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ORTHOPAEDIC PHYSICAL THERAPY PRACTICE

The publication of the Academy of Orthopaedic Physical Therapy, APTA

FEATURE:
Effects of Concussion and the Risk for Musculoskeletal Injuries

APTA
American Physical Therapy Association

ORTHOPAEDIC
PHYSICAL THERAPY PRACTICE

The publication of the Academy of Orthopaedic Physical Therapy, APTA

In this issue

Regular features

OPTP Mission

To serve as an advocate and resource for the practice of Orthopaedic Physical Therapy by fostering quality patient/client care and promoting professional growth.

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President's Corner

A Pivot in AOPT Direction!

Joseph M Donnelly, PT, DHSc

The holidays have come and gone and now it is time to embrace 2020 and get ready for the Combined Sections Meeting in Denver, CO. The AOPT had their strategic planning meeting October 9-11, 2019, in La Crosse, WI. The meeting included over 40 AOPT leaders and members and it was facilitated by Janet Bezner, PT, PhD. In September, we sent out a survey asking for membership input and part of the introduction paragraph included some of the highlights that the AOPT leadership and members had accomplished between 2014 and 2019. We had a pretty respectable number of members participate compared to 2014, 38 and 108, respectively.

We discussed the following areas in detail prior to developing the new mission and vision statements for the AOPT as follows:

- Overview of strategic planning process
- Status of current AOPT strategic plan
- Reviewed member survey data and conducted an environmental scan (see https://www.orthopt.org/uploads/content_files/files/SurveyResults.pdf)

New Mission Statement: The Academy of Orthopaedic Physical Therapy empowers members to excel in Orthopaedic Physical Therapy.

New Vision Statement: The Academy of Orthopaedic Physical Therapy will lead the world in optimizing movement and musculoskeletal health.

New Goals (not displayed in any specific order or priority)

Goal 1 - Payment - ***Enhance payment for services by demonstrating the value of physical therapy***

Goal 2 - Movement Experts - ***Position members as experts in managing movement and functional performance impairments***

Goal 3 - Diversity and Inclusion - ***Increase the diversity of members and leaders and engage in efforts to make AOPT a more inclusive organization***

Goal 4 - Evidence to Best Practice - ***Promote the development and implementation of evidence for best practice***

The new mission and vision statement and goals are in line with what members reported as their primary concerns over the next few years (create best practice guidelines and fund practical research; develop CPGs; provide CE opportunities; improve payment/reimbursement; promote the value of physical therapy). The new plan also creates better alignment of the AOPT and its special interest groups. There is much work to be done with the organization of strategic initiatives and action plans. We will be calling on members to get engaged and help us implement the new plan to empower members to excel in orthopaedic physical therapy.

During the AOPT Membership Meeting at CSM on Friday February 14, 2020, at 5:00 p.m. (Convention Center rooms 705-711), we will be introducing the new plan to the membership and getting the membership involved in creating our organizational values (which we currently don't have and would like to adopt to drive behavior in the Academy). Thank you for being a member of the Academy, for your input into the strategic plