmental cervical mobility and pain, and pressure pain threshold (PPT). Data analysis included descriptive statistics for demographics, with independent samples t-tests for age and Pearson chi-square for gender. Cervical ROM, neck flexor endurance, and PPT were compared between groups with independent t-tests employing a Bonferroni correction at a= 0.003. Segmental cervical examination was examined for O-C4 by group using Fisher exact tests.

Results: Thirty-one subjects with SH (77.4% female; age 43.7(9.9) years) and 30 healthy controls (76.7% female; age 34.7(10.6) years) were included in the analysis. Average symptom duration for the SH group was 89.7 (± 85.6) months. Average SNOT-22 and HIT-6 scores were 36.2 (15.3) and 56.7 (7.1) respectively. Neck pain was reported by 83.9% (n=26) in the SH group. There were no differences between groups for gender or age. There was a significant difference between groups for neck sagittal plane ROM (14.3o [5.3o, 23.3o,p=0.002) and rotation ROM (21.5o [12.4o, 30.6o], p < 0 .001), and no difference between groups for flexion (p=0.08) or lateral flexion (p=0.017). There were significant differences between groups in neck flexor endurance (19.5s [10.1s, 28.9s], < 0 .001) and segmental dysfunction O-C4 (p < 0 .001). There was no difference in PPT between groups (p=0.04).

Discussion / Conclusion: Results indicate many people with SH have neck pain. They also demonstrate musculoskeletal impairments including cervical rotation, sagittal plane ROM, neck flexor endurance, and segmental function, but not in PPT. Neck dysfunction should be considered as a possible contributing factor in patients with SH. Further research is needed to determine if interventions directed at the neck are beneficial for this population.

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ID: 66 / PO7
Spinal manipulation included within an impairment based management plan for TBI: A case report

Background / Purpose: PURPOSE: The purpose of this case study is to report the safe implementation of spinal manipulation in reducing spasticity in the affected upper limb of a patient with a Traumatic Brain Injury (TBI). BACKGROUND: An 18-year-old patient 10-year s/p TBI participated in 8 months of impairment based physical therapy including: resisted exercise, long duration stretching, instrument assisted soft tissue mobilization, joint mobilizations and dry needling. Spasticity in the left elbow flexors continued to limit progress with volitional movement. Spinal manipulation was then included to potentially modulate spasticity through central nervous system processes. It was hypothesized that spinal manipulation could accomplish modulation of the nervous system allowing for greater volitional movement of the upper limb.

Case Description: CASE DESCRIPTION: Prudent screening and assessment of contraindications were completed prior to performing the thoracic manipulation technique. Four sessions of spinal manipulation were provided at one-week intervals to supplement an impairment-based intervention plan. The “pistol” manipulation was performed at several levels of the thoracic spine on each session and immediately followed by neuromuscular reeducation techniques. Spasticity was assessed via the Tardieu scale, pre- and post-manipulation on each session, which has moderate to strong test-retest reliability. The scale involves assessing passive range of motion (ROM) with a goniometer to gain a baseline measurement of available range. Next the examiner rapidly elongates the muscle being tested to elicit spasticity. A measurement is taken when spasticity occurs. The two measurements are compared to analyze the spastic effect on the given motion.

Outcomes: OUTCOMES: No adverse events were recorded during or after manipulation sessions. Tardieu scale measurements demonstrated pre-manipulation elbow extension ROM improvement over 4 weeks, 126° to 138°. Elbow extension ROM increased by a mean 9.25° within session. The first session of thoracic manipulation exhibited the largest change with a 24° increase in elbow extension ROM.

Discussion / Conclusion: DISCUSSION: Spinal manipulation may be a beneficial addition to an impairment-based management of patients with a TBI. Improvements in elbow extension ROM were identified within and between physical therapy sessions. There were also no adverse events suggesting good tolerance of this intervention in this patient. More literature is needed regarding spinal manipulation on patients outside the traditional orthopedic realm.

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ID: 67 / PO21
Dry needling for gluteal tendinopathy after failed bout of physical therapy

Background / Purpose: Treating recalcitrant chronic gluteal tendinopathy can be difficult, however recent studies have shown slow resistance exercise can reduce pain and improve hip function. Incidence of gluteal tendinopathy has been reported as 4.22/1000. Despite the benefits of slow resistance exercises, there is a paucity of evidence in the treatment and management of patients with chronic gluteal tendinopathy that do not respond to slow resistance exercises or other therapeutic exercises. One of the theorized underlying mechanisms of gluteal tendinopathy pain and dysfunction for is the inadequate transference of forces at the musculotendinous junction. Dry needling has been shown to improve muscle function by reducing pain, increasing blood flow and causing changes at a cellular level to enhance muscle activity. The purpose of this case report is demonstrate the effectiveness of a standardized approach to dry needling with electrical stimulation to various points of the musculotendinous junction of the gluteal muscle group in a patient who failed previous conventional physical therapy utilizing six session of dry needling.

Case Description: A sixty-seven-year-old male was referred to physical therapy for right recalcitrant chronic gluteal tendonopathy by a sports medicine physician. Over the year the patient failed several conservative treatments such as a home exercise program, previous physical therapy, naproxen, NSAIDS, heat and corticosteroid injection. Patient reported outcome measure revealed a raw score of 43 on the Hip Osteoarthritis Outcome Score (HOOS). Physical examination revealed painful and weak (manual muscle testing 2+) right hip abduction and external rotation. Passive right hip range of motion was moderately limited due to guarding into hip extension, external rotation and internal rotation. The patient was instructed in progressive resistance exercises of the gluteus maximus and medius, however, over the course of a month, the patient's symptoms continued to regress. Since progressive resistance exercises resulted in an increase in pain and worsening symptoms, a bout of dry needling was performed. Three 75 mm monofilament needles were inserted into the inferior, medial and superior aspects of the right trochanter where the gluteus medius/maximus/minimums insert, and three 75 mm monofilament needles were inserted into three common trigger points.

Outcomes: After each dry needling treatment session, the patient reported a longer period of time of symptom reduction in pain and symptoms. By the six session of dry needling, the patient reported a low amount of pain (1-2/10) from 8/10 at initial evaluation with improved force production (4/5) with resisted manual muscle testing (3+/5 at time of initial evaluation) of hip abduction and external rotation.

Discussion / Conclusion: The use of dry needling at the site of the musculotendinous junction is a viable alternative with less risk factors for long term success.

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ID: 68 / PO32

A progressive regional interdependence approach in the management of posterior shoulder pain in an elite climber

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Background / Purpose: It is increasingly being recognized in the literature that seemingly unrelated structures may be contributing to overall dysfunction, often termed as "regional interdependence." There is a growing trend in the research to examine whether deficits in thoracic or cervical spine mobility may be contributing to overall shoulder dysfunction. Combining therapeutic exercise with manual therapy has shown promise as an effective treatment strategy in this population. In patients with shoulder pain, it seems prudent, and efficacious of an in-depth approach, to evaluate and treat mobility deficits in the adjacent cervical/thoracic spine. This case report describes the management of a climber with posterior shoulder pain utilizing a regional interdependence approach within treatment.

Case Description: A 33-year-old male elite rock climber presented 1 year after bicep tenodesis and debridement of suprascapular nerve entrapment. Patient underwent formal physical therapy and was discharged after surgery but 6 months later complained of continued cramping and pain in his upper thoracic spine and medial scapula when climbing. Initial examination demonstrated early upward movement of his right (R) scapula compared to the left (L) side in active scaption, 4/5 middle and lower trapezius strength, decreased R shoulder GH inferior and posterior glide, and tenderness to palpation R rhomboids, levator scapulae, and upper trapezius. Additional testing revealed 25% limitation in cervical R rotation and side-bend (SB) compared to L, 25% limitation in cervical extension with pain on the R, and hypomobility/pain with unilateral PA spring testing to upper thoracic spine on the R. Initial DASH (Disabilities of the Arm, Shoulder, and Hand) was 27%, VAS 7/10, and PSFS (Patient Specific Functional Scale) activity of climbing was rated at 4/10. Initial treatment consisted of GH joint inferior and posterior glides, scapular setting training for lower trap recruitment in prone and sidelying, and dry needling to noted myofascial trigger points. In the following sessions, additional techniques were added to include cervical-thoracic manual therapy aimed at lower R cervical levels using thrust and non-thrust, CT junction seated/prone thrust, and both thrust and non-thrust manual therapy to upper thoracic spine on the R. As cervical and thoracic mobility normalized, shoulder girdle strengthening was progressed into overhead positions to mimic the functional demands of climbing.

Outcomes: After 12 treatment sessions, patient reported VAS of 0, PSFS of 9/10 when climbing, and DASH score of 0%. Pt was able to return to competitive climbing without limitation.

Discussion / Conclusion: This case report describes how a regional impairment based approach was used in the management of an athlete with shoulder pain. Including cervico-thoracic manual therapy techniques has the potential to be a catalyst for optimal recovery for those who have residual shoulder girdle impairments.

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ID: 69 / PO50

Management of an inversion ankle sprain: a case report incorporating external evidence into clinical reasoning.

Background / Purpose: Clinicians face multiple barriers with incorporation of external evidence to guide clinical reasoning. The balance between external evidence, patient values, and clinical experience could become compromised resulting in skewed clinical reasoning. Clinical Practice Guidelines (CPG), an example of external evidence, exist including one for Ankle Ligament Sprains. This case report aims to demonstrate the effectiveness of incorporating external evidence, including a CPG for Ankle Ligament Sprains, to help guide clinical reasoning in an Orthopaedic Manual Physical Therapy (OMPT) approach to treatment of a Grade I inversion ankle sprain at a hospital-based, outpatient (OP) physical therapy (PT) clinic.

Case Description: A 39 year-old male sustained a left Grade I inversion ankle sprain approximately two-months prior to PT. Initial treatment consisted of immobilization and cryotherapy. A consultation with a podiatrist followed, with subsequent referral to PT. During his PT exam, the patient expressed a desire to strengthen his left ankle to avoid worry about performing activities of daily living. Following discussion, and consulting the Ankle CPG, the OMPT management for this patient included talocrural mobilization in weight bearing (WB) and non-weight bearing (NWB), subtalar, and distal tibiofibular nonthrust joint mobilization; and, proximal tibiofibular joint thrust manipulation. Progressive resistance, WB functional, and both double and single-leg stance balance exercises were integrated. Primary outcomes measured were self-reported function (Foot and Ankle Ability Measure-FAAM), range of motion (ROM), and balance (Single Leg Balance Test-SLBT). Secondary outcomes included patient discomfort (Numeric Pain Rating Scale-NPRS) and perceived change in strength and ADL fear reduction (Global Rating of Change-GROC).

Outcomes: The patient made meaningful improvements in both primary and secondary outcome measures after six visits of varying frequency over 4 weeks. He had a 20-point increase in the ADL subscale of the FAAM and a 36-point increase in the sports subscale. The ROMs of his left ankle also increased in the following directions: 9 degrees in dorsiflexion measured both with the knee extended and the knee flexed, 24 degrees in plantarflexion, and 9 degrees in supination. His performance on the left SLBT improved 23.3 seconds as compared to 25.8 seconds on the right SLBT. He reported 0/10 left ankle discomfort, a 3-4/10 point change on the NPRS, and he rated +6 on the GROC scale. Although not formally measured, the patient reported 80% adherence to home management recommendations.

Discussion / Conclusion: A CPG, which contain recommendations based on current research findings and are routinely updated, was among the external evidence utilized in this case. This facilitated overcoming barriers with incorporating external evidence in a patient case with a primary focus on strengthening. Coupling a CPG with clinical experience and patient values to guide clinical reasoning in OMPT management was supported in this case. However, the treatment effect beyond the short-term was not assessed.

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ID: 70 / PO4
DIFFERENTIAL DIAGNOSIS IN A PATIENT PRESENTING WITH BOTH GENITOURINARY AND MUSCULOSKELETAL PATHOLOGY: A CASE REPORT

Background / Purpose: Patients presenting with pain in multiple regions can create diagnostic challenges for physical therapists. Musculoskeletal and non-musculoskeletal pathologies may occur simultaneously causing similar symptoms. As direct access providers, differentiating between these symptoms and recognizing potential red flags are vital skills for physical therapists. The purpose of this case report was to detail the clinical-reasoning leading to both medical and physical therapy management of a patient presenting with left sided low back pain, preceded by left anterolateral hip and groin pain, as well as left thigh numbness.

Case Description: The patient was a 49-year-old male referred to physical therapy for pelvic and low back pain with sciatica. A mechanically biased evaluation was performed, resulting in an initial treatment diagnosis of "low back pain with extension intolerance." The patient was then seen by the author for all remaining visits. During the second visit, additional subjective examination caused suspicion of a potential non-musculoskeletal pathology. Further objective testing lead to physician referral due to findings potentially suggestive of abdominal aortic aneurysm, iliopsoas abscess, or abdominopelvic neoplasm. He was referred back to his primary care physician and then gastroenterologist. Imaging showed a vesical calculus resulting in cistolitholapaxy.

Outcomes: Subjective and objective findings suggestive of sinister pathology resolved following the cistolitholapaxy. The patient continued experiencing groin and anterolateral hip pain, consistent with gluteus medius and iliopsoas tendinopathy, superimposed on intra-articular hip dysfunction. Following treatment consisting of manual therapy and exercise through two visits in four weeks, patient self-discharged due to significant reduction in symptoms.

Discussion / Conclusion: This case problem provides an opportunity to discuss the differential diagnosis, clinical reasoning, and outcome of a patient who presented with both genitourinary and musculoskeletal pathology. This report reiterates the importance of the ability of physical therapists to screen for non-musculoskeletal pathologies and recognize when to refer.

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ID: 71 / PL25
Work-Related Musculoskeletal Disorders in Physical Therapists Attributable to Manual Therapy

Background / Purpose: Manual therapy (MT) is an evidence-supported skill physical therapists (PTs) use to evaluate and treat patients. Its use, however, may be a risk factor for the development of work-related musculoskeletal disorders (WRMD) in physical therapists. Current evidence is limited on the specific relationship between WRMD and MT. The purpose of this study was to explore the relationship between MT and WRMD, and understand the type, cause, and prevalence of injuries, along with determining the impact this relationship has on physical therapists.

Methods: A web-based survey was constructed and distributed with the assistance of the Orthopaedic Section of the APTA with data collection through Qualtrics®. The survey was designed to gather information pertaining to the respondents' professional profiles, on any WRMD among those PTs responding, on how those injuries may have affected their professional and personal lives, and on how subsequent decision making with patients may have been affected.

Results: A total of 366 physical therapists participated in the survey with specific interest in those who perform MT routinely. Overall, 38% of the PT respondents who stated they use MT in their practices reported having sustained a manual therapy attributable WRMD at some point in their careers. Female respondents reported a greater rate of manual therapy attributable injury (43%) as compared to males ($p < 0 .032$). The data also revealed a higher rate of injury occurring within the first 5 years of practice and also in those who have practiced longer than 30 years ($p < 0 .003$). When considering females only, 30% of the respondents who utilized MT in their practice experienced a WRMD within the first four years of their PT careers ($p < 0 .019$). A large number of these injuries were reported to be related to treating patients substantially larger than the practitioner. PTs credentialed as Fellows of the American Academy of Orthopedic Manual Physical Therapists (FAAOMPT) and those with other specialized MT credentials were significantly less likely to experience a WRMD as compared to those who had not obtained MT credentials ($p < 0 .012$ & $p < 0 .028$).

Discussion / Conclusion: More than one-third of physical therapist respondents to this survey reported having experienced a WRMD attributable to MT. These injuries reportedly occurred at a disproportionately greater rate among female practitioners. Those particularly at risk for injury were within their first four years of practice and after 30 years of practice. These data indicate WRMD are an important professional issue for manual physical therapists. The data also suggest the need for academic institutions, residency and fellowship programs, and educational efforts at all other levels within the profession to address this issue, including the instruction in MT techniques to minimize stresses placed on the practitioner in order to reduce the risk of WRMD among PTs.

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ID: 72 / PL26
Physical Therapist Classification and Decision Making in Patients with Headache Disorders

Background / Purpose: Headache disorders are common presentations encountered by physical therapists with potentially increasing frequency in the future through primary patient contact. Relatively little is known, however, regarding physical therapist clinical decision making of patients presenting with headaches. This study investigates physical therapist decision-making criteria and processes regarding subjective history taking, examination components, and weighting of the importance of results in patients presenting with headaches, including consistency with the International Headache Society (IHS) classification system.

Methods: A web-based survey on patients with headaches and the IHS classification system was distributed in cooperation with the Orthopaedic Section of the APTA. The data were gathered on Qualtrics® with subsequent multiple statistical analyses of the practitioner and patient factors in relationship to the IHS classification system. Relationships of physical therapist education, training, experience, and self-efficacy are analyzed in comparison to classification of three complex theoretical patient cases with headache presentations. Sixteen patient data elements and their perceived relative importance were used to explore the decision making processes of physical therapists along with the theoretical cases and separately in the IHS categories.

Results: A total of 384 physical therapist members of the Orthopaedic Section of the American Physical Therapy Association (APTA) completed the survey. Among all practitioners, the tension-type headache, cervicogenic headache, and migraine headache hypothetical cases were classified consistent with the IHS categories in 32%, 55%, and 40%, respectively. More experienced physical therapists and those with advanced professional credentials (i.e. FAAOMPT and OCS) categorized the patient cases with greater consistency with the IHS classifications. The weight of individual patient history elements and examination findings varied markedly among practitioners, even among those consistent with the IHS classifications in all cases. Specific manual examination findings were ranked highly important to be either negative or positive by respondents, depending on headache presentation. Familiarity with the IHS headache classifications by physical therapists was low at 36% being not familiar and 37% being somewhat familiar.

Discussion / Conclusion: These findings suggest large variability in clinician classification consistency between various headache presentations. These data highlight the need for greater understanding of consensus-derived classifications and management by physical therapists as primary contact clinicians. Fundamental differences in the approach to examination and classification for patients with headache presentations between physicians and physical therapists are highlighted. This is supported by increased weight of importance of specific manual examination findings by physical therapists in each headache presentation, consistent with current physical

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ID: 73 / PO65
The Use of Manual therapy and Biopsychosocial Patient Education for an Acute Wrist Injury: A Case Report

Background / Purpose: Physical Therapists (PTs) typically use conservative treatment approaches when treating patients with acute wrist injuries; however, it may take several weeks and many visits for the patient to return to full function. The U.S. health care system is in need of reducing overall costs, and PTs have the opportunity to employ effective and efficient methods when returning patients to sport, work, and previous function. The purpose of this case study is to demonstrate a treatment approach for an acute wrist injury that combines manual therapy and biopsychosocial patient education that lead to an excellent outcome in an efficient manner.

Case Description: The patient was a healthy 40-year-old male who sustained a traction wrist injury after slipping on a ladder and catching himself on a rung with his right wrist while at work. Initial imaging showed no fracture which correlated with clinical examination. The patient reported 7/10 pain using the NPRS, numbness and tingling in the 4th and 5th digits and in the forearm extending from the wrist to the elbow. Impairments included decreased range of motion in all planes, hypomobility of the radiocarpal and ulnocarpal joints, decreased muscle function, and adverse neural tension in the involved extremity. Subjectively, the patient expressed his fear regarding tissue damage, enduring pain, and absence from work. Treatment was provided for 2 sessions over a six-day period. Interventions included thrust manual therapy to regional joints (cervical and thoracic) and non-thrust techniques to local joints and myofascial structures, exercises designed to reduce neural tension and sensitivity, and functional activities specific to the patient's work tasks. Individualized education within a biopsychosocial framework was provided based on current pain neuroscience to reframe the patient's beliefs about his injury and symptoms.

Outcomes: The patient's impairment and functional goals were met by the second visit, and he was discharged with the following outcome measures: NPRS, Quick Disability of the Arm, Shoulder and Hand (Quick DASH, Quick DASH-Work, Quick DASH-Sport), Fear Avoidance Beliefs Questionnaire of Work and Physical Activity (FABQ-W and FABQ-PA). The NPRS improved to 0/10 at rest and with activity; Quick DASH, DASH-W, DASH-Sport improved from 43% to 0%, 43.75% to 0%, 56.25% to 0%, respectively; the FABQ-PA and FABQ-W improved from 20/24 to 0/24, and 22/42 to 8/42, respectively.

Discussion / Conclusion: Identifying and reframing this patient’s specific beliefs about his injury and symptoms was crucial to providing education within a biopsychosocial and pain science framework. This, along with manual therapy and exercise, was beneficial in improving this patient’s pain, reducing fear avoidance, and returning them to their prior level of function effectively and efficiently.

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ID: 74 / PO58
CVA and chronic lower back pain: a treatment approach applying manual therapy and strengthening

Background / Purpose: Every year approximately 795,000 people have a new or recurrent stroke which can leave lasting effects on the musculoskeletal system. These effects include tone, muscle weakness, or decreased muscle activation. Any of these impairments can lead an individual to have movement dysfunctions during functional activities and a decreased quality of life. These movement dysfunctions can lead to low back pain in healthy individuals, let alone individuals who have suffered a stroke. Low back pain is a condition that effects 80% of people at some point in their lives and can be debilitating and expensive. Most people will be asymptomatic after 5 months, but the 10% of the patients continuing to experience lower back pain make up most of the health care costs associated with this diagnosis.

Case Description: The patient is a 54 year old female who was referred for physical therapy for right knee pain with radiating symptoms into her right foot with no mechanism of injury. The patient reported a history of a CVA affecting her right side in 2013 with minimal residual deficits. She has a history of chronic lower back pain with previous physical therapy treatment for 3 months without resolution. The patient reported difficulty walking greater than 2 blocks and walking up and down one flights of steps. The patient displayed limitations in knee, trunk and hip AROM, hip weakness, glute maximus, glute medius weakness bilaterally, right quad weakness, hypomobility of L5 with hypertonicity in her erector spinae and iliopsoas. The patient displayed positive ANTT testing with impaired gait and squatting technique. The patient was seen 1x/a week for 6 weeks with interventions focusing on manual therapy of the lumbar spine and hip, hip strengthening, and core activation and strengthening. Outcome measures were walking, climbing steps, ROM and LEFS. Treatment for the first 4 visits were plinth based exercises on core, hip and glute strengthening with emphasis on muscular activation without increased symptoms. Treatment during visits 5 and 6 emphasized weight bearing exercises and functional activities of her daily living, such as squatting, walking up hill, walking up steps and continued core and glute strengthening.

Outcomes: By visit four, scores on the LEFS improved from 39 to 42 and then to 58 on visit 6. Trunk ROM improved to normal limits in all directions by visit three. The patient displayed normal knee AROM at visit 2 and hip ROM at the completion of care. She was able to ascend flights of steps without discomfort and walk uphill at 10% incline for 8 minutes without symptom aggravation

Discussion / Conclusion: The combination of manual therapy with hip and core strengthening was successful in improving trunk, knee, hip ROM, walking tolerance, stair negotiation and LEFS score for this patient. Further research would be warranted regarding patients who suffered a stroke to determine if they have lower back pain and if manual therapy and/or core, hip and glute strengthening would be impactful for this patient population.

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ID: 76 / PO5
Lumbar Rotation-Extension Syndrome: Correction of Faulty Movement Patterns in a 24-Year-Old Patient with Low Back Pain

Background / Purpose: It is estimated that over 70% of adults have at least one episode of low back pain (LBP) in their lifetime. It affects work performance and social responsibilities, while also is increasingly a major factor in escalating health-care costs due to use of medication. LBP has profound effects on well-being and is often associated with significant physical health and movement impairments. Identifying movement impairment syndromes to address poor movement patterns may aid in alleviation and prevention of mechanical musculoskeletal pain problems.

Case Description: The patient was a 24-year-old female with a diagnosis of strain of muscle, fascia, and tendon of the lower back who presented to outpatient physical therapy complaining of sharp and aching pain across her low back that started with prolonged standing and lifting as an inventory worker. Prior to physical therapy intervention, the patient attempted to manage her symptoms with rest, pain medication, and heat but reported that her symptoms persisted as she returned to standing, lifting, and carrying at work. The patient displayed increased lumbar lordosis, hypermobility of L3-L5 segments, and ipsilateral pelvic and lumbar rotation at L5 with pelvic drop of stance leg during gait. With supine combined hip abduction and external rotation, she demonstrated lumbar rotation during the first 50% of lower extremity motion. Lumbar AROM produced her pain in all directions with most limitation with extension and left side-bending.

Outcomes: The patient was seen twice weekly for 4 weeks. Interventions included corrective exercises to prevent excessive lumbar extension and rotation to alleviate faulty movement patterns and tissue adaptations causing mechanical musculoskeletal pain modeled after Sahrmann's diagnosis and treatment of movement impairment syndromes. Outcome measures included the Oswestry Disability Index (ODI), floor to waist lift progression, and treadmill walking speed. Findings at discharge revealed resolution of LBP with an improved score on the ODI from 19% to 5%, improved body mechanics and weight with floor to waist lift, and an increased self-selected ambulation speed.

Discussion / Conclusion: In addition to treating the cause of the presenting impairments, physical therapists should consider addressing the "cause of the cause" of these impairments by identifying and correcting poor movement behavior and postures. In this way, the therapist may be able to alleviate mechanical musculoskeletal pain and decrease risk of future injuries. Through learning to correct her own movement patterns and postures, the patient was able to reduce faulty movements in the symptom-producing direction in order to perform her work related tasks without symptoms. Trials with a long-term follow up are needed to further determine the efficacy of this treatment approach for this population.

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ID: 77 / PO35

Top-Down, Bottom-Up: The Use of Pain Neuroscience Education, Graded Motor Imagery, and Manual Therapy in an Individual with Plantar Fasciitis: A Case Report

Background / Purpose: Current evidence and Clinical Practice Guidelines suggests biomechanical treatment of plantar fasciitis including manual therapy, stretching, taping, temporary foot orthoses, and night splinting. However, growing evidence suggests a multimodal approach, one that considers psychosocial aspects of care, in addition to biomechanical interventions, especially in the presence of central sensitization. This case report describes the management of a patient with chronic bilateral plantar fasciitis that presented with signs of central sensitization.

Case Description: A 69-year-old female with a 5-month history of bilateral plantar fasciitis was referred to physical therapy following a lack of progress after 1-month of aggressive soft tissue mobilization. Her complaints included Numeric Pain Rating Scale (NPRS) of 7/10 to medial-plantar aspect of both feet, which aggravated with weight bearing and walking without shoes. Initial outcome measures revealed her Foot and Ankle Measure (FAAM) = 0%, indicating a perception of significantly impaired function. An initial score of 7/12 on the Modified Neurophysiology of Pain Questionnaire (NPQ) suggested misconceptions about the biology and nature of pain processing. Results of the Patient Health Questionnaire (PHQ-2) indicated potential psychosocial influences related to her symptoms. Physical examination revealed bilateral limitations in talocrural and subtalar joint physiologic and accessory motion, impaired neurodynamic mobility, and palpable tenderness to medial calcaneal tubercle and peripheral branches of the tibial nerve. Manual therapy interventions were utilized to treat the identified mechanical impairments. Additionally, Pain Neuroscience Education, graded motor imagery, and referral to a grief counselor were incorporated to address psychosocial aspects of her pain experience.

Outcomes: The patient was seen for 16 sessions over 12 weeks. At discharge, ankle range of motion, pain, and perceived functional ability all demonstrated meaningful clinical improvement as noted through goniometry, NPRS, and FAAM respectively. Additionally, her understanding of pain processing via the NPQ improved to 11/12. A 2-month follow-up confirmed continued functional improvement without return of symptoms.

Discussion / Conclusion: Clinically meaningful improvements in function and pain were demonstrated following a multimodal approach that utilized impairment guided manual therapy techniques and addressed psychosocial features, including fear-avoidance beliefs and central sensitization. The concurrent use of manual therapy, Pain Neuroscience Education, and graded motor imagery was representative of her pain experience and appeared more effective than the mechanical impairment focused approach she previously received. This case demonstrates application of the suggested interventions described by Clinical Practice Guidelines, but also reflects the growing body of literature indicating awareness to psychosocial influences of pain and the treatment of pain through education.

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ID: 78 / PO63
Psychomotor training for performance of the deep neck flexor test

Background / Purpose: Psychomotor training is integral to physical therapy education. Skill attainment in examination procedures, as well as interventions, requires structured psychomotor learning and practice. The deep neck flexor test (DNFT) represents one special test designed to assess the neuromuscular control of the deep neck flexor muscles. Previous research indicates inter-rater reliability of the craniocervical flexion test (CCFT) as ranging from an intraclass coefficient value (ICC) of .63-.82. Although the evidence for reliability of the CCFT appears to support the use of the test, the CCFT is not as clinically applicable due to time constraints as well as the need for use of a specialized pressure biofeedback cuff. The purpose of this research was to determine the agreement in performance among DPT student raters of the deep neck flexor test (DNFT). A second aim of the research was to describe how the process of obtaining agreement was incorporated into the student research process through a process of feedback and training provided by mentors.

Methods: Four DPT students participated in a trial determining between tester agreement in performance of the deep neck flexor test (DNFT). A corollary to this study was to determine whether their agreement in performance of the test would allow them to participate in data collection in a larger clinical trial. The latter study is examining if people with cervical spine pain who respond to directional preference exercises will demonstrate an improvement in spinal stability as assessed with the DNFT. In the present study, descriptive statistics were used to assess agreement between two testers for each of the three subjects.

Results: The mean scores among the four raters in the three subjects ranged from 3.39-3.89 (SD 0.29-0.80). The difference in mean ratings across the three subjects was calculated according to an average of four trials of the DNFT. The average range of difference among raters was 1.0 for Subject 1, 0.36 for Subject 2, and 0.28 for Subject 3. These results lent support for the student raters to participate in the larger clinical trial during their clinical internship in year 3 of the program.

Discussion / Conclusion: The results suggest that practice time, random practice, demonstration, feedback and reflection led to psychomotor skill acquisition in the performance of the DNFT in four DPT students. Their performance allowed them to participate in a clinical trial which includes measurements obtained through the DNFT.

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ID: 79 / PL40
Real-Time Feedback is an Effective Adjunct to Instructor Feedback while Teaching Joint Mobilizations to the Knee

Background / Purpose: Background: Manual physical therapy strategies, including joint mobilizations, are effective for patients with knee osteoarthritis (OA). Learning joint mobilization is challenging due to the complexity of the motor task. Instrumented feedback helps to improve motor learning of joint mobilizations for the spine. Integration of real-time feedback may facilitate instruction of knee joint mobilizations in the context of a continuing education course. The purpose of this prospective stratified randomized educational control trial was to 1) determine the feasibility of using real-time feedback to teach physical therapists knee mobilizations and 2) determine if the use of real-time feedback enables physical therapists to apply mobilization forces to the knee with increased consistency and accuracy.

Methods: Methods: Sixteen physical therapists and four physical therapy students completed 8-hours of an instructor led course emphasizing manual physical therapy for the treatment of patients with knee OA. Participants were stratified, based on clinical experience and professional certifications. One group had real-time feedback (RTF) and one had peer and instructor feedback (PIF). All participants received the same training, however the RTF group utilized the Novel loadpad® force sensory system to provide augmented feedback during practice sessions. Pre-training and post-training measurements of force, amplitude, and oscillation frequency were measured and recorded using the Novel loadpad® force sensory system and compared to the expert clinicians.

Results: Results: Grade III knee extension peak-to-peak amplitude ($p < 0.001$), end range joint mobility (ER) ($p < 0.05$), oscillation frequency ($p < 0.001$) were significantly improved in both groups from pre-training to post-training indicating improved accuracy with no difference noted between groups. Consistency improved at a moderate level in both groups, again with no difference noted between groups (Cronbach's ?= 0.55). All participants in the RTF group reported that the use of the loadpad improved their training experience and the majority felt that it helped with motor learning.

Discussion / Conclusion: Discussion/Conclusion: The use of the Novel loadpad® force sensory system provides both novice and expert learners with goal-directed practice and augmented feedback while performing joint mobilizations to the knee. The results of this study, demonstrate that instruction from both an expert instructor providing one-on-one feedback or using the loadpad ® as an adjunct, is beneficial for the learning of joint mobilization. The constraints of many learning environments do not allow the expert clinician to be present during all practice sessions. Once the initial practice session is completed and the expert clinician has established the goal directed practice, there is a potential that utilizing the loadpad ® could allow for more targeted practice with the goal of improving the learning of joint mobilizations

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ID: 81 / PO56
THE USE OF HIGH VELOCITY LOW AMPLITUDE MOBILIZATIONS AND MANUAL THERAPY IN THE TREATMENT OF SACROILIAC JOINT DYSFUNCTION: A CASE REPORT

Background / Purpose: The health care system realizes that physical therapy plays a vital role in the treatment and return to function of patients with work-related injuries. Current research remains inconclusive as to the use of physical therapy, and the efficacy of manipulation over other treatments, involving sacroiliac joint dysfunction (SIJD). Furthermore, no clear guidelines or management plans have been determined. The purpose of this case report is to demonstrate the effectiveness of manual therapy in the physical therapy treatment of a patient who sustained an injury at work resulting in sacroiliac joint dysfunction.

Case Description: A 49-year old male presented to physical therapy with acute low back pain following a work-related injury one day prior. The patient reported injuring his back in an attempt to stop a refrigerator from falling over. The weight of the appliance hyperextended and rotated his back to the right, landing against the wall with him falling underneath it. The patient presented with chief complaint of right-sided low back pain, associated right buttock and posterior thigh pain. The patient localized his pain inferomedial to the right posterior superior iliac spine (PSIS), a positive fortin finger sign below L5. Aggravating factors included prolonged sitting, standing, walking, and pain with transitional movements. Clinical examination revealed 3/5 positive sacroiliac joint provocation tests (distraction test, thigh thrust test, compression test), while remaining tests were deferred due to pain. Right long sacroiliac joint ligament palpation reproduced his pain. Further assessment ruled out lumbar spine and hip pathology. Following the examination, manual therapy was performed, including three sacroiliac joint high velocity low amplitude (HVLA) mobilizations – sacroiliac joint long axis distraction, sacroiliac joint spring off, and sacroiliac joint posterior rotation. Immediate pain reduction and improved mobility was expressed by the patient and observed by the physical therapist. During the following sessions, appropriate exercises were prescribed and functional task education including proper lifting mechanics were performed.

Outcomes: The patient was treated for three visits over the course of four days with manual therapy to the sacroiliac joint and returned to full-duty work with complete confidence. The patient reached all functional goals and reported 0/10 pain. The patient's Modified Oswestery Low Back Pain Disability Questionnaire improved from 40% at evaluation to 0% at discharge. The FABQ-PA from 13/24 to 6/24 and the FABQ-W from 9/42 to 6/42. At a 6-week post-discharge survey, the patient reported he remained pain-free and fully functional.

Discussion / Conclusion: This patient was able to achieve full and pain-free function from a physical therapy treatment approach that emphasized the use of high velocity low amplitude mobilizations. These manipulations can be effective in reducing pain and restoring patient function. Now, this case report supports manual therapy as a critical component in the immediate treatment of patients following an acute work-related injury.

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ID: 82 / PO49
Physical Therapy Treatment of an Adolescent Female Presenting With Neck and Jaw Pain Following Concussion: A Case Report

Background / Purpose: Physical therapists are becoming increasingly involved in the management of persons following a concussion. Mechanical Diagnosis and Therapy (MDT), cervical stabilization, and manual physical therapy are interventions often used in the treatment of cervical spine and headaches. Research in the examination and treatment of the youth population post-concussion is limited. This case report describes the treatment of an adolescent female presenting with headaches, neck pain and jaw pain following a concussion seen in an orthopaedic physical therapy setting.

Case Description: A 12 year old female presented to physical therapy with a seven-day history of jaw pain, headaches, and neck pain. She was struck under the chin by a child on a swing, and fell backwards hitting her head on the ground with brief loss of consciousness. Chief complaint was intermittent headache located in the forehead and suboccipital regions rated 2/10 using numeric pain rating scale (NPRS), (0= no pain, 10 = the worst pain imaginable). Symptoms were made worse with concentration, watching television, and talking on the phone. Secondary complaints of jaw pain and clicking were made worse with yawning and talking. Cervical Active Range of Motion (AROM) was not limited, but she reported pain during flexion and extension. Headache increased during posture correction, palpation of the suboccipital muscles, and oculomotor testing. Initially, a conservative plan of care was adopted. This included cervical stabilization, temporomandibular joint (TMJ) isometrics, soft tissue mobilization, posture education, and upper quarter stretching. The patient reported reduced frequency and intensity of neck pain and headaches. Principles of MDT were introduced for the TMJ and cervical spine, and added to the plan of care.

Outcomes: The patient demonstrated directional preferences for both the cervical spine and TMJ. Neck pain decreased and remained better with cervical retraction. Jaw retrusion with self-generated overpressure decreased left sided TMJ pain and right jaw pain from 2/10 to 0/10 using NPRS; jaw opening improved from 40 to 45 millimeters. Over the next few sessions, she reported reduction in headaches, neck and jaw pain. The patient attended twelve physical therapy sessions over eight weeks. Upon discharge, symptoms were abolished for more than one week. Post Concussion Symptom Scores did not vary significantly during the course of treatment.

Discussion / Conclusion: This case highlights the physical therapy interventions used in a young patient presenting status post concussion with neck pain, headaches and jaw pain. Following an initally conservative plan of care, principles of MDT were explored. Directional preference was found in both the cervical spine and TMJ. As physical therapists become more involved in post-concussion management, more research is needed in determining effective treatment interventions for this population.

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ID: 83 / PL27
High performing physical therapists consistently use manual therapy regardless of baseline lumbar disability

Background / Purpose: The importance of manual therapy is challenging to study and quantify. Differences in skill and training of the physical therapist (PT), and heterogeneous treatment effects on patients often make meaningful inferences challenging to deduce in typical research settings. Using observational data and methods, we can compare 'real world' treatment signatures between cohorts of PTs. The purpose of this study was to compare manual therapy utilization of high and low performing PTs by baseline disability per the modified Oswestry Disability Index (ODI).

Methods: Patient data and ODI outcomes were obtained from the ATI Patient Outcomes Registry. Physical therapists identified as high (n=281, 10.1% PTs) and low (n=297, 10.7% PTs) performing relative to predicted ODI, controlling for sex, body mass index (BMI), payer, baseline ODI and Veteran's Rand 12-Item Health Survey (VR12) were included. All patients (n=139,476) were divided into quartiles by initial ODI score and patients treated by high (n=13,604) and low (n=15,298) performing PTs were compared. Linear regression was used to estimate manual therapy units per visit (MPV), controlling for sex, payer, age, BMI and VR12 for comparison between levels of performance categories (high, low) and baseline ODI quartile. Least squares means for MPV were estimated then compared between high and low performing PTs by baseline ODI disability quartile using 95% confidence intervals (CI).

Results: High performing PTs increased MPV as baseline disability increased per ODI, while low performing PTs utilized manual therapy most in quartiles (Q) 1 and 2, and decreased utilization in patients with higher baseline disability per ODI {Q1: high(H)=0.87 [95%CI 0.85-0.89], low(L)=0.77 [95%CI 0.74-0.80]; Q2: H=0.93 [95%CI 0.91-0.95], L=0.80 [95%CI 0.78,0.82]; Q3: H=0.94 [95%CI 0.92-0.96]; L=0.77 [95%CI 0.75-0.79]; Q4: H=0.96 [95%CI 0.93-0.99], L=.0.75 [95%CI 0.73-0.77]}. Additionally, high performing PTs required 1.5 visits fewer on average across all patients.

Discussion / Conclusion: Manual therapy is used consistently across patients by high, but not low performing PTs. The greatest differences in MPV were observed in patients with higher baseline disability. Differences of 0.17 to 0.21 in MPV between high and low performing PTs for Q3 and Q4 amount to 30-60 minutes of manual therapy in an episode of care. This suggests that consistent application of manual therapy was associated with better risk-adjusted outcomes across a large national sample of patients and PTs. This is the first study comparing manual therapy utilization of high and low performing PTs by baseline disability, a pragmatic approach to observe variability in treatment signatures based upon patient complexity. This study does not purport that manual therapy is what differentiates these PTs, simply that high performing PTs use manual therapy more than low performing PTs—and the difference in MPV increases with higher baseline disability.

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ID: 84 / PO15
Multi-modal physical therapy management of an ultra-runner athlete post-meniscectomy: a case report

Background / Purpose: Meniscus injuries are one of the most common types of knee injuries limiting range of motion, strength, exercise and quality of life. Current evidence and practice guidelines comparing surgical intervention to conservative treatment are equivocal in outcomes, although it is unknown if this recommendation applies to high-level athletes. Research has shown that strengthening the hip musculature, including the gluteus medius and maximus, can improve function and pain in patellofemoral syndrome as well as improve knee stability in individuals with excessive knee valgus. The purpose of this case study is to describe the physical therapy (PT) management of a high-level athlete post-meniscectomy utilizing a multi-modal approach targeting hip strengthening and neuromuscular re-education in combination with manual therapy for a quick return to sport.

Case Description: A 37 year-old male recreational ultra-runner presented to PT for evaluation after a R partial meniscectomy 4-days prior. The patient was diagnosed after experiencing progressive knee pain and clicking with long-distance running and extreme knee flexion. A multi-faceted treatment approach was utilized, with initial visits targeting neuromuscular re-education of the quadriceps and isolated hip strengthening and stretching, then moving to closed-chain activities by Visit 3, such as emphasizing gluteus maximus/medius activation. Additionally, manual therapy approaches were emphasized including long-axis hip distraction and soft-tissue approaches to the posterior calf. Over the final 4 visits, treatment progressed to unilateral strengthening, balance activities, and movement retraining.

Outcomes: By visit #2, the patient was already able to walk 1-2 miles with some residual soreness, and was able to resume light jogging on a home treadmill post-op 2 weeks. At his final PT session 1 month post-surgery, the patient was back to power walking without pain and continued to increase mileage gradually, returning to his pre-injury weekly 30-40 mileage in the 10 weeks post-discharge with no pain. Self-reported outcome measures demonstrated a substantial improvement during the course of care, with the patient scoring 80/80 on LEFS, 100% on the KOS – SAS, and 100% on VISA at 5-month follow-up. Muscle strength, measured by hand-held dynamometry, improved and exceeded pre-operative measures with the exception of ankle plantarflexion, which, although improved since surgery, had not yet returned to preoperative values.

Discussion / Conclusion: An individualized treatment plan focusing on manual therapy, neuromuscular re-education, and targeted hip strengthening was effective in improving pain, self-reported function, and strength in an ultra-runner post meniscectomy. This individual was able to return to pre-injury running levels pain-free within 4.5 months post-surgery. It is likely that the patient's prior level of fitness, which had included targeted glute and hip rotator strengthening exercises, contributed to his excellent outcomes and quick return to activity.

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ID: 85 / PO37
Pelvic Pain: A Hypothesized Evaluation and Treatment Option for the Non-Pelvic Floor Specialist

Background/Hypothesis: The clinical recognition of hip pain associated with femoroacetabular impingement (FAI) has increased over the past decade. Also noted is a proportion of females with FAI who complain of concomitant pelvic pain. While FAI and pelvic pain conditions have been separately studied, the interdependence of these anatomically linked conditions is not well described. That having been said, it is known that extracapsular hip structures and nerves can refer pain to the pelvic floor. The possibility for referred pelvic pain from surrounding and distant anatomical structures can challenge the clinician to determine the involved tissues. For the orthopedic manual physical therapist (OMPT), a subjective examination, deductive clinical reasoning, and clinical experience can guide intervention management; however, further research to help identify and subsequently treat individuals with a complaint of pelvic pain that is referred from the hip would be beneficial. While anatomy and general pelvic health are within the entry-level physical therapy curriculum, the number of clinicians specifically treating pelvic floor dysfunction is actually quite low. Therefore, for the OMPT who does not perform internal pelvic examinations, it is hypothesized that evaluating and treating the hip may provide symptomatic and functional improvement in those with a complaint of pelvic pain with or without hip pain.

Summary of Findings: Prior research identifying individuals with concomitant hip and pelvic pain remains unclear for diagnostic criteria and problem area association. Coady et al identified 75 subjects with a vulvodynia diagnosis who also had clinical and radiological confirmation for FAI. While the correlation between hip pathology and pelvic pain has been reported, it was unclear if a hip examination recreated the reported pelvic symptoms, or vice versa. When pelvic symptoms are reproduced with a hip examination, a pragmatic intervention approach could include, but is not limited to, manual therapy, dry needling, exercise, and/or pain neuroscience education. The literature mainly consists of case series including “typical” care indicating higher quality research should be performed. Coady et al identified 36% of the studied population with concurrent hip and pelvic pain went on to receive surgical intervention for FAI after failed conservative interventions focused towards both the hip and pelvic floor. This means nearly 64% of individuals with both hip and pelvic pain benefited from conservative care intervention; however, since the problem areas were poorly defined and treatment to multiple body regions was provided, it is unclear what conservative interventions were meaningful to reduce pelvic pain.

Conclusion / Significance: Clearly reproducing a patient's pelvic floor symptoms with a hip examination can identify the appropriate provider for effective care. This research could highlight how the OMPT could address other body segments, including the hip, to impact individuals with a primary complaint of pelvic pain

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ID: 86 / PO67
The Effectiveness of Dry Needling for the Treatment of Cervicogenic Dizziness in a 55 Year Old Female: A Case Report

Background / Purpose: Dizziness is associated with a variety of medical diagnoses. Cervicogenic dizziness, in particular, is the most common dizziness seen in physical therapy (PT practice. Cervicogenic dizziness is a non-rotatory, postural unsteadiness that is associated with cervical pain, with or without the presence of hypomobility, and may be stimulated by head movements. Dizziness stemming from trigger points and other abnormal tissues is a frequent and poorly diagnosed condition that does not respond well to medication. However, cervicogenic dizziness is often effectively treated with dry needling (DN. The purpose of this case study is to demonstrate the effectiveness of DN as a stand-alone treatment on a patient with cervicogenic dizziness and hypomobility.

Case Description: The patient was a 55-year-old woman who worked as a florist and a seamstress. Two years ago, she began to experience the gradual onset of dizziness or, felt like as if she were on a boat. Soon after the onset of her symptoms, the severity increased to the point that she had to stop working and applied for disability. Her physicians tested for Meniere's disease, ordered multiple brain scans, angiograms and prescribed medication. None of these tests, measures or medication improved her symptoms. Eventually, after two years, she was referred to PT. Her initial evaluation showed the following: Dizziness Handicap Inventory (DHI score = 92, cervical active range of motion (AROM of extension = 10°, flexion = 15°, right rotation (ROT = 22°, left ROT = 18°, right side-bending (SB = 12°, left SB = 8°, and bilateral C2-C7/T1 down-glide hypomobility of passive intervertebral movement (PIVM. DN was the only intervention performed for the treatment of this patient secondary to intolerance of traditional manual treatment. The DN intervention was performed on all trigger points in the sub-cranial, cervical and upper thoracic spines over the course of 10 treatments.

Outcomes: Following two treatments per week for five weeks, the patient's symptoms abolished. The patient was discharged and remained symptom free through the three-month follow-up. At discharge, her evaluation showed the following: DHI score = 2, cervical AROM of extension = 56°, flexion = 40°, right ROT = 61°, left ROT = 64°, right SB = 33°, left SB = SB 31°, and all PIVMs were normal except that the down-glide of left C4/5 and R C7/T1 remained hypomobile.

Discussion / Conclusion: Dizziness stemming from sources other than the inner ear is a difficult and challenging impairment to treat effectively, secondary to the diversity and complexity of systems that may be involved. The treatment including DN of all trigger points in the sub-cranial, cervical and upper thoracic spines appeared to be beneficial for a suspected cervicogenic dizziness, as interactions between the somatosensory, vestibular and ocular systems all provide afferent information to the central nervous system to maintain stability and balance during everyday activities.

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ID: 87 / PL38
Does a Thrust Manipulation to the Hip Joint lead to Kinematic and Kinetic Changes: A Pilot Study

Background / Purpose: Thrust manipulation is a frequently employed manual therapy technique for the spine and for peripheral joints such as the hip joint. A thrust manipulation can lead to reduced pain and perceived changes in motion at the joint (s). The actual mechanism by which these changes occur has been long questioned. Whereas in the past the changes were considered to have occurred due to biomechanical effects, it is now more commonly accepted that changes occur as a result of neurophysiological input. However, it is unclear whether biomechanical changes might also occur with these neurophysiology changes. The purpose of this study was to use instrumented gait analysis to quantify whether kinematic or kinetic changes occurred as a result of an application of a thrust manipulation to the hip joint.

Methods: Ten healthy participants, 7 females and 3 males, with a mean age 22.1 years old (± 1.79 SD) underwent 3-D motion analysis before and 10 minutes after thrust manipulation to the hip joint. Lower extremity kinematics (100 Hz, VICON) and ground reaction forces (1000 Hz, AMTI) were recorded while participants walked 10 times at a self-selected speed. Consistency of walking speed was maintained pre to post testing using a metronome. Cluster markers were used to allow for functional hip joint calculation. Gait kinematics and kinetics were processed and computed using the Visual3D software (C-Motion, USA).The data from the thrust limb was compared pre to post for peak hip extension, hip extensor moment, and for loading. All data were assessed for normality and then either paired t-tests or the Related Samples Wilcoxon Signed Rank test were used. An alpha level of 0.05 was used and statistical analysis of the data was completed using SPSS, version 23.

Results: There was no statistically significant difference between walking velocity in the pre to post trials (p=.84). There was a mean difference of 1 degree between hip extension pre manipulation to post manipulation, but this change was not statistically significant (p=.13). Relative to loading, it was noted that the initial loading response was greater following thrust manipulation, but this was not statistically significant (p=.26). The hip extensor moment increased positively but this change was also not statistically significant (p=.22).

Discussion / Conclusion: Thrust manipulation to the hip joint can lead to changes in pain and perceived motion at the joint. In this study, changes in peak hip extension, ground reaction forces, and hip extensor moments were identified; however, none of these changes were statistically significant. It should be considered that this study was completed on individuals who did not have reports of hip pain or limited motion. Future studies should be completed to establish whether statistically significant mechanical changes occur in those with hip dysfunction following a thrust manipulation to the hip.

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ID: 88 / PO59
Becoming a Movement Systems Specialist: Manual Therapy by a Student Physical Therapist for an Injured Inpatient Physical Therapist: A Case Report

Background / Purpose: Physical Therapy has become a diverse field with 9 distinctive specialties within the American Physical Therapy Association (APTA), subspecialties, and special interest groups. Since 2013, the APTA has identified those within the profession as Movement Systems Specialists, distinguishing the physical therapist's unique role in recognizing and treating movement dysfunctions. The purpose of this case report is to describe the utilization of manual therapy by a Student Physical Therapist (SPT) and a fellowship-trained orthopaedic and manual physical therapist in the treatment of an injured inpatient physical therapist.

Case Description: The patient was a 31-year-old female who sustained a low back injury while at work as an inpatient physical therapist. The evaluation and treatment of this patient was performed in an occupational outpatient orthopedic setting by a physical therapy student with oversight from a fellowship-trained orthopedic and manual physical therapist. The patient presented with a primary ICF impairment of acute low back pain with movement coordination deficits, a movement systems impairment syndrome of lumbar extension with rotation, and a primary tissue-specific impairment of an acute sacroiliac joint dysfunction. The plan of care incorporated high velocity low amplitude (HVLA) manual therapy locally at the sacroiliac joint and regionally at the thoracolumbar spine and hip; additionally, the plan of care incorporated exercise designed to control lumbar movement during the patient's various functions as an inpatient physical therapist.

Outcomes: After completing six visits over two weeks, the patient returned to her work as an inpatient physical therapist. The patient's pain level (utilizing the numeric pain rating scale) decreased from 7/10 at the initial visit to 0/10 at discharge, and her Modified Oswestry Low Back Disability Questionnaire score decreased from 42% disability to 2% disability. Likewise, her Fear Avoidance Belief Questionnaire (FABQ) Physical Activity score decreased from 24/24 at initial evaluation to 4/24 at discharge.

Discussion / Conclusion: As Movement Systems Specialists, Physical Therapists must apply their distinctive knowledge of the movement system in order to optimize patient-specific functional performance. This case report demonstrates that the identification of a movement impairment syndrome and utilization of manual therapy by an SPT and a fellowship-trained PT lead to a rapid return to function, reduction of disability and pain and fear avoidance beliefs of an inpatient physical therapist.

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ID: 91 / PL47
Dry needling curricula in entry-level education programs for physical therapists

Background / Purpose: Physical therapists routinely use a variety of interventions in the management of patients with neuromusculoskeletal disorders. One intervention that has recently gained popularity is dry needling, which is a technique used to treat dysfunctions of skeletal muscle, fascia, nervous and connective tissues. While research that is evaluating the efficacy of dry needling is emerging, the current status of dry needling instruction in entry-level education programs for physical therapists is unknown. Therefore, the purpose of this study was to determine the extent to which dry needling is instructed in entry-level education programs for physical therapists.

Methods: Program directors from 226 entry-level education programs recognized by the Commission on Accreditation in Physical Therapy Education were recruited via e-mail to participate in an anonymous 35-item electronic survey during the 2017-2018 academic year. The survey evaluated dry needling curricula, faculty qualifications, attitudes and experience, and programs' future plans for teaching dry needling.

Results: A total of 75 programs responded to the survey (response rate = 33.1%). Of these 75 programs, 40 (53.3%) had integrated dry needling theory and practice into their entry-level education programs and 8 (10.7%) planned to include such content in their curriculum in the future. Of the 40 respondents, 23 indicated that dry needling education was integrated into a required course, 4 indicated that dry needling was an elective course, and 13 did not specify how dry needling education was integrated. Faculty teaching dry needling content appear to be well qualified, with the majority having between 5 and 10 years of experience using dry needling in clinical practice. Given the depth and breadth of dry needling instruction, 21 respondents rated their graduates as “not competent” to implement dry needling into clinical practice, 5 rated their graduates as “minimally competent”, and 4 rated their graduates as “competent”; 10 respondents did not reply to this question. The programs currently not teaching dry needling reported reasons, including belief that it was a post-professional skill (42.9%), not considered by the program to be a high enough curricular priority (37.1%), lack of qualified faculty (14.3%), not enough time (14.3%), and perceived lack of scientific evidence regarding efficacy (14.3%).

Discussion / Conclusion: Of the 75 responding entry-level education programs, 40 (53.3%) are currently teaching dry needling and 8 (10.7%) soon plan to do so. There appeared to be variability in how dry needling was integrated into the curricula, as well as in the depth and breadth of instruction. Our research may serve as a benchmark for faculty to assess existing dry needling curricula and as a guide for developing curricula in new or existing physical therapy programs.

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ID: 92 / PL1
The Accuracy of Biceps Tendon Palpation by Physical Therapists

Background / Purpose: Shoulder pain related to long head of the biceps tendon (LHBT) pathology can be debilitating. Accurate diagnosis of LHBT pathology can be difficult and often involves a combination of special tests and palpation. Interventions such as dry needling requires a certain degree of accuracy with regards to palpation of the LHBT. The ability of physical therapists to accurately and reliably palpate the LHBT remains unknown. The aim of this study was to conduct a prospective single blinded study to determine the accuracy and reliability of physical therapists palpating the LHBT with the use of ultrasound as the gold standard.

Methods: Two physical therapists (19 and 22) years experience each; palpated the LHBT within the intertubercular groove of the humerus in two test positions on bilateral shoulders of 32 asymptomatic participants (11 female) with a mean age of 24.3 (+/-1.9 years), body mass index mean of 23.5 (+/- 1.9 kg/m2). Position 1 was supine, with 90°elbow flexion, 0°shoulder abduction, 20°medial rotation. Position 2 was supine with 90°elbow flexion, 30°shoulder abduction and neutral (0°) rotation to allow examiner preference for desired rotation. Examiner order and shoulder position were randomized for each participant. Once the examiner had their palpating finger on LHBT, the position was marked by taping a disposable 18 gauge needle on the skin, parallel to the biceps tendon over the intertubercular groove. A radiologist blinded to the palpation order then evaluated the shoulder sonographically to assess the position of the needle in relation to the underlying LHBT and intertubercular groove. The needle placement relative to the groove was graded as being inside (within 2mm of the border) or outside of the groove. The distance from the needle to either the medial or lateral border of the groove was also recorded in millimeters using an unpaired t-test with a 95% confidence interval. Accuracy was determined by percent accuracy. The magnitude of the distance between the needle placement and the intertubercular groove was compared between the 2 positions using an independent t-test.

Results: Overall accuracy rate was 45.7% (117/256) with the accuracy of position 1, 49.2% (63/128) being slightly higher than position 2, 42.2% (54/128). Overall, missed palpations (either medial or lateral to the border of the intertubercular groove) were localized 7.5 mm (+/- 4.7 mm) in position 1 and 8.3 mm (+/- 4.6 mm) in position 2 with 78.5% of misses occurring medially in position 1 and 93.3% of misses occurring medially in position 2.

Discussion / Conclusion: The results of this study did not support one position being significantly more accurate over another for palpation of the LHBT. However, the overall accuracy of physical therapists ability to palpate the biceps tendon was 40.7% higher than that of physicians in a similar study. Further research is necessary to determine the best position to optimally examine and treat the LHBT.

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ID: 93 / PL7

A Survey to Investigate the Use of Thrust Joint Manipulation by Student Physical Therapists during Clinical Education Experiences

Background / Purpose: Thrust joint manipulation (TJM) is used in clinical practice by physical therapists. Research regarding TJM usage by student physical therapists (SPT) is scarce. The purpose of this study was to explore the use of TJM in SPT clinical education (CE) and the factors influencing usage.

Methods: Accredited physical therapy (PT) programs in the US (n=277) were invited to participate in an electronic survey in Spring 2018. SPTs were queried about clinic demographics, clinical instructor (CI) credentials, clinical practice patterns and manual therapy (MT) techniques used during their last MSK CE experience.

Results: Fifty four programs (19%) responded. Of those, 45 programs had SPTs who met the timeline for the survey and whose students had recently completed or were currently completing their final outpatient (OP) musculoskeletal (MSK) clinical experience. An estimated 2,147 SPTs received the survey; 665 responded. SPTs who had not completed all of their MSK coursework to date or who did not answer all of the key questions in the survey were excluded;414 (19%) were used for analysis. SPTs were in clinics located in 45 states and from programs throughout the US. High utilization (99%) of MT was reported; 97% reported use of non-TJM techniques; 69% reported using TJM techniques, and 86% reported using MT clinical decision tools in varying amounts to help with patient selection. TJM was used most frequently in the thoracic and lumbosacral (LS) regions. Chi squared analysis found that SPTs who utilized TJM were more likely to have a CI who used TJM ($p < 0$ .001) or had an advanced certification/training in MT (p

Discussion / Conclusion: SPTs reported a high utilization rate of MT in their final OP MSK CE experience. More than two-thirds used TJM techniques, predominantly in the thoracic and LS spine. Psychomotor skill performing TJM and CI use of TJM appear to play key roles in the use of TJM among SPTs. It is critical that the CE experience promote and advance the educational objectives initiated during the academic phase of DPT education. Standardization of CE expectations is key for all students to receive equivalent educational experiences. Future research should explore teaching methods of TJM and query clinicians' clinical decision making regarding TJM.

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ID: 94 / PO55
Treatment-based Classification System for Low Back Pain: The movement Control Approach

Background/Hypothesis: The treatment-based classification system (TBC) has been used for treating low back pain (LBP) since 1995. Recently, the TBC has been updated with two levels of triage: at the level of healthcare provider and at the rehabilitation provider. The triage at the rehabilitation provider involves 3 rehabilitation approaches: symptoms modulation, movemen control, and functional optimization. The purpose of this paper is to describe the movement control approach.

Summary of Findings: This approach clarifies that for movement to occur in a dynamically controlled fashion, the lumbar spine requires both local mobility and global stability. Local mobility means that the lumbar spine and its adjacent regions possess adequate nerve and joint(s) mobility and soft tissue compliance (ie, the malleability of tissue to undergo elastic deformation). Global stability means that the muscles of the lumbar spine and its adjacent regions can generate activation that is coordinated with various joint movements and incorporated into activities of daily living. Local mobility and global stability are housed within the bio-behavioral and socio-occupational factors that should be addressed during movement rehabilitation. This approach is converted into a practical physical examination to help the rehabilitation provider to construct a clinical rationale as to why the movement impairment(s) exist. The examination findings are used to guide treatment. We suggest a treatment prioritization that aims to consecutively address neural sensitivity, joint(s) and soft tissue mobility, motor control, and endurance. This prioritization enables rehabilitation providers to better plan the intervention according to each patient's needs.

Conclusion / Significance: The significance of this movement control approach is that it clarifies the message that both local mobility and global stability are equally necessary for improving lumbar spine movement. The approach clarifies that movement control does not equal motor control alone. Rather, movement control views motor control as one component among others necessary for improved lumbar movement. The approach embraces both the pathokinesiology and kinesiopathology models of movement impairment. Local mobility speaks to pathokinesiology, which considers how tissue dysfunction can lead to movement impairment. Global stability speaks to kinesiopathology, which considers how movement impairment can lead to tissue dysfunction. The approach provides a rationale for manual therapy of impaired mobility of nerves, joints, and soft tissues as components of the movement control approach to rehabilitation. These mobility interventions can be employed concurrently with stability interventions such as motor control exercise, endurance, and strength training. In conclusion, the movement control approach embraces a dynamic stability concept for movement. This proposed approach represents a more encompassing model that accounts for all aspects necessary for improving human movement characteristics.

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ID: 95 / PO28
Clinical Reasoning in the Treatment of Chronic Shoulder Pain in a High School Tennis Player

Background / Purpose: Overhead athletes have a high prevalence of shoulder pain due to the repetitive high energy forces being put through the shoulder system during activity. Tennis players have an extra added stress when the racquet is taken into consideration due to the increased lever arm and repetitive impact forces that occur when a ball is hit. There is a paucity of research that incorporates treatment of the cervical spine when addressing shoulder pain in the overhead athlete. The purpose of this case study was to describe the clinical reasoning and treatment of chronic shoulder pain and the role that the cervical spine plays as a contributing factor.

Case Description: The patient is an 18 year old female tennis player who presented with a 3 year history of right shoulder pain that occurred during a tennis serve. The patient had immediate shooting pain down her right arm during serve impact and was unable to return to the sport. She underwent previous medical evaluation from an orthopedic physician, osteopathic physician, physical therapy with emphasis on shoulder strength and stability, and acupuncture without long term benefit. Current physical therapy evaluation using a Maitland Australian approach indicated cervical spine contribution as determined by reproduction of comparable sign, positive neurodynamic testing, decreased shoulder strength, and overall poor shoulder control.

Outcomes: Treatment incorporated 24 visits of care over a total of 7 months duration. Physical therapy focused on joint mobilization to the cervical spine where the comparable sign was found as well as treatment of neurodynamic structures. As cervical and neurodynamic symptoms subsided, treatment shifted to strength and control of the right shoulder and finally to more sport specific movement patterns and a gradual return to competitive tennis. She achieved a full recovery and returned to pain free competitive tennis. Pain rating on a visual analog scale decreased from a 5/10 to a 0/10. QuickDash score decreased from a 32 indicating 48% perceived disability to zero. QuickDash Sports Module score decreased from 18 indicating 87.5% perceived disability to zero.

Discussion / Conclusion: Tennis players often get lumped into the common overhead athlete and treatment as if treating a baseball pitcher. However, given the different mechanical stresses placed on the shoulder during tennis and the differences in cervical position during ball striking, it is important to address the cervical spine as a potential contributor to the symptoms. The take home message of this case report is to use appropriate clinical reasoning to look at all possible sources of symptoms, clinically prioritize them to determine primary and secondary sources, and treat using specific techniques, exercises, and education to achieve the desired goals.

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ID: 96 / PO39
Challenging Contraindications: Modulation of Buttock Pain in the Presence of a Bone Metastasis

Background / Purpose: Metastatic skeletal growths interrupt bone homeostasis causing severe bone pain and functional decline. A review of the literature reveals the underutilization of outpatient rehabilitation to manage patients with cancer related bone pain. OMPT is frequently used to modulate musculoskeletal pain, however, there exists a paucity in the research to support the modulation of metastatic cancer pain with manual therapy secondary to the potential risk of incurring pathologic fracture.There are rehabilitation contraindications in the presence of metastatic lesions to reduce incidence of fracture. However, it can be argued this is prematurely assumed risk as not all metastases have equivalent pathologic fracture risk. This case report illuminates the role of OMPT in the modulation of buttock pain in a patient with an ischial bone metastasis.

Case Description: A 53-year-old female with metastatic breast cancer was referred to physical therapy with recent onset of right deep gluteal pain. Imaging revealed an ipsilateral ischial bone metastasis. Aggravating activities included prolonged sitting, ascending stairs, and walking with a long stride. The pain was constant, yet variable in intensity (Numeric Pain Rating Scale (NPRS) Worst: 6/10; Best: 2/10) and her Lower Extremity Functional Scale score was 68/80. Functional exam revealed pain during terminal stance phase of gait and 6" forward step up. Significant objective findings include symptom reproduction with slump and straight leg raise and hypomobility with passive accessory intervertebral motion at right L4-5. Prone passive and active hip extension was limited and elicited familiar gluteal pain. Strength was appreciated via observation: right gluteus maximus 3-/5 and right hamstrings 3+/5.

Outcomes: The patient was seen for 12 visits. Focus of visits 1-7 was OMPT consisting of neural mobilizations, coxafemoral joint mobilizations, and lumbar joint mobilizations. At visit 3, pain was rated 0/10 with functional tests of step up/gait and her Global Rating of Change scale (GROC) was scored at +6 (A great deal better). During visits 4-7, her NPRS remained 0/10 and GROC improved to +7 (very great deal better). Visits 7-12 focused on painfree stabilization. She was able to resume her Zumba and water aerobics as well as walk without pain.

Discussion / Conclusion: This case report demonstrates the potential role for manual therapy and exercise in the modulation of pain in the presence of a metastatic lesion. To date, manual therapy has not been extensively evaluated for it's effect on pain modulation and management in metastatic bone pain. More research is needed to outline safe and efficacious interventions as well as guidelines to determine their utilization.

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ID: 97 / PL2
Spinal Manipulation and Dry Needling versus Mobilization and Exercise in Patients with Cervicogenic Headache: a Multi-Center Randomized Clinical Trial

Background / Purpose: Manual therapy, particularly joint manipulation and mobilization, are commonly applied for the management of individuals with cervicogenic headache (CH). In addition, dry needling is being increasingly used by physical therapists for the treatment of CH; however, to date, the supporting evidence appears anecdotal. Although commonly utilized interventions, no studies have directly compared the effectiveness of combining high-velocity low-amplitude thrust spinal manipulation with dry needling to nonthrust mobilization and exercise in individuals with CH. Therefore, the purpose of this clinical trial was to compare the effects of spinal manipulation and dry needling to mobilization and exercise in individuals with CH.

Methods: One hundred and forty-two participants (n=142) with CH were randomized to receive upper cervical and upper thoracic thrust spinal manipulation plus dry needling (n=74) or nonthrust spinal mobilization and exercise (n=68). The primary outcome was headache intensity as measured by the Numeric Pain Rating Scale (NPRS). Secondary outcomes included headache frequency and duration, disability as measured by the Neck Disability Index (NDI), medication intake, and the Global Rating of Change (GROC). The treatment period was 4 weeks with follow-up assessment at 1 week, 4 weeks, and 3 months after initial treatment session. The primary aim was examined with a 2-way mixed-model analysis of variance (ANOVA), with treatment group as the between subjects variable and time as the within subjects variable.

Results: The 2X4 ANOVA demonstrated that individuals with CH who received both thrust spinal manipulation and dry needling experienced significantly greater reductions in headache intensity (NPRS: F=31.881; P < 0 .001) and disability (NDI: F=14.546; P < 0 .001) than those who received nonthrust mobilization and exercise at a 3-month follow-up. Individuals in the spinal manipulation and dry needling group also experienced less frequent headaches (P < 0 .001) and shorter duration of headaches (P < 0 .001) at 3 months. Based on the cutoff score of ?+5 on the GROC, significantly (X2 = 54.840; P < 0 .001) more patients (n= 57, 77%) within the spinal manipulation and dry needling group achieved a successful outcome compared to the mobilization and exercise group (n=10, 15%) at 3 months follow-up. Effect sizes were large for headache intensity (SMD=1.25) and disability (SMD=0.94) in favor of the spinal manipulation and dry needling group at 3 months. In addition, patients receiving spinal manipulation and dry needling were 7.6 times more likely to have completely stopped taking medication for their pain at 3 months than individuals receiving mobilization and exercise (OR: 7.56; 95%CI: 3.54-16.17; P < 0 .001).

Discussion / Conclusion: Six to eight sessions of upper cervical and upper thoracic high-velocity low-amplitude thrust spinal manipulation and dry needling were shown to be more effective than nonthrust mobilization and exercise in patients with CH, and the effects were maintained at 3 months.

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ID: 98 / PL46
Knowledge, attitudes and beliefs about pain in third-year DPT students and clinical instructors

Background / Purpose: A shift in entry-level DPT education to include modern pain neuroscience and foster attitudes and beliefs which support this information is critical to training today's health care providers. A concern related to PT education is the potential disparity between what students learn in the classroom and the clinic. The purpose of this study was to determine if there were differences in knowledge, attitudes and beliefs about pain between clinical instructors (CI's) and third year DPT students and determine if knowledge, beliefs and attitudes about pain are associated with age, gender and participant pain levels.

Methods: During their final internships third-year DPT students (N=40) and their current clinical instructors (N=39) completed the Pain Neurophysiologic Questionnaire (PNQ), Health-Care Providers Pain and Impairment Relationship Scale (HC-PAIRS) and the Pain Attitudes and Beliefs Scale for Physiotherapists (PABS). Scores on these tools were compared using independent sample t tests ($p>0.05$) and correlations explored using Pearson ($p>0.05$).

Results: The survey response rate was 85.1% (40/47) for students and 82.9% (39/47) for CIs. There was no significant difference ($p=0.82$) between students (9.6 +/-0.93) and CIs (9.54 +/-1.35) for scores on the PNQ. There was no significant difference ($p=0.54$) between CI's (48.87 +/-7.71) and students (49.90 +/-6.97) for HC-PAIRS scores. There was no significant difference ($p=0.91$) between CI's (59.18 +/-9.15) and students (58.98 +/-7.41) for PABS scores. There were no significant correlations between knowledge, attitudes and beliefs about pain with age and pain levels and no differences by gender. The mean age of CIs (36.1 years) was significantly higher ($p < 0$ .01) than for students (26.9 years).

Discussion / Conclusion: The absence of a significant differences between the knowledge, attitudes and beliefs about pain between third year DPT students and their CI's may reflect the introduction and increased emphasis of pain neuroscience concepts in entry level and post professional continuing education. However, the average HC-PAIRS score of 3rd year DPT students in this study were lower and indicated a great biopsychosocial understanding of pain than 3rd year DPT students previously reported in the literature (mean 61.2). One possible explanation for this difference may be curricular design. PT's with post-professional residency or fellowship training have been reported to have average HC-PAIR scores (39.0) lower than the CI's (12.8% had post-professional residency or fellowship training) and DPT students in this study suggesting a potential benefit of continued post professional residency and fellowship training. The knowledge, attitudes and beliefs about pain in entry-level 3rd year DPT students did not differ significantly from CI's. These findings may suggest a shift in health-care education about pain. Future research should consider curricular design and the effects of post professional education training.

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ID: 99 / PL21
The Effects of Upper Limb Neurodynamic Mobilization on Intraneural Fluid Dispersion in Cervical Nerve Roots of Un-Embalmed Cadavers

Background / Purpose: Cervical nerve root radiculopathy is a common cause of neck pain and can result in intraneural edema and impaired nerve function and movement. The absence of lymphatic vessels in the endoneurium, combined with the compartmentalized structure of peripheral nerves, creates limited edema drainage and increases potential for a minicompartment syndrome within the nerve. One strategy used to treat cervical radiculopathy is neurodynamic mobilization (NDM); however, little is known about the effect of this treatment on nerve tissue. The purpose of this study is to investigate the impact of upper limb, median nerve-biased NDM on longitudinal intraneural fluid dispersion in the C5, C6, and C7 nerve roots in un-embalmed cadavers.

Methods: Un-embalmed human cadaver specimens were dissected to expose and inject the C5, C6, and C7 cervical nerve roots with a biomimetic dying agent. Once dye spread stabilized, averaged measurements of the most prominent proximal and distal borders of the initial longitudinal dye spread were taken using digital calipers. Specimens were then taken through 150 repetitions of upper limb, median nerve-biased NDM across a five-minute period followed by longitudinal dye spread re-measurement. Paired-samples t-tests with Bonferroni correction ($a = 0.017$) were used to compare pre- vs post-NDM dye spread measurements at C5, C6, and C7 nerve roots, and a one-way repeated measures ANOVA ($a = 0.05$) was used to examine differences between change scores for C5, C6, and C7 nerve roots.

Results: Data was collected on 5 female and 3 male specimens with a mean age of 76.4 years and mean weight of 70.8kg. Median nerve-biased NDM resulted in significant intraneural longitudinal dye spread at C5 and C6 nerve roots (mean±standard deviation dye spread of 0.6±0.6mm and 3.6±3.9mm respectively). Dye spread was not significant at the C7 nerve root (0.4±0.7mm). There was no difference between C5, C6, and C7 nerve roots in longitudinal dye spread change between C5, C6, and C7 nerve roots.

Discussion / Conclusion: In conclusion, this study demonstrated that median nerve-biased NDM resulted in significant longitudinal intraneural fluid dispersion in the C5 and C6 nerve roots in un-embalmed human davers. It is unclear why the C7 nerve root did not experience significant intraneural dye spread in response to median nerve-biased NDM, though the less-robust anatomical relationship of the C7 nerve root to the median nerve and limited access to the C7 nerve root for measurement could be factors. The results of this study support use of median nerve-biased NDM as a possible conservative intervention for cervical radiculopathy. Median nerve-biased NDM may positively impact cervical radiculopathy at the C5 and C6 nerve roots through promoting intraneural edema dispersion that occurs as a result of injury or inflammation, thus reducing pain.

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ID: 100 / PO41
Resolution of shoulder pain through cervical spine OMPT for return to CrossFit: A case report

Background / Purpose: Shoulder pain results in 4.5 million visits to a physician in the United State annually, second only to lower back pain, and results in loss of work productivity and an estimated $3 billion dollars in healthcare costs. Shoulder pain can arise from local structures, proximal referral from the cervical spine, as well as visceral referred pain. Physical therapists are faced with the task of recognizing the multitude of causes for shoulder pain to provide appropriate treatment and referrals when warranted. The purpose of this case is to describe the management of a patient with shoulder pain through use of orthopedic manual physical therapy (OMPT) interventions directed at the cervical spine.

Case Description: A 38-year-old female presented with left (L) anterior shoulder pain of 3 months duration that began while performing an overhead press during CrossFit. She also reported a 10-year history of intermittent and dull mid-cervical pain. The L shoulder pain radiated to the upper trapezius, lateral bicep and elbow and was constant, sharp and burning in nature. Shoulder pain intensity using the Numeric Pain Rating Scale (NPRS) was rated at 10/10 and neck pain at 7/10. Active shoulder flexion was limited by 70° and lower cervical extension and L rotation were limited to 75% of full range. Passive accessory assessment of the C5-C6 joint and L first rib revealed hypomobility and concordant L shoulder pain. All shoulder special tests were negative and L posterior capsular hypomobility was noted. Initial treatment included OMPT Grade III non-thrust cervical mobilizations which resolved her neck pain and decreased her shoulder pain to 6/10. OMPT Grade III non-thrust mobilization was then directed at her first rib, decreasing her shoulder pain to 3/10. OMPT thrust and non-thrust mobilization directed at the scapulothoracic and glenohumeral joints, and her thoracic spine resolved the shoulder pain completely, allowing for full active range of motion.

Outcomes: The patient was seen for 13 sessions. Outcomes included the Neck Disability Index, which improved from 63% to 0% and the QuickDASH which improved from 63.6 to 9.1. She reported a +6 on the Global Rating of Change. Active cervical rotation and shoulder flexion improved to within normal limits (WNL) with pain decreasing from 7/10 to 0/10 and 9/10 to 0/10 respectively. She was also able to return to participating in CrossFit with no restrictions.

Discussion / Conclusion: This case describes the use of OMPT directed at the cervical and thoracic spine in a patient with shoulder pain. Clinical diagnosis of specific painful tissues resulting in shoulder pain can be challenging, however, appropriate screening of the cervical spine is imperative for patient with shoulder pain to safely rule-out proximal structures. Past research has demonstrated improvements of upper extremity (UE) conditions with use of OMPT at the spine. Future research may benefit from investigation into the specifics mechanism of OMPT at the spine and pain modulation in the UE condition

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ID: 102 / PO31
Use of Lumbar Manual Therapy to Guide Successful Management of a Patient with Spine-Related Knee Pain: A Case Report

Background / Purpose: Degenerative changes account for knee pain in nearly 25% of adults over the age of 50. While arthroscopic surgery rates continue to rise, evidence questions its efficacy for meniscus tears in older adults. Due to high failure rate of arthroscopies, it is vital to consider the role of the lumbar spine in lower extremity (LE) pain. Additionally, centrally mediated pain mechanisms (CMM) are often present, with nearly 70% of patients with degenerative knee symptoms exhibiting altered somatosensation that may implicate facilitated mechanisms of pain. The purpose of this case report is to show how proper utilization of OMPT can more efficiently identify and manage spine-related LE pain in an individual exhibiting signs of CMM.

Case Description: A 52 year old female presented 3 weeks post left (L) knee arthroscopy for medial meniscus debridement of a degenerative tear. She reported no improvement in her knee pain after surgery with the onset of new mechanical symptoms. She had a history of and current presentation of lumbar pain with radiating pain into the right (R) posterolateral LE. Past medical history included: L4/5 laminectomy, hysterectomy, depression, migraines, and whiplash. Knee exam positive for L hamstring tightness, patellar hypomobility and incisional tenderness; but no reproduction of concordant pain. The hip and lumbar exam included passive accessory intervertebral glides to L2/3 which reproduced her pre-operative knee pain, with hypomobility and localized pain at L3/4, L5/S1. L hip internal rotation ROM was limited, but without pain provocation. Manual muscle testing revealed 5/5 strength in LEs except: 4/5 hip abductors, 4+/5 hip extensors, knee flexors/extensors L. Quantitative sensory testing showed widespread diminished pressure pain thresholds (PPTs) and vibratory detection (VD) deficits (L 4/8 Hz vs. R 8/8 Hz). Neuro exam was intact and neural provocation tests negative. Given the clinical impression of lumbar somatic referred pain with CMM, intervention focused on lumbar spinal manual therapy (SMT), pain science education, LE strengthening, and balance training.

Outcomes: Lumbar SMT resulted in decreased pain with forward step up (8/10 to 0/10) and forward step down (7/10 to 1/10) via the numeric pain rating scale in 8 visits over 8 weeks. Global Rating of Change Scale score of +6, and Lower Extremity Functional Scale improved 23 points, both clinically significant improvements. L hamstring length improved from lacking 35 degrees to 2 degrees. PPTs and VD improved, and her mechanical symptoms resolved.

Discussion / Conclusion: Examination solely focused at the knee in patients with seemingly obvious peripheral and/or post-operative knee pain may lead to misdiagnosis and ineffective treatment. PTs must remain vigilant to recognizing spine-related LE pain and the influence of CMM. Unnecessary interventions such as knee arthroscopy can then be avoided, and PT treatments, including manual therapy and strategies to address CMM, can be better tailored to the individual.

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ID: 105 / PL34
We are Doing Just Spine: Tracking objective measures in persons with low back pain

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Background / Purpose: The lifetime prevalence of low back pain (LBP) in the United States is estimated to be nearly 70%. Exercise has proven to be an effective treatment in persons with LBP, with core stability training in particular having a strong theoretical foundation for the treatment of this condition. However, no long-term studies have tracked global core endurance in symptomatic individuals over time. It is, therefore, difficult to conclude whether patients with LBP are making objective improvements during the course of their physical therapy treatment. The purpose of this study was to determine whether physical performance tests (PPT) change over time in persons with LBP. Specifically, if core stability exercises such as plank, side plank, Sorensen and the ratio of plank to Sorensen improve in persons being treated by a physical therapist for LBP.

Methods: This is an ongoing prospective study in collaboration with UT Orthopedics, Mischer NeuroScience Institute, and Texas Woman's University. Data collection continues to occur at Memorial Hermann Sports Medicine and Rehabilitation, Bellaire and Woodlands locations. All therapists conducting research are residency and/or fellowship trained and have completed 2 training sessions on physical performance testing (PPT). Pain free, maximum isometric hold times are collected for 3 PPTs: prone plank, side plank and Sorenson. If a participant is unable to perform the full version of these tests, they are asked do the modified version. Data was collected at baseline and at 4 week intervals during physical therapy. Baseline data was compared to the final data collection for analysis. Currently, a total of 19 male and female subjects, ages 18-80, with low back pain were included. Exclusion criteria included: systemic red flags, contraindications to manual therapy and exercise, surgery and/or ER visit for chief complaint, significant neurological insult, wheelchair bound, and non-English speaking.

Results: Preliminary results demonstrate a statistically significant ($p = 0.01$) increase in pain free prone plank time, from an average of 60.6 seconds (s) to 77.8 s, in patients with low back pain undergoing physical therapy treatment. Data was analyzed using a 2-tailed dependent measures t-test (alpha set to 0.05), with a mean of 17.2, and standard deviation (SD) of 27.5. Symmetry of right side plank to left side plank showed no significant change over time. The ratio of prone plank to Sorenson showed a statistically significant decrease over time, from 2.18 s to 1.77 s, indicating that participants' pain free Sorenson time increased in proportion to their prone plank time.

Discussion / Conclusion: Patients undergoing treatment for LBP demonstrate improved PPT times. Further, the ratio of plank:Sorenson moves closer to 1, indicating relative improvement in lumbar extensor endurance. A limitation of this study is that the side plank ratio was not standardized to the painful side, making it difficult to draw conclusions about changes in symmetry, which was defined as 1.

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ID: 106 / PO13
Motor Vehicle Collision-Related Low Back Pain: A Case for the Cervical Spine

Background / Purpose: Roughly 2.4 million people sustained survivable injuries from motor vehicle collisions (MVC) in 2015. Seventy-five percent of these injuries are documented as Whiplash Associated Disorders (WAD), and 50% of people with WAD experience ongoing pain and disability at one year. Current clinical guidelines for WAD classify individuals based on upper quarter, neck and head symptoms despite evidence that 40% of individuals involved in an MVC report low back pain (LBP). While MVC-related peak acceleration forces are greater at the cervical spine than the lumbar spine and cervical spine injuries can induce pain in other body regions, few studies describe the cervical spine as a potential source of LBP in WAD. Widespread pain, likely due to central sensitization, is reported in 20-30% of people with WAD which may explain the mechanism of LBP after MVC. This case report demonstrates the utility of cervical spine evaluation and treatment in a patient with LBP after multiple MVC's and failed interventions.

Case Description: The patient was a 53-year-old female who presented with 16-year history of chronic LBP and neck pain after an MVC in 2002, with onset of bilateral buttock and left leg pain after a second MVC in 2010. Interventions including cervical and lumbar fusion, lumbar nerve blocks and ablations, SIJ injections, and physical therapy (PT) had failed. Previous PT included thoracic and rib mobilization, and standard post-operative care. Reflecting the primary mechanism of injury of suspected whiplash, cervical examination revealed cervical flexion and upper cervical flexion range of motion loss, upper cervical joint accessory motion hypomobility, and positive Slump test – all of which reproduced familiar neck, low back, and leg pain suggesting possible central sensitization. Within-session changes in her complaints were noted following treatments to the cervical spine including C2 joint mobilization, self-cervical sustained natural apophyseal glides (SNAG), and deep neck flexor (DNF) isometrics.

Outcomes: The patient was seen for 4 visits. On discharge, her LBP, neck, buttock, and leg improved from 10/10, 7/10, 7/10, and 4/10 respectively on the numeric pain rating scale to 0/10 throughout. Her Modified Oswestry Disability Index improved from 64% to 22%. Her cervical flexion range of motion was full and pain-free. She had episodes of LBP but was able to reduce LBP with cervical SNAGs and DNF isometrics.

Discussion / Conclusion: This case describes the examination and treatment of a patient with MVC-related LBP and leg pain that was recreated with cervical spine assessment. As isolated treatment to the upper cervical spine rapidly resolved her chronic complaints it may be that sustained and untreated nociceptive input from the upper cervical spine, the likely primary source of injury following her MVCs, may have contributed to her complaints via central sensitization. Research into the cervical spine as a potential source of MVC-related LBP may further elucidate treatment in this population.

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ID: 107 / PO9
Force Produced by Orthopedic Physical Therapists During Thoracic Spine Joint Mobility Assessment and Manipulation

Background / Purpose: There is a paucity of literature regarding the force application by physical therapists during joint mobility assessment and manipulation. The purpose of this study was to quantify the amount of force orthopedic physical therapists use to perform joint mobility assessment and grades I to IV of joint manipulation of the thoracic spine.

Methods: Nineteen licensed manual physical therapists working in the outpatient orthopedic setting with 2-30 years of clinical experience, who frequently use thoracic spine manipulation were recruited to participate. The orthopedic physical therapists performed joint mobility assessment and Maitland grades I-IV manipulation in a posterior-anterior direction on the thoracic spine of the same individual. The forces exerted by the physical therapists were measured with a sensor measuring manual therapy forces. Descriptive statistics were performed to determine the mean high and low forces used for thoracic joint mobility assessment and grade I-IV manipulation, and mean time between oscillations for grade I-IV manipulation. Two repeated measures analyses of variance (ANOVAs) were performed to determine if significant differences occurred in mean high force and mean low force (N) between manipulation grades I-IV. A third repeated measures ANOVA was performed to determine if significant differences occurred in time between oscillations (s) in grades I-IV manipulation.

Results: The results showed a high amount of variability for both high and low mean forces for joint mobility assessment, and a high amount of variability was observed for the Maitland grades I-IV manipulation as well. The mean high force during assessment was 104.93 N (SD=33.80) and the mean low force was 63.20 N (SD=33.35). Grade I high force of 49.38 +30.05 N, and grade IV high force of 129.71 + 62.37 N. Grade I low force of 33.33 + 26.07 N, grade IV low force of 84.95 + 59.21 N. Time between grade I oscillations of .78 + .53 seconds, and time between grade IV oscillations of .87 + .75 seconds. A statistically significant difference was found in force (N) between all grades I-IV of joint manipulation for both mean high force ($F=22.004$, $df=3$, $p=.000$) and mean low force ($F=11.095$, $df=3$, $p=.000$). There was also a statistically significant difference ($F=4.436$,$df=3$,$p=.019$) in time (s) between oscillation frequency, with the only pairwise significant difference in time between oscillations occurring between grade I and II ($p=.007$).

Discussion / Conclusion: There is a high amount of variability between orthopedic physical therapists for both high and low mean forces used to perform thoracic joint mobility assessment, and Maitland grades I-IV of joint manipulation. Despite this variability, clinicians were able to differentiate forces and timing of the different grades of manipulation. The use of a force sensor during the instruction of manual therapy techniques may contribute to a higher level of consistency of force application. Further research is needed to improve clinical standardization of joint assessment and manipulation techniques, and the effectiveness of force sensors as instructional tools.

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ID: 108 / PL35
Is an in-built smartphone compass application reliable to quantify internal rotation in two different tests used in hip pain management?

Background / Purpose: Background: The Impingement Sign (IS) and Flexion Adduction Internal Rotation (FADIR) test are typically used as pain provocation tests (dichotomous measures) for hip assessment. The internal rotation ROM, presents in both test, seems to decrease in presence of intra-articular hip modifications (Femoroacetabular impingement, hip osteoarthritis). However, to date, no simple assessment protocol provides quantitative measures to those tests. Purpose: To validate a new protocol for the quantification of internal rotation, present in both tests using a built-in smartphone compass application.

Methods: Twenty participants (50% males, 24.0± 2.1 years) without lower limb or back pain were recruited. Three inexperienced raters evaluated each participant during two sessions, one day apart. The built-in smartphone compass application (SCA) was used to obtain internal rotation range of motion (ROM). Statistical analyses included ICC for intra- and inter-rater reliability and standard errors of measurement (SEM). The influences of gender, rater practice and between-session on these psychometric qualities were also observed.

Results: ICC for intra- and inter-rater reliability were 0.80 and 0.70 for the IS test and 0.75 and 0.40 for the FADIR test. No influences on reliability were observed for gender, rater practice and session. The SEMs ranged from 8 to 12° for the IS test and from 8 to 16° for the FADIR test.

Discussion / Conclusion: The good intra-rater reliability and acceptable SEM values suggest that SCA is an adequate tool for inexperienced clinicians to quantify those tests. The moderate to poor inter-rater reliability for both test suggest that increasing standardization in manual techniques would be beneficial. Lastly, further studies should investigate the effect of experienced clinicians on those reliability coefficients and SEM values.

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ID: 109 / PL29
Graded Exposure and Orthopedic Manual Physical Therapy for Kinesiophobia and Function in Chronic Temporomandibular Dysfunction: A Case Report

Background / Purpose: Temporomandibular Joint Dysfunction (TMD) is the second most common musculoskeletal complaint after chronic low back pain, contributing significantly to health care expenditures in the United States. Patients with TMD often experience comorbid depression, kinesiophobia, anxiety, and stress. These psychosocial factors significantly impact quality of life and may contribute to development of chronic/persistent symptoms via central pain mechanisms. A multitude of physical therapy (PT) interventions for TMD have been described in the literature, however few have focused on addressing psychosocial contributors and the effects of treatment on kinesiophobia. The purpose of this case report is to describe the successful use of multi-modal physical therapy management, including orthopedic manual physical therapy (OMPT), graded exposure, exercise, and education in a patient with chronic TMD, with emphasis on the outcomes of kinesiophobia and function.

Case Description: A 41 year old female presented with five year history of bilateral (primarily left) chronic myofascial TMD and comorbid neck/arm pain aggravated by motor vehicle collision two years prior. She had splinting therapy for four years with no benefit. She initially had 30mm of maximal mouth opening, hypomobility in the left temporomandibular joint and bilateral C0-1, C1-2, and C2-3 segments, provocation of arm pain at right C5-6, masticatory muscle tenderness, score of 76 on the Jaw Functional Limitation Scale (JFLS), and a score of 35 on the Tampa Scale of Kinesiophobia-TMD (TSK-TMD). Lower scores on the TSK-TMD indicate less fear, and lower scores on the JFLS indicate greater function. The patient was treated for 11 visits over 12 weeks with OMPT to the temporomandibular joints and cervical spine, therapeutic exercises, education, and a graded exposure to eating program. Graded exposure consisted of progression within a hierarchy of patient's feared foods, addressing maladaptive beliefs, and positive reinforcement.

Outcomes: The patient demonstrated clinically significant improvements on the TSK-TMD with a final score of 23 points, indicating a significant reduction in fear with functional jaw use. She also demonstrated clinically significant improvement in maximal mouth opening with range of 45mm, Global Rating of Change scale of +7, and improvement to 18 points on the JFLS.

Discussion / Conclusion: The mechanisms underlying chronic TMD are complex, and likely influenced by both peripheral and central sensitization. Current evidence supports PT management of physical impairments related to TMD via OMPT and exercise, however neglecting the central drivers or psychosocial factors in a patient's presentation may result in suboptimal outcomes. Physical Therapists are uniquely equipped to address both peripheral and central mechanisms of pain, and future research should examine best use of multi-modal PT to improve kinesiophobia and function in patients with chronic TMD.

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ID: 110 / PL36
Risk factors for the elevation of psychosocial barriers in the recovery of lumbar pathology

Background / Purpose: The prevalence of low back pain (LBP) continues to rise, despite the increasing technological advancement in the medical field. Following the natural course and history, episodes of LBP increase healthcare utilization and lead more patients into chronic stages. Each patient presentation is variable and unique, making a "one size fit all" approach obsolete. Following the ICF framework, a biopsychosocial approach takes in multiple facets of a patient presentation. A recent Cochrane review lends support to the use of a biopsychosocial approach for treatment of subacute LBP, compared to usual care (Marin 2017). Findings also suggest that this approach may be comparable to other forms other PT intervention, aligning to results of Critchley et al for a chronic population.To the best our knowledge, there are no studies evaluating the relationship of the score on the STarTBack Screening Tool to the access point the patient enters the health system. Our hypothesis is that patients that access care through the medical model (primary care or specialist) will exhibit greater psychosocial risk.

Methods: We performed a retrospective analysis of 1390 cases of LBP from September 2015-December 2016 utilizing FOTO (Focus on Therapeutic Outcomes) to gather data from 13 outpatient physical therapy clinics in the Philadelphia, PA area. Utilizing PMHx, demographic information, and SBT data we performed a linear regression model to identify potential predictors that impact the SBT score. The SBT risk level was analyzed using cumulative logistic regression model with potential predictors.

Results: Our analysis found previous surgery, higher BMI, OA, COPD, HTN, HA, Major vision disease, previous accident, anxiety, depression, sleepy dysfunction, and referral source had a positive impact on the SBT score and probability to have high risk classification. Osteoporosis, MI, and previous episode of CA had a negative impact on SBT score and lower probability of high risk classification. Referral source was positive as predicted to increase the SBT. Compared to direct access, accessing care through a primary care physician had an odds ratio of 2.802 and specialist an odds ratio of 3.195 to present with high risk as measured by the SBT.

Discussion / Conclusion: This study provides evidence to the impact that access may have on the psychosocial status of patients with LBP. In addition to the other risk factors found in the data, the factors that offered a reduce probability of high risk status were insightful. Conditions that support the patient exercising or give context to an injury or pathology reduced the risk of having high psychosocial impairments. We look to use this study to develop a prospective study looking at different study designs and methods to further assess the impact access points have on psychosocial barriers. Access may have an impact beyond cost of imaging, medications, or interventions. The approach taken by the healthcare provider may impact long term pain and functional outcomes.

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ID: 111 / PO27

The Use of Dry Needling as an Early Intervention for Gluteus Medius Weakness in a Patient Following Hip Arthroscopy for Femoral Osteochondroplasty and Labral Repair: A Case Report.

Background / Purpose: Hip arthroscopy is a minimally invasive procedure for the treatment of a variety of conditions in the hip joint with a 465% increase in procedures between 2005 and 2013. The gluteus medius muscle (GM) commonly exhibits muscle reflex inhibition following hip surgery. There is limited evidence for the use of dry needling (DN) with intramuscular electrical stimulation (IES) for this population in early post-operative management. The purpose of this case was to examine the effectiveness of DN with IES to improve GM strength and endurance post hip arthroscopy.

Case Description: A 38-year-old healthy, male presented 2 weeks post arthroscopic left hip femoral osteochondroplasty and labral repair. At initial evaluation, his Numeric Pain Rating Scale was 0/10. Left hip manual muscle testing (MMT) was 5/5 except seated internal rotation (IR) 4/5, seated external rotation (ER) 4/5, and side-lying abduction (ABD) 4/5. An average of 3 handheld dynamometer (HHD) measurements were taken for hip ABD and IR at each re-evaluation. Post-operative management included range of motion (ROM), lumbopelvic motor control, and hip strengthening. At 6 weeks post-op, DN with IES to L4 and L5 lumbar multifidi bilaterally was added. At 9 weeks post-op, DN with IES was added and included L4 and L5 multifidus bilaterally and left GM. At 10 weeks post-op, DN with IES was added and included left GM only.

Outcomes: At 6 weeks post-op, baseline HHD for left hip ABD was 18.3 pounds (lbs) and IR was 11.7lbs. After treatment, left hip ABD was 19.3lbs and IR was 17.6lbs. Left hip ABD endurance pre-treatment was 141 seconds(s) but was not measured post treatment. At 9 weeks post-op, baseline HHD for left hip ABD was 27.3lbs and IR was 17.2lbs. After treatment, HHD left hip ABD was 30.2lbs and IR was 20.7lbs. At 10 weeks post-op, baseline HHD for left hip ABD was 26.0lbs and IR was 28.2lbs. After treatment, HHD for left hip ABD was 29.1lbs and IR was 29.6lbs. Left hip abduction endurance was 211s. MMT was 5/5 for left hip IR, ER and ABD.

Discussion / Conclusion: This case study demonstrates an improvement of gluteus medius strength and endurance using the addition of DN with IES to the L4 and L5 multifidus at week 6 and 9; and DN with IES to gluteus medius at week 9 and 10 post hip arthroscopy. DN with IES was done in addition to rehabilitation following hip arthroscopy. DN with IES is a likely contributor to increased gluteus medius strength and endurance, however additional research is needed to determine the effects of DN with IES on gluteus medius strength and endurance during early post-operative management for hip arthroscopy.

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ID: 112 /PL3
Development of a Musculoskeletal Imaging Competency Examination for Physical Therapists

Background / Purpose: Medical imaging aides in the diagnosis and management of many musculoskeletal conditions. As physical therapist practice evolves, imaging has become more central to such practice. While some physical therapists have shown competency with imaging privileges, the known level of competency and knowledge is generally lacking within the profession. Therefore, the purpose of this study was to develop a reliable and valid musculoskeletal imaging competency examination for physical therapists.

Methods: A sample of competencies, guidelines, and clinical decision rules were used for development of an examination that assessed multiple facets of physical therapist practice in the areas of conventional radiography, magnetic resonance imaging, computed tomography, bone scintigraphy, and ultrasound imaging. A three round Delphi method utilized content experts to reach examination consensus. Content experts were selected based upon knowledge of orthopedics and musculoskeletal imaging, current work setting, and previous contributions to the field of musculoskeletal imaging. There were 29 physical therapists, 3 orthopaedic surgeons, 3 radiologists, and 2 primary care physicians on the Delphi panel. Content experts rated each question on a five-point Likert rating scale of importance, with '0' being least important and '5' being most important. Consensus was achieved with an a priori decision of: 1) ?4 on the Likert scale and ?75% agreement of the expert panel, and 2) ?0.90 on Cronbach's alpha and intraclass correlation coefficients. The examination was subsequently reviewed by five additional radiologists with expertise in musculoskeletal imaging for content and external validity.

Results: The utilized Delphi methodology resulted in a 151 question musculoskeletal imaging competency exam. Interrater agreement and internal consistency were excellent with a mean intraclass correlation coefficient and Cronbach's alpha of 0.93 and 0.95, respectively.

Discussion / Conclusion: A musculoskeletal imaging competency examination for physical therapists was developed through Delphi methodology. The developed musculoskeletal imaging competency examination has the potential to be a standardized test to determine a baseline level of competency and knowledge in the area of musculoskeletal imaging for physical therapists. This could provide a foundation to determine where the need is in assisting physical therapists to achieve proficiency in musculoskeletal imaging. Subsequently, it could become a future model for determining whether a physical therapist is capable of using imaging in their practice. Further validation of the examination is needed through pilot testing.

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ID: 114 / PO25
Cervicothoracic orthopedic manual physical therapy comprehensive management of chronic shoulder and upper extremity symptomology: A Case Report.

Background / Purpose: Shoulder pain, affecting up to 66.7% of individuals over a lifetime, can present challenges to clinicians as multiple sites can refer symptoms here. Chronicity, with multiple symptom locations, complicates the differential diagnosis process requiring a comprehensive assessment. A detailed history and physical examination can instruct an understanding of the patient's pain patterns and possible mechanisms, guiding treatment. The cervical spine (CS) and thoracic spine (TS) are not only a possible source for shoulder and upper extremity (UE) symptoms, but can also be an impactful treatment area. The purpose of this case is to describe the clinical reasoning in the differential diagnosis of chronic shoulder, elbow, and hand symptoms lending to effective treatment strategy of CS and TS non-thrust OMPT.

Case Description: A right (R) handed 50-year-old female presented to physical therapy (PT) with a 6-month chief complaint of R posterosuperior shoulder pain (Numeric Pain Rating Scale (NPRS) worst: 6/10) that was aggravated by end range shoulder abduction and flexion. Questioning revealed four year development of R medial scapula, lateral elbow pain, and R dorsal hand paresthesias. Two previous PT episodes focused on shoulder interventions resulting in short-term relief. Significant exam findings revealed lower CS and TS hypomobility, painful and limited active shoulder abduction and passive internal rotation, glenohumeral hypomobility, and + special testing of Neer's, Hawkin's-Kennedy, Cozen's, and Mill's; Phalen's, Spurling's, and 1st rib accessory mobility produced no symptoms. Medial scapula and posterior shoulder symptoms were reproduced with R lower cervical quadrant and unilateral anterior-to-posterior glide at C6-C7. A progressive exercise program was utilized to reinforce manual therapy, address scapular and cervical weakness.

Outcomes: Four visits of PT consisting of non-thrust mobilizations directed to the CS and TS and progressive exercise program resulted in abolishment of all her symptoms except 1/10 shoulder pain with end range shoulder abduction, a Global Rating of Change of +5 (Quite a bit better), and negative shoulder and elbow special testing. Right passive glenohumeral internal rotation improved from 25 degrees to 55 in four visits, symmetrical to the other side. Dynamometer shoulder external rotation strength in sitting improved from R: 9.4#, Left (L): 12.6# at Evaluation to R: 14.7#, L: 14.5# at visit 4.

Discussion / Conclusion: Heightened clinical reasoning, in the presence of chronic pain, is essential in prioritizing treatment strategy. With multiple impairments and positive findings, PTs are challenged to use judicious reasoning and an efficacious treatment strategy leading to long-term positive outcomes. This case report describes the comprehensive management of chronic, multiple location UE and shoulder symptoms that was effectively treated with cervicothoracic non-thrust OMPT.

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ID: 115 / PO26

Conservative management of an individual with femoral acetabular impingement syndrome using an impairment-based approach and a regional interdependence model: a case report.

Background / Purpose: There is limited evidence for conservative management of patients with femoral acetabular impingement syndrome (FAIS). Since FAIS is a syndrome, the implementation of an impairment-based approach, supplemented with regional interdependence (RI) hypotheses, may be beneficial in managing this issue. The purpose of this study is to examine the effectiveness of a multimodal, impairment-based, physical therapy approach utilizing a RI model for an individual diagnosed with FAIS.

Case Description: The patient was a 33-year-old female who presented with complaints of chronic, proximal, left hamstring pain, a recurrence of anterolateral hip pain for the past 10 years and low back pain for the past 5 years. She had functional mobility deficits associated with ballet and other disciplines of dance, especially when performing arabesque maneuvers. The patient reported a 5/10 on the Numerical Pain Rating Scale (NPRS) and a 17/80 on the Lower Extremity Functional Scale (LEFS). She demonstrated decreased left knee extension range of motion, reproduction of familiar symptoms during the supine hamstring flexibility assessment and during standing active lumbar flexion. Familiar hip pain was reproduced with end range hip flexion, internal rotation maneuvers and standing toe touch. The patient demonstrated 4/5 muscle weakness in bilateral hip flexion, bilateral hip abduction, left hip adduction, and left hip external rotation during manual muscle testing. Interventions were directed at the noted hip joint range of motion and lower extremity strength impairments. Due to the previous history of low back pain, and in line with a RI model considering the lumbar spine as a potential contributor to the pain in the hip regions, lumbopelvic motor control/re-education interventions were also provided. A sports-specific progression was integrated to improve movement patterns specific in single stance dance maneuvers. Finally, a home self-management program was given utilizing lumbopelvic motor control/reeducation activities and hip self-mobilizations.

Outcomes: The patient was seen for 6 visits over the course of 6 weeks. Her NPRS improved from 5/10 to 0/10 with daily activities. Her LEFS score of 17/80 improved to 63/80. She was able to return to dance activities while reporting 1-2/10 pain intermittently. Interventions associated with the positive outcome included instrument assisted soft tissue mobilization to the proximal hamstring, orthopedic manual physical therapy directed at the hip, restorative exercise and lumbopelvic motor control/re-education. The order of the provided interventions first focused on inhibiting protective muscular guarding, then restoring joint arthokinematics, and finally enhancing lumbopelvic motor control.

Discussion / Conclusion: This case study demonstrates that utilizing an impairment-based approach and a RI model may be beneficial for conservative management for individuals with FAIS.

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ID: 116 / PO70
Neurodynamic Interventions and Functional Exercise for the Management of a Patient with Juvenile Rheumatoid Arthritis: a case report

Background / Purpose: Juvenile rheumatoid arthritis (JRA) is an autoimmune, inflammatory disease affecting over 300,000 children in the United States. JRA presents with synovial joint pain, stiffness and swelling leading to difficulty with daily activities. Children with JRA are more likely to have lower pain pressure thresholds, increased muscle atrophy and lower activity levels. Peripheral nervous system impairments are common and may present as pain, paresthesias, sensory disturbances or weakness. Physical therapist management is recommended to maximize function and joint mobility but limited evidence exists in the management of neurological symptoms with JRA. Neural mobilizations have been suggested for pain reduction in adults with RA when neurogenic symptoms were absent. Clinical reasoning suggests the use of nerve gliding for patients with poor neurodynamics and hypersensitivity with prolonged tissue loading. The purpose of this case report is to review the effects of nerve gliding and functional exercises on pain and disability in a child with JRA.

Case Description: The patient was a 15-year-old male with JRA presenting to physical therapy with bilateral (B) hip and knee pain. His primary compliant was difficulty with stairs due to pain and weakness. Pertinent exam findings included: painful and restricted lumbar flexion active range of motion (AROM), +B Slump Test, +B straight leg raise (SLR), hypersensitive LE palpation, weak and painful B quadriceps and hamstrings, weak and painless hip extensors and abductors, and 1/3 squat (Functional Movement Screen grading). Central and unilateral posterior to anterior mobilizations of the lumbar spine did not reproduce symptoms and deep tendon reflexes were 2+B. Management began with active-assisted sciatic and tibial neural gliding in supine until an asymptomatic SLR was achieved in session, followed by a pragmatic, functional exercise program based on impairments. Exercises focused on mobility, motor control, coordination and functional tasks. This included: half kneeling hip and ankle self-mobilizations, chops and lifting patterns, quadruped reaching, step ups, lunging, single limb balance and neuromuscular retraining for squatting and hip hinging.

Outcomes: After four weeks and eight sessions outcomes were as follows: Lower Extremity Functional Scale improved from 55 to 66/80, Numeric Pain Rating Scale reduced from 6 to 2/10, lumbar flexion AROM measured fingers to floor improved from 13 to 0 inches and SLR tolerance increased by 23 and 35 degrees left and right respectively.

Discussion / Conclusion: Nerve gliding and functional exercise was effective in reducing pain and disability for this patient. Lumbar flexion AROM and SLR measurements were also significantly improved. Though neurodynamic function was markedly improved, further research is needed to determine if neural gliding or functional exercise alone is more effective for managing neurogenic pain in patients with JRA.

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ID: 117 / PO62
Intra-Triangular Unit Theory: Blending Biomechanics and the Law of Conservation of Energy

Background/Hypothesis: Human movement, like all things in the natural world, abides by the law of conservation of energy (that potential energy (PE) equals kinetic energy (KE)). However, movement with minimal energy expenditure requires an efficient base from which to move. One of the most common structural bases observed in nature is a triangle. The integrity of a triangle is dependent upon its ability to dissipate compressive forces across a larger base. Biomechanically this allows for distribution of force, transfer of energy, and efficiency of movement, a theory I have called the intra-triangular unit (ITU).

Summary of Findings: Musculoskeletal dysfunction arises when there is an imbalance between either the need for more energy to move or the inability to release enough energy through movement. For example, tonic musculature requires more energy in order to stabilize a hypermobile joint. The energy imbalance causes the biomechanical triangle to no longer be able to balance the compressive and distractive forces put upon it, forcing other tissue to compensate. This may lead to dysfunctions like hyper- or hypomobility of joints, tendonitis, osteophytes, avulsion fractures, or disc pathologies. Triangular patterning may also explain how subjective symptoms and causative pathologies may be found in different body regions. As an example, a midfoot hypermobility would cause inefficiency in the foot to work as a solid lever during gait. As a result, the destabilized triangular pattern between the midfoot, knee, and ankle would cause the gastroc-soleus musculotendinous complex to hold onto potential energy for propulsion and become hypertonic. This would overstress the Achilles tendon, eventually leading to irritation and tissue breakdown - Achilles tendinitis.

Conclusion / Significance: The ITU theory blends the law of conservation of energy and biomechanics. The goal of the ITU theory for the orthopedic manual therapist is to encourage practitioners to think about movement as a flow of energy from ground reaction force to the build up of potential energy and the release of kinetic energy. And, it is the job of the orthopedic manual therapist to optimize this flow of energy through an understanding of functional anatomy in relation to regional and interregional joint interactions which correlate in a triangular pattern. Additionally, there are several areas along the spinal column which have both biomechanical and neurological importance. It appears that those areas not only have interactions with multiple ITUs, but are also areas of vast neurological input (i.e. the cervico-thoracic junction and the thoracolumbar junction, among others). It is worth considering them if the ITU pattern collates the proprioceptive information being provided to the central nervous system via these areas. Further investigation of this theory might consider the interaction between the summation of proprioceptive information via the ITU and the effectiveness of central pattern generators.

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ID: 119 / PO3
REPRODUCTION OF ENCEPHALIC SYMPTOMS WITH PERIPHERAL NERVE TENSION TESTING IN A PATIENT REFERRED FOR TREATMENT OF VERTIGO: A CASE REPORT

Background / Purpose: Dizziness is a common diagnosis amongst middle aged and older populations, frequently resulting in referral to outpatient physical therapy. Entry level physical therapy education often does not cover extensive differential diagnosis and treatment of these conditions. Pathologies of different systems may occur simultaneously, potentially with similar presentations, thus requiring precise clinical reasoning for appropriate differential diagnosis and treatment. The purpose of this case report is to detail this process in a patient with multifactorial causes of dizziness, including recurring interaction with medical providers based on findings.

Case Description: The patient was a 55-year-old female referred to physical therapy for treatment of left benign paroxysmal positional vertigo. During the initial evaluation patient reported chronic history of central nervous system symptoms, partially reproduced by positioning in cervical rotation. This lead to suspicion of cervical artery dysfunction, which was cleared following referral to neurologist. Subsequent objective examination suggested symptoms of predominantly central origin, with potential secondary cervicogenic and vestibular hypofunction components. Dizziness and blurry vision was reproduced with peripheral nerve tension testing of all four limbs, modified to avoid cervical motion. After second referral to neurologist, magnetic resonance imaging revealed cervical central cord compression, resulting in referral to spine surgeon and performance of multilevel anterior cervical discectomy and fusion.

Outcomes: The patient returned for post-operative care with progressive improvement of dizziness, gait and visual symptoms. Treatment intervention has consisted of peripheral nerve gliding techniques based on principles of irritability, manual therapy and exercise with a focus on cervical joint position sense.

Discussion / Conclusion: The multifactorial nature of this case required extensive clinical reasoning and collaboration with the neurologist and spine surgeon for appropriate intervention. The reproduction of encephalic symptoms with peripheral nerve tension testing was suggestive of potential mechanical irritation of cranial structures. However, imaging showed no signs of tethered cord syndrome, or other specific central nervous system pathologies. This patient presented with concomitant musculoskeletal pathologies of bilateral feet, for which she had previously received physical therapy over the last two years. Patients with comparable central nervous system pathologies may be treated for other orthopaedic conditions, however, appropriate differential diagnosis, clinical reasoning and extensive history taking may help provide more timely and comprehensive intervention. This case also highlights the need for both improved education on and execution of interprofessional collaboration.

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ID: 120 / PO14
Scar tissue manipulation with adapted dry needling to address chronic motion impairment: A case report

Background / Purpose: Residual mobility deficits integument with scarring can lead to life-long functional loss. Loss of tissue mobility in the lower extremity requires adaptations in movement patterns and alterations in activity choice, which can be progressively disabling. An example is loss of posterior thigh mobility restricting both functional hip and knee mobility. Scar formation post significant trauma presents complex challenges for the restoration of function. Dry needling is a developing treatment modality utilized by physical therapists to restore function and alleviate movement impairments. Interventions to address mobility impairments and functional loss with scarring involving dry needling are utilized but in a limited fashion currently. Assessing the utilization of dry needling for scar management in chronic presentations allows for the development of research questions and alternate means to address human movement restrictions.

Case Description: A 26-year-old female suffered blunt force trauma to her posterior left thigh when struck whilst riding her bicycle. The force of impact split open a ten-inch section of her posterior thigh and led to a requirement for surgical closure. The scar line opened eight times subsequently before achieving full closure four months later. Subsequent mobility loss and functional change in movement developed to the point that walking, squatting and prolonged sitting were all impaired. Thirty-two months post onset, dry needling with specific emphasis to scar manipulation was commenced, completed one time per week for four weeks. At baseline, hip flexion in bilateral stance was limited at 102 degrees, in combination with 77 degrees of knee flexion on the left side. The Patient Specific Functional Scale (PSFS) was 4, 5 and 6/10 for squatting, prolonged sitting and walking for exercise.

Outcomes: Following four sessions of dry needling of the identified scar tissue impairments, spaced one week apart, the patient demonstrated 127 degrees of hip flexion in combination with 95 degrees of knee flexion in a bilateral squat. PSFS scores for squatting, prolonged sitting and walking for exercise improved to 8, 9 and 9/10. Self-report on the global rating of change was +6, ‘a great deal better’. Review at 12 weeks, eight weeks post the last session in the initial episode of care noted no reported change in mobility but slight regression in the PSFS scores to 8, 7 and 7/10 and a GROC from baseline of +4, moderately better.

Discussion / Conclusion: Identifying adaptations in modality use for the management of complex presentations allows for the development of treatment approaches, which provide further options for optimal patient management. This case demonstrates initial success in addressing a close to four year mobility impairment in a young patient dealing with significant impairment due to traumatic scarring of the posterior thigh using dry needling with an intentional focus to scar tissue manipulation. Further research is needed to establish efficacy and effectiveness of this approach

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ID: 121 / PO40
USE OF HIP MOBILIZATIONS FOR RETURN TO EN POINTE IN A BALLET DANCER WITH POSTERIOR ANKLE IMPINGEMENT: A CASE REPORT

Background / Purpose: Ballet dancers at the amateur and professional levels are prone to frequent acute and overuse injuries, with the foot and ankle complex being one of the most commonly implicated areas. This can likely be attributed in part to the high frequency, intensity and volume, as well as extreme ranges of motion, requiring active and passive stability. When en pointe, significant loads are placed on the talocrural joint while weight bearing in physiological end range plantar flexion. Posterior ankle impingement and os trigonum have been reported in dancers and are likely related to chronic overuse. Ballet also requires large ranges of motion at the hip joint, with flexion, abduction and external rotation often being most dominant. The leading cause of injury in dancers is related to the low back. It is hypothesized that compensatory lumbar extension due to lacking hip extension is one of the contributing causes. The purpose of this case is to examine a potential link between limited ipsilateral hip extension in an adolescent dancer with pain en pointe due to posterior ankle impingement.

Case Description: The patient was a 13-year-old female ballet dancer referred to physical therapy for right posterior ankle impingement and os trigonum. Since her last production, she had been unable to return en pointe and has been experiencing pain with prolonged weight bearing activities and active open kinematic chain plantar flexion. She demonstrated significant compensatory hip abduction and external rotation with right hip extension, both in standing and with front splits. During functional testing en pointe, she demonstrated compensatory forward shift at the ankle with subsequent increase in plantar flexion. This was hypothesized to be in part due to limited ipsilateral hip extension. Manual intervention focus was placed on passive accessory mobilizations of the right hip in end range extension with sustained adduction and internal rotation bias. Additionally, localized techniques for improved mobility and pain modulation were performed. The exercise program focused on modifications of splits to avoid compensation, as well as neuromuscular re-education and graded exposure to en pointe positions.

Outcomes: At initial evaluation the patient had a FOTO score of 53, compared to 64 at discharge. One of the largest improvements noted was the patient improving from being able to complete five single leg heel raises on the right to 25 at discharge. Additionally, initially she was unable to go en pointe on the right, but at discharge was able to perform 15 heel raises en pointe without pain. The patient was able to perform ballet movements en pointe in the clinic without pain or compensatory motions. Additionally, she was able to perform double and single leg plyometric exercises without reproduction of pain.

Discussion / Conclusion: This case emphasizes the need for physical therapists to recognize and address potential regional interdependence, such as the hypothesized relationship of limited hip extension and posterior ankle impingement. Furthermore, the high physiological demands of ballet, especially en pointe, require excellent motor control to avoid even minor compensatory movements. This is reflected in the high incidence of both acute and overuse injuries of ballet dancers at all levels.

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ID: 123 / PO12
Clinical Utility of Lumbar Anteroposterior (A/P) Mobilizations in a Patient with Degenerative Lumbar Spondylolisthesis

Background / Purpose: Degenerative Lumbar Spondylolisthesis (DLS) is a condition characterized by an anterior vertebral body slippage absent a defect in the pars. This condition affects women (9%) more than men (5%), and is reported to have associated neurological symptoms by descending nerve root compression of L4 and L5. Clinical presentation of this condition include symptoms of mechanical low back pain, neurogenic claudication, and abnormal neurological findings. The role of Orthopedic Manual Physical Therapy (OMPT) in DLS has not been well studied. Lumbar A/P joint mobilizations are detailed in Maitland's Vertebral Manipulation text. To date, there is a paucity of literature on the effectiveness of Lumbar A/P mobilizations in the treatment of lumbar spine pain and associated radicular pain. This case serves to discuss the additional benefits of lumbar A/P mobilizations in the management of DLS.

Case Description: A 53 year old caucasian male arrived to Physical Therapy (PT) with a diagnosis of insidious ten week old DLS with radicular lower extremity pain. Medical diagnosis was made via A/P and oblique radiographs along with T2 weighted imaging. On initial examination the patient presented with an intact neurological exam, limited lumbar active range of motion (AROM), weak proximal hips, poor lumbo-pelvic neuromuscular control, and chronic calf pain and weakness. The patient reported an inability to sit, stand, work and was not responding favorably to traditional PT.

Outcomes: Patient progress was noted at the sixth visit with improved AROM into lumbar lateral flexion and rotation pain free. At visits seven through ten the patient reported additional benefits of lumbar A/P mobilization with an elimination of posterior thigh and calf pain, and pain free hip extension with improved control. At discharge, the patient reported a 58% improvement in Oswestry Disability Index, a 7 point improvement on the Fear-Avoidance Belief Questionnaire – Physical Activity, a 13 point improvement on the Fear-Avoidance Belief Questionnaire – Work, and a +5 on the Global Rating of Change.

Discussion / Conclusion: This case report reviews the clinical decision making process included in the selection of OMPT treatments and complementary therapeutic exercise. The aim of each treatment was to reduce the patient's lower back pain leg pain, improve lumbar AROM and lumbo-pelvic coordination. Short term neurophysiological effects utilizing both spinal and peripheral joint mobilizations are well documented in today's literature as an effective means to decrease local nociceptive and peripheral neurogenic forms of pain, along with aiding in proximal and distal neuromuscular control. The addition of Lumbar A/P joint mobilization employed in this case allowed the patient to progress to higher levels of therapeutic exercise, pain free ADL's, and a progressive return to the gym and work. There is a lack of evidence to support the clinical utility of lumbar A/P joint mobilizations and this case serves as a novel approach to effective management of DLS.

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ID: 124 / PL10
Effectiveness of Manual Therapy for Cervicogenic Dizziness: A Systematic Review

Background / Purpose: Dizziness is a common reason for seeking medical attention. There are numerous causes of dizziness, but one of particular interest to physical therapists is cervicogenic dizziness (CD). Cervicogenic dizziness is described as an alerted space orientation, disequilibrium, and/or postural disturbance. Patients may complain of neck stiffness, tenderness over cervical spine joints and muscles, as well as diminished joint-position sense. Patients commonly report reproduction or alleviation of symptoms with cervical spine movements. Manual therapy (MT) is a common conservative treatment for many musculoskeletal disorders, and it has been found to be an effective treatment for individuals with mechanical neck pain. However, it's effectiveness in treating CD remains unclear. The purpose of this review is to evaluate this topic using recent literature published on the effectiveness of MT for CD.

Methods: The authors performed a systematic search of literature using a combination of keywords, including: "cervicogenic," "cervicogenic dizziness," "manual therapy," "manipulation," "mobilization," and "physical therapy." Only articles published from 2012 to present were reviewed. The databases utilized were CINHAL, SPORTDiscus, and Medline. The authors only included randomized controlled trials. Outcome measures of pain, function, range of motion (ROM) were all eligible for inclusion, and all studies must have met the criteria of at least a 7/10 on the Physiotherapy Evidence Database (PEDro) Scale.

Results: Initially, the authors identified 108 articles. After assessing for relevance and duplication, along with gathering full-text and evaluating each one, only three articles were included in the study. The three studies utilized passive joint mobilization and or sustained natural apophyseal glides (SNAGs). Two reviewers assessed the three articles using the PEDro Scale—and if there was a discrepancy, a third reviewer scored the study. All three studies identified met inclusion criteria of greater than or equal to 7/10. Patients receiving MT demonstrated improvement in ROM, less intensity in their dizziness, less frequent dizziness, and a greater global perceived effect at 12 weeks and at 12 months compared to placebo. There was a slight, but minimal difference between MT favoring SNAGs for ROM. There was also a minimal improvement in balance and pain intensity in the MT groups, but no improvement in head repositioning accuracy.

Discussion / Conclusion: This systematic review discovered some evidence for the utilization of MT for CD. The MT approaches had a similar affect with SNAGs improving ROM more than passive joint mobilization—but the review found no difference in other outcomes, like less intensity in dizziness, less frequent dizziness, and a greater global perceived effect. More research is needed to determine if MT is an effective intervention for CD in the long-term.

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ID: 125 / PO33
Physical therapist management of a patient with chronic cervicogenic headaches and concomitant Ehlers-Danlos Syndrome: a case report

Background / Purpose: Ehlers-Danlos Syndrome (EDS) is a genetic disorder that effects connective tissue throughout the body. The hypermobile type of EDS (hEDS) results in joint hypermobility of both large and small joints. A variety of headaches have been associated with EDS. Currently there is no known research on the physical therapy management of patients with both hEDS and chronic cervicogenic headaches. The purpose of this case report was to describe the successful physical therapist management of a patient with chronic cervicogenic headaches with concomitant hEDS.

Case Description: The patient was a 15-year old female high school student reporting a five-year history of chronic headaches. The patient's headache encounters were associated with extensive periods of sitting during home schooling or playing video games on a hand-held device. The impairment-based physical therapy examination revealed five musculoskeletal impairments: functional limitations, forward head posture, hypermobile spinal segments in the middle and lower cervical spine, neuromuscular deficits throughout the cervical/shoulder regions, and reproduction of neck pain and headaches with palpation to the left suboccipital musculature. The patient was treated with neuromuscular training and postural education.

Outcomes: The patient was seen in physical therapy for six sessions over a three-week period. The patient demonstrated successful outcomes related to cervicogenic headaches. The Neck Disability Index (NDI) improved by 10 points (22.3%), the numeric pain rating scale (NPRS) improved by 40% and the patient reports no pain at rest. The frequency of headaches reduced from four times per week to one time per week. The muscle impairments in her shoulder region improved to good functional strength. The cervical spine deep neck flexor final performance score was normal based on the craniocervical flexion test (CCFT). The patient's forward head posture improved in sitting.

Discussion / Conclusion: Ehlers Danlos Syndrome most likely caused this patient to have cervical spine hypermobility and associated cervicogenic headaches. The physical therapy management strategy successfully addressed the patient's impairments with dynamic muscular stability and postural education. Cranio-cervical flexion and scapular stabilization training helped the patient decrease the use of compensatory motions to control head and shoulder positioning. As a result, the patient was able to perform school work and functional activities with minimal headache symptoms. This is the first known case report to successfully treat a patient with hEDS and associated chronic cervicogenic headaches.

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ID: 126 / PL33

Plank Performance Testing: Examining the relationship between subjective and objective outcome measures in patients with low back pain.

Background / Purpose: Low back pain is highly prevalent in the US, with physical therapy (PT) being a common treatment strategy. Currently, there are validated, reliable subjective reports utilized to track patient progress throughout PT. However, there is a lack of evidence regarding the validity of functional objective measures such as plank performance testing, despite the fact that these measures are frequently utilized in PT practice. This study was designed to examine the relationship between the validated subjective measure, the Modified Oswestry Disability Index (MODI) and objective plank performance testing as patients progress through formal physical therapy. We investigated two hypotheses: [1] there will be an inverse relationship between plank performance testing and the MODI and [2] there will be a relationship between plank symmetry and the MODI. By evaluating the relationship between subjective and objective outcome measures, we hope to establish criterion-based validity for plank performance testing, using the MODI as the gold standard.

Methods: Currently, 21 participants with low back pain completed the MODI and performed plank performance testing at baseline, 4, 8, 12 and 16+ week follow up. Plank performance testing included the side plank, front plank, and Sorenson, with modifications available for those unable to perform the full test.

Results: A Pearson product-moment correlation coefficient was computed to assess the relationship between the MODI and lumbar objective performance tests. At baseline, a significant, inverse relationship was found between the MODI and front plank, r= -.595. At follow up, no significant relationship was found.

Discussion / Conclusion: As of now, the findings of this study are inconclusive. We are able to support that there is a relationship between plank times and MODI at baseline, but unable to conclude a relationship at follow-up. Though decreased plank times correspond with increased MODI scores at baseline, more follow-up data points will be required to thoroughly evaluate the relationship between the two.

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ID: 127 / PO34
Neck-Tongue Syndrome: Spinal Manipulation below the level of the patient's atlanto-axial instability: A case report

Background / Purpose: Neck-Tongue Syndrome (NTS) is a rare disorder characterized by brief attacks of neck and/or head pain accompanied by ipsilateral tongue dysethesia brought on by sudden head/neck rotation. One proposed cause of this disorder is lateral atlanto-axial joint subluxation during rotation. NTS is a well-characterized disorder that clinicians can recognize on clinical examination. The intervention of NTS is less understood. The purpose of this case report was to describe the successful intervention strategy by a physical therapist administering spinal manipulation below the level of atlanto-axial instability to a patient with NTS.

Case Description: The patient was a 15-year old male high school basketball player reporting a six-month history (four 10-second episodes) of sharp neck/occipital pain/numbness with concomitant tongue numbness. The patient's neck-tongue encounters were associated with jumping with both arms intensely overhead to block a basketball shot of an opposing player. Flexion/extension radiographic imaging of the neck revealed the atlantal-dental interval (ADI) greater than 3mm which indicated atlanto-axial instability. The impairment-based physical therapy examination revealed five musculoskeletal impairments: impaired function, forward head posture, upper cervical instability, mobility deficits (decreased active range of motion and stiff spinal segments in the lower cervical/thoracic spine), and neuromuscular deficits of the cervical and shoulder regions. Interventions included spinal manipulation to the lower cervical and thoracic spine, neuromuscular training, and postural/NTS education.

Outcomes: The patient was seen in physical therapy for nine sessions over a ten-month period. The patient demonstrated successful outcomes. The Neck Disability Index (NDI) improved by 9 points (20.0%). The frequency of neck-tongue episodes was reduced to zero. The impaired musculature in the shoulder region improved to good functional strength. The cervical spine deep neck flexor final performance score was normal based on the craniocervical flexion test (CCFT). The patient's forward head posture improved.

Discussion / Conclusion: NTS has been treated in a variety of ways with approximately 50 documented cases. This case demonstrates the successful intervention strategy of administering spinal manipulation (thrust and non-thrust) to areas of stiffness below the radiographically identified atlanto-axial instability. The clinical reasoning that supports this strategy is to restore normal segmental motion below the area of instability to decrease the mechanical stress at the area of instability. Improved regional cervical range of motion will help recruit the deep neck flexor muscles to facilitate dynamic stabilization of the neck. As a result, enhanced postural positioning, balance and function may also decrease the stress at the area of instability. Skilled manual physical therapists can be safe and effective in administering spinal manipulation away from the area of upper cervical instability.

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ID: 128 / PO66
Use of Advanced Clinical Reasoning in the Differential Diagnosis of Cervical Radiculopathy in a Patient with Relapsing-Remitting Multiple Sclerosis: A Case Report

Background / Purpose: Multiple sclerosis (MS) is a disease of the central nervous system that effects more than 2.3 million people worldwide. The most common form of the disease is relapsing-remitting multiple sclerosis (RRMS), which is found in approximately 85% of cases. RRMS is defined by its characteristic relapses, which present with various physical symptoms including visual changes, transient cognitive changes, bowel and bladder changes, extremity pain, paresthesia, and weakness, which can mimic musculoskeletal pathology. One of the most common causes of upper extremity radicular pain is cervical spine dysfunction, which can cause pain in specific dermatomal and myotomal patterns, as well as create neurological symptoms which can mimic those seen in patients with RRMS. This case report discusses the differential diagnosis and successful management of the cervical spine in a patient presenting with recurrent left upper extremity (UE) paresthesia and left hand weakness with a 7-year history of RRMS, and the importance of conducting a thorough physical examination to determine if current

Case Description: A 70-year-old female presented to PT with a three-month history of left sided neck pain with radicular pain into her lateral shoulder and arm as well as numbness and tingling (N/T) and weakness into the first and second digits of the left hand. She also complained of left arm and hand weakness. She had a 7-year medical history of of RRMS, and associated left UE paresthesia with relapse. Upon examination, she demonstrated left bicep weakness and decreased left grip strength compared to the contralateral side. Her left biceps reflex was diminished, and she demonstrated some non-dermatomal sensory loss in the first and second digits of the left hand. Left unilateral treatment of the C5-6 cervical segment resulted in significant improvement in pain which the patient had previously related to MS relapse. She also demonstrated improvement of grip strength with carryover noted between sessions.

Outcomes: Outcome measures demonstrated improvement for this patient and included pain level at the neck from 5/10 to 0/10 and the left shoulder from 5/10 to 2/10 via numerical pain scale, Quick DASH from 22/55 to 15/55, Neck Disability Index from 23/50 to 10/50, and hand-held dynamometry grip strength gains at the left hand from 60lbs to 73lbs.

Discussion / Conclusion: Although relapse symptoms with RRMS are neurological in nature, the symptom presentation is variable and may mimic musculoskeletal pathology, which warrants further investigation into pathology and causes in this body system. It is important for healthcare practitioners to recognize and appropriately diagnose and treat these symptoms in this patient population in order to improve their overall outcomes and quality of life.

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ID: 130 / PL39
The Relationship of Manual Physical Therapy to Habitual Physical Activity and Sleep Behavior for Patients with Knee Osteoarthritis

Background / Purpose: Patients with knee osteoarthritis (OA) experience progressive loss of function and develop health comorbidities from the lack of physical activity. Decreased sleep quality is also common, resulting in decreased quality of life. Manual physical therapy improves symptoms and functional performance in patients with knee OA, but it is not known if this improvement leads to increased self-selected physical activity or improved sleep quality potentially improving overall health measures. The purpose of this study is to assess for a relationship between manual physical therapy and habitual physical activity and sleep behavior in individuals with knee OA.

Methods: This was a prospective observational cohort study of 17 patients with knee OA. Habitual physical activity and sleep measures were assessed at baseline using wearable sensors. The primary patient-reported outcome (PRO) was the Western Ontario and McMaster's University Osteoarthritis Index (WOMAC). Performance-based outcomes (PBO) included self-selected gait speed, 400-meter walk, five times sit to stand (5TSTS), and the timed up and go (TUG). Based on current best evidence, subjects received a pragmatic course of manual physical therapy with reinforcing exercise targeting relevant impairments to movement and strength in the lower quarter. General advice on increasing physical activity was provided but no specific walking or progressive activity program was included. Habitual activity, PRO and PBOs were assessed at four and 12 weeks.

Results: Significant changes were noted in the WOMAC from baseline to four weeks (mean change: 81.24±35.97, 55% reduction) which was maintained at 12 weeks (mean change: 75.58±49.44, 51% reduction). We observed similar improvements in the PBOs that were maintained out to 12 weeks. No significant differences were observed at any time point in habitual physical activity or sleep quality. However, the quartile of subjects that walked less than 4,000 steps per day at baseline demonstrated a meaningful 26% increase in steps per day with a corresponding decrease in sedentary behavior.

Discussion / Conclusion: Our results add to the growing body of literature that a short course of manual physical therapy leads to substantial improvement in symptoms and functional abilities in patients with knee OA. While symptomatic improvement may improve a patient's subjective assessment of their symptoms and some measures of physical function, there does not appear to be a carry over to habitual activity except in the lowest functioning patients. Further research should explore the inclusion of programs with formalized progression of activity to recommended levels when symptoms and functional ability improve. There may be other barriers to physical activity to consider such as biopsychosocial and environmental factors.

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ID: 131 / PO2
Maitland's Clinical Reasoning Construct with Application of Manual Grades of Movement for Shoulder Pain. A Case Study

Background / Purpose: Generalized somatic shoulder pain is a commonly diagnosed condition in outpatient orthopedics. With Magnetic Resonance Imaging (MRI) diagnostic accuracy in question and lack of specific/sensitive shoulder special tests available, it is imperative that physical therapists understand clinical reasoning concepts in response to symptom reproduction. The Maitland Concept exemplifies clinical reasoning as it fosters decision making and orthopedic manual physical therapy (OMPT) integration based on assessment of comparable symptoms.

Case Description: This case illustrates how Maitland's clinical reasoning guides the use of OMPT intervention of a 40-year-old female patient with a 4-month history of somatic shoulder pain. Intervention included manual graded movement delivered by passive physiological and passive accessory shoulder motions, exercise, modalities, and postural re-education.

Outcomes: Outcomes include changes of shoulder active range of motion (AROM), Fear Avoidance Beliefs Questionnaire-Physical Activity subscale (FABQ-PA), Disabilities of the Arm, Shoulder, and Hand (DASH), Visual Analog Scale (VAS) for shoulder pain, and functional ability self-assessment on a VAS. Results included increased pain free active range of motion of the left shoulder, decreased DASH score, decreased FABQ-PA score, and improved self-assessed functional ability VAS.

Discussion / Conclusion: Geoffrey Maitland's shoulder grades of movement progression, used in a multimodal approach to physical therapy, can reduce shoulder co-contraction to improve mobility and decrease pain. Maitland's clinical reasoning construct allows the therapist and patient to see in-session changes which guides treatment intervention and builds patient trust in physical therapy. Recommend further research to objectify OMPT's relationship with peripheral physiological pain mechanisms.

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ID: 132 / PO24
MANUAL THERAPY OF THE CERVICAL SPINE AND ELBOW IN THE SUCCESSFUL MANAGEMENT OF RADIO-CAPITELLA OA WITH GRIP WEAKNESS: A CASE REPORT

Background / Purpose: Primary osteoarthritis (OA) of the elbow is relatively rare accounting for only 1-2% of elbow arthritis. Radio-capitellar (RC) cartilage injuries may lead to RC OA particularly in men working with heavy machinery. Symptoms of RC OA often overlap with lateral epicondylalgia (LE), making diagnosis of this condition challenging. The use of manual therapy (MT) for the management of RC OA has been minimally investigated. The purpose of this case report is to describe the successful management of an individual with RC OA using cervical and radial MT.

Case Description: A 43-year-old right (R) handed male truck driver presented with 8-month history of left (L) elbow pain. Past medical history was unremarkable except for a whiplash injury a year prior from a car accident. He reported 10/10 pain in the morning, crepitus, limited motion, difficulty pushing up from supine to sit and decreased grip strength affecting daily function and work activities. Examination findings included L elbow limited range of motion (ROM) in flexion-extension, 25-125 degrees L versus 5-135 degrees R, and lack of 10 degrees of L pronation. Gripping with rotation provoked pain at the elbow. Cervical spine screening revealed full painfree ROM, yet central and L unilateral posterior-to-anterior (PA) accessory motions were hypomobile at C4-5-6 reproducing concordant pain at the elbow. Deficits in MGF was exhibited on the L at 68.5 lbs/F compared to R of 150 lbs/F. Cozen's test, palpation, and stretching of wrist extensors were negative. Interventions consisted of cervical spine UPA/CPAs followed by PAs, and Ext/Add at the RC joint. MGF was measured after each intervention. C spine MT produce gains in MGF separate from gains made from MT at the RC joint. Home exercises consisted of RC joint self-mobs and mid C-spine SNAGs.

Outcomes: The individual was seen for 4 visits. MGF on the L increased to 145.2lbs/F, improving over 100%, and L elbow ROM increased to 10-135 degrees with full pronation. Morning pain decreased from 10/10 to 3/10. He scored +5 on the Global Rating of Change, indicating a clinical meaningful change. The Patient Specific Functional Scale increased in 5 areas including push up to supine (0 to 9) and turning a steering wheel (2 to 7). He returned to full work and leisure activities with minimal reported disability.

Discussion / Conclusion: MGF was measured after each cervical MT intervention, prior to the elbow, indicating that the spinal intervention was vital to maximizing MGF gains. It is hypothesized that MGF was a measure of decreased pain and motor inhibition, possibly influenced by OA and the prior whiplash injury. Evidence for spinal and peripheral MT to address elbow OA is limited, and further research is merited to guide interventions for positive outcomes and subsequent reduction in healthcare utilization and production loss.

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ID: 133 / PO8
Differential Diagnosis of Shoulder Pain and Paralysis Status Post Cervical Fusion: Parsonage-Turner Syndrome

Background / Purpose: Parsonage Turner Syndrome is a rare condition that is characterized by an acute onset of shoulder and upper arm pain which typically subsides within days to weeks. After the pain subsides, motor weakness/paralysis may develop in upper extremity musculature, sometimes mimicking conditions such as cervical radiculopathy, rotator cuff pathology, brachial plexus pathology, or systemic disease. The purpose of this case report is to describe the differential diagnosis process for a patient who had a primary diagnosis of s/p C5-7 ACDF, but then developed pain, progressive paralysis, and decreased functional use of the right upper extremity 2 months after the surgical procedure.

Case Description: The patient was a 72-year-old female referred to physical therapy with sharp stabbing pain to her right shoulder and upper extremity (UE) region which began 2 months s/p C5 – C7 ACDF. The pain that was reported to the right upper extremity subsided after 2 months which was then followed by an onset of progressive motor function loss to the right UE that has not returned. Prior to her physical therapy evaluation, she had returned to the neurosurgeon that performed her ACDF who then referred her to an orthopaedic specialist who then referred her back to neurosurgery without resolution of her chief complaint. After the performance of a thorough physical therapy examination, relevant clinical impressions included: C5 cervical radiculopathy, rotator cuff pathology, suprascapular nerve entrapment and C5 palsy. Based on the subjective interview and objective measures, which included a detailed neurological screen and special testing, there was not clear information to support my 3 clinical impressions. After a further literature review, Parsonage-Turner Syndrome matched many of the signs and symptoms which the patient presented with. A neurologist was consulted who was able to examine the patient and confirm the diagnosis. The patient and neurologist opted to pursue conservative intervention which included skilled PT services.

Outcomes: Interventions were aimed to improve right UE active range of motion and strength. The patient was seen for a total of 11 visits over the course of 6 weeks. The outcomes measures utilized in this case included the Numeric Pain Rating Scale (NPRS), QuickDASH, and Tampa Scale of Kinesiophobia (TSK-11). These outcome measures were assessed at visits 1, 6, and 10. At time of discharge, the patient made clinically meaningful improvements in her NPRS score as well as her QuickDASH score. However, the patient did not meet her personal goal of being able to care for her daughter who was dependent on the patient for mobility. As a result, she opted for surgical management for her complaints related to Parsonage-Turner Syndrome

Discussion / Conclusion: This case highlights the importance of clinicians having a sound knowledge of the neuroanatomy of the cervical and upper extremity. This knowledge was key when performing differential diagnosis examinations and communication with involved physicians

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ID: 134 / PO36

Treating Unilateral Upper Extremity Pain With Neurodynamics: A Case Series Describing Using the Contralateral Limb to Influence the Painful Side.

Background / Purpose: Pain in the upper extremity originating from a peripheral nerve often presents as increased mechanosensitivity during neurodynamic testing. Neuromobilization of the peripheral nervous system is often used to treat pain mechanosensitivity of the peripheral nerve. Unfortunately, little research exists on how to appropriately dose or modify the intervention when patients plateau with basic techniques. Therefore, the purpose of this case series is to describe the management of two patients with mechanosensitivity of their nervous system in their upper extremity that responded to neuromobilization with the contralateral limb.

Case Description: This case series focuses on two patients with chronic upper extremity pain who presented to an outpatient orthopaedic practice. Both subjects were male, over the age of 30, had unilateral symptoms that did not extend below the elbow, and symptoms present for over one year. Each individual demonstrated mechanosensitivity of the nervous system during upper limb tension test 1. Treatment for both individuals involved neuromobilization of the median nerve both passively and actively. In each instance progress with neuromobiilzation plateaued, at which point the contralateral limb was applied to influence the amount of tension on the nervous system.

Outcomes: Ultimately, each individual responded differently to the application of bilateral upper extremities in neurodynamic intervention. One patient's symptoms and function quickly improved, while the other patient responded to this intervention more gradually. Clinically significant changes in the DASH and Yellow Flag Risk Form were noted at the end of care. Both patient's maintained improvements or continued to improve 3 months after treatment had stopped.

Discussion / Conclusion: The patients in this case series were suspected of having two different mechanisms underlying their upper extremity pain: a nociceptive inflammatory mechanism and a nociceptive ischemic mechanism. In both cases, using the contralateral limb simultaneously with the involved limb reduced upper limb median nerve mechanosensitivity that was present for over a year. This case also demonstrates that there is the potential for significant variability in how individuals respond to this type of intervention, which might be explained by the different mechanisms previously mentioned. Ultimately, further research is needed to determine if there are different mechanisms associated with mechanosensitvity of the nervous system and if so, what is the appropriate way to manage them in order to improve outcomes.

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ID: 135 / PO68
Manual Therapy and Exercise Management of Chronic Tendinopathy in a Division I Basketball Player

Background / Purpose: Achilles tendinopathy is an overuse injury caused by repetitive energy storage and release with excessive compression, which can lead to sudden injury or rupture. Physical Therapy treatment for the Achilles Tendon has been noticed throughout literature, including manual interventions, eccentric loading, proper body mechanics, gradual load progression, taping in the acute stages, and orthotic use in more chronic conditions. The purpose of this case is to demonstrate the effectiveness of taping, manual therapy, and eccentric exercises on a Division I basketball player suffering from chronic achilles tendinopathy.

Case Description: The patient was a 22-year-old male collegiate division I basketball player. The athlete had a gradual onset of pain and decreased tolerance to activity as a result of a right Achilles Tendon injury. He described the pain as "sharp and pulling" that limited his ability to participate in conditioning drills, practice, and home/away games. Midway through the season conventional management, which included taping, stretching, physical agents, and exercise, became ineffective and ultimately led to student athlete being placed in a walking boot. The team physician determined that the patient was suffering from chronic Achilles tendinopathy which was confirmed with an MRI. Upon examination by the physical therapist, pain reported during evaluation was 5/10 at rest and 8/10 with any basketball related activities, ankle dorsiflexion range of motion was 5 degrees on the right and 10 degrees on the left, and the posterior glide of the R talus demonstrated a hypomobile talocrural joint with a capsular endfeel.

Outcomes: Following 4 weeks of PT, which included immobilization in a walking boot, palliative care, soft tissue mobilization to the gastroc and Achilles Tendon, joint manipulation, eccentric exercise, and prophylactic taping, the patient symptoms and point tenderness were abolished. At discharge, the R talocrural joint regained normal mobility with a normalized end-feel. Ankle dorsiflexion ROM on the right increased to 12 degrees and 16 degrees on the left. The patient was able to return to full participation in practice as well as play in the last three regular season games. Intensive exercise or practice sessions still resulted in pain mild pain at 2/10, while at rest he remained asymptomatic.

Discussion / Conclusion: Diminished mobility at the talocrural joint can result in decreased range of motion at the ankle which correlates with onset of achilles tendinopathy. The biomechanics of landing and the force production of the achilles can be altered. During reactive tendinopathy, research indicates that complete immobilization should not be encouraged due to the atrophic changes it causes to the patient. Physical therapy, with a focus on optimal tendon loading and joint manipulation to relieve joint restrictions and improve dorsiflexion ROM, are effective in the early stages of tendon repair.

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ID: 137 / PL17
Inter-rater Reliability and Criterion Validity of the Inclinometric Kyphosis Measure

Background / Purpose: Hyperkyphosis, an exaggerated rounding of the upper and mid-thoracic spine, is associated with a number of problems including decreased lung capacity, vertebral body fracture, shoulder impingement, impaired functional mobility, and increased fall risk. The current reference standard for measurement of kyphosis is a Cobb angle obtained from standing lateral radiograph. However, this method is costly, exposes patients to radiation, and is not practical for assessing postural change in response to manual therapy and exercise interventions. Therefore, a simple, reliable, responsive, and valid clinical measure of dorsal kyphosis that is easily applied in clinical practice would be valuable to clinicians. The purpose of this study was to estimate inter-rater reliability of the Inclinometric Kyphosis Measure (IKM) and compare the IKM to the reference standard Cobb angle as a clinical measure of dorsal kyphosis.

Methods: Two examiners measured the IKM on 20 healthy participants aged 18-73 years using a bubble inclinometer. The IKM was compared to a Cobb angle measure obtained from a standing lateral radiograph. Inter-rater reliability was calculated using ICC2,1, and the MDC was calculated from the SEM. Criterion validity was analyzed with Pearson product correlation and a dependent samples t-test.

Results: Ten males and ten females participated in the study. Two radiographs were of poor quality; therefore the analysis was based on 18 participants. Mean height and weight of participants were 66.87 ± 3.15 cm and 164.15 ±26.8 lbs, respectively. Mean IKM was 130.7°±4.6 with a range from 121.5°-140.5°. The Cobb angle measurement ranged from 23.15°-54.25° with a mean of 36.94±8.84°. Inter-rater reliability of the IKM was nearly perfect with an ICC2,1of .98 (95% CI .94-.99, p=.000). The SEM was 1.28° and MDC was 3.55°. A strong correlation existed between the IKM and the Cobb angle measurement (r=.72; 95% CI .36-.1.08, p=.001). The mean difference between the two measures was -12.40 (95% CI -15.55—9.25; p=.000), and the Cobb angle consistently reported a smaller kyphotic angle than the IKM.

Discussion / Conclusion: The results of this study support prior research on the properties of the IKM as a reliable and valid clinical measure of dorsal kyphosis. Although a strong correlation exists, the IKM and Cobb angle cannot be used interchangeably, as a significant mean difference was observed between the two measures. Further study of the IKM in clinical populations is needed to determine the utility of the IKM as a tool to assess change in kyphosis in response to postural interventions.

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ID: 138 / PO47

Chance of a lifetime: Using orthopaedic manual physical therapy (OMPT) to impact the quality of life for a person with a rare form of cancer - Extraskeletal Myxoid Chondrosarcoma (EMCS).

Background / Purpose: EMCS represents less than 3% of all soft tissue sarcomas, and 1% of Chondrosarcomas. Patients with EMCS often need invasive medical interventions to excise tumors and secure clean margins. Many patients with cancer fail to receive appropriate access to physical therapy (PT) which could improve their overall quality of life. This case demonstrates how OMPT sessions positively impacted the life of an individual with EMCS in the proximal right upper extremity.

Case Description: Complications related to the excision of a 5 cm EMCS tumor (dominant arm) in a 33 year-old man persisted despite 6 months of PT at a previous site. Patient reported persistent pain (3/10,) loss of functional reach (maximum elevation, 100-110 degrees,) safety concerns while holding/caring for his child (13 months,) and difficulty using his dominant arm at work (mechanic). He showed upper quadrant weakness, significant upper limb lymphedema, myofascial tightness (latissimus dorsi (LD,) subscapularis, deltoid) and a corded keloid axillary scar. Scapular dyskinesia, abnormal scar appearance, and observation of myofascial issues suggested OMPT was warranted. Treatment utilized targeted OMPT and regional interdependence manual therapy models.

Outcomes: The client's first pro bono intervention (30 minutes) provided a 15 degree improvement in elevation. The intervention included progressive scapula-thoracic mobilization and low level laser therapy to the adhesions/scar. The second pro bono session (60 minutes) afforded additional improvements in elevation (30 deg. flexion, 40 deg. abduction,) reduced scar site pain (0/10,) and improved motor control with less compensation. Interventions included: dry needling (6 sites) with electrical stimulation, tool-assisted mobilization (scar, LD, serratus anterior, post deltoid,) lateral rib mobilization, sternal depression techniques, and diaphragm stretch with timed breathing sequences. A home program (thera-band presses, lower trapezius facilitation & flexion wall scrubs) was issued to improve reaching. Advice to obtain 20-30 mmHg compression sleeve and techniques for lymphatic self-massage were given to help lymphedema. 48 hours after OMPT client remained pain free and sustained his increased motion. But upon return to work compensations returned but he continued with better ability to hold his child. Client was reflective on OMPT and felt it was more effective than the previous 6 months of PT he had received.

Discussion / Conclusion: Failure to provide OMPT significantly limited this client's overall prognosis. Prior to the implementation of OMPT, the client's physician contemplated additional invasive procedure and closing the case. The effectiveness of OMPT has not been properly studied in the field of oncology. Further research would likely prove beneficial, especially to avoid invasive alternatives for those with rare forms of cancer.

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ID: 139 / PO51
The Sensation of Bladder Pressure and Urgency Referred from the Lumbar Spine (L4). Clinical Decision Making for a Unique Presentation Treated with Manual Therapy and Exercise: A Case Report

Background / Purpose: Background: The sensations of bladder urgency and pressure may indicate serious medical or spinal cord conditions. Less frequently, these symptoms may originate from the lumbar spine (LS), and are appropriate for physical therapy treatment. Differentiating between non-musculoskeletal and musculoskeletal presentations is a primary goal of examination. Accurately identifying the origin of bladder symptoms in a direct access setting is critical for diagnosis, safety and good outcome. Clinical decision making may be challenging when conditions mock each other or when presentations have not been reported, such as bladder symptoms referred from the LS. Purpose: To describe clinical decision making and treatment for a patient with bladder symptoms, referred from the LS.

Case Description: Patient was a 67-year-old female reporting sensations of bladder urgency and pressure for 2 months, after exercise class. She reported low back stiffness. She was medically cleared by her PCP and gynecologist. Denied bladder dysfunction and other red flag questions. Numeric pain rating scale (NPRS) was 3/10. Lower Extremity Functional Scale (LEFS) was 57%. Oswestry Disability Index (ODI) was 26%. Patient Specific Functional Scale (PSFS): exercise class 2/10, walking 30 min 4/10, lifting 1/10. Neurological examination was normal, including Babinski and Clonus. Straight leg raise and prone knee flexion were normal. LS range of motion was normal, no symptoms. Palpation of L4 provoked stiffness and the familiar bladder symptoms. Abdominal weakness noted. The patient was treated for 2 sessions over 3 weeks with manual therapy directed to the LS, strengthening, education and a home based program.

Outcomes: NPRS was 0/10. ODI was 0%. LEFS was 98%. Global Rating of Change (GRoC) was +7. PSFS: exercise class, walking 30 min and lifting, all 10/10. Full function was sustained 6 months later with no change in all outcomes.

Discussion / Conclusion: DISCUSSION: The patient significantly improved beyond the minimal clinical important differences for NPRS, LEFS, ODI, PSFS and GRoC. Several clinical decision-making hallmarks were the medical clearance of the urogenital/reproductive systems and symptoms based on movement. Physical exam showed the absence of central spinal cord neurological signs and reproduction of bladder symptoms with palpation of the LS at the area of L4, with no other symptom provoking tests. Characteristically, L4 does not innervate the bladder or is not associated with referred symptoms to this area, yet it may be possible. Symptom reproduction from L4 palpation localized the origin to the LS, yielding directed treatment and rapid resolution. This is the first case to report bladder urgency and a sensation of fullness reproduced from the area of L4 and treated with manual therapy and exercise. CONCLUSION: This patient with unique bladder symptoms, appeared improve with a decision making process of medical clearance, symptom reproduction and treatment of manual therapy and exercise.

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ID: 140 / PO23
Clinical Diagnosis and Management of Posterior Hip Instability: A Case Report

Background / Purpose: Microinstability continues to gain recognition as a clinical problem. Posterior Hip Instability (PHI) is under recognized and often confused with other pathologies. PHI can occur from traumatic or insidious onset. The most common clinical presentation includes buttock or groin pain, painful and limited hip motion, weakness and a feeling of instability. PHI is difficult to identify with a clinical examination and imaging is frequently negative making the clinical diagnosis difficult to identify and treat. The purpose of this case study is to introduce a novel posterior relocation test (PRT) used to detect possible clinical PHI. A conservative rehabilitation program is also proposed emphasizing a stabilization approach including motor control and strengthening exercises for gluteal and trunk musculature.

Case Description: Examination: A 29-year-old female presented with an insidious onset of posterior lateral hip pain which had been present for 1.5 years. Aggravating factors included walking, bending, squatting, lifting, sitting with legs crossed and stretching. Symptoms were relieved when the hip was positioned in submaximal hip range of motion. Subsequent examination revealed limited and painful hip flexion. The patient scored a 7/9 on the Beighton Scale. Sacroiliac joint, Labrum and Neurodynamic provocation tests were negative. The use of a Posterior Relocation Test (PRT) demonstrated a decrease in hip pain and subsequent increase in hip range of motion. The initial Lower Extremity Functional Score (LEFS) was 64/80 and Oswestry Disability Index (ODI) was 8%. Pain on the Visual Analog Scale (VAS) was 0-6/10. Clinical Impression: Based on the history and examinaiton findings, the authors suspected the primary hip complaints were related to recurrent posterior ligamentous hip sprain with probable underlying PHI. Intervention: The patient was urged to avoid provocoative activities. Positions that decreased pain and promoted posterior tissue protection were advised. The treatment plan consisted of progressing the patient through a home program focusing on strengthening and neuromuscular rre-education of the posterior hip and trunk musculature.

Outcomes: The patient was seen for 11 visits over 2.5 months. LEFS and ODI scores improved to 77/80 and 0% respectively at discharge. Subjective functional improvements were noted with work and recreational activities. Pain levels reduced to 1-2/10 with squatting and bending.

Discussion / Conclusion: In this case the clinical diagnosis of PHI was based on a cluster of findings including generalized hyepromobiilty with an apparent loss of hip motion. Use of the PRT demonstrated an immediate increase in hip range of motion with less pain. Approximation of the anterior bony structures may contribute to a levering mechanism that elongates the posterior capsulo-ligamentous structures creating PHI. Limited hip mobility is frequently addressed with manual therapy techniques. It will be important to identify a true laxity from an apparent laxity for optimal results

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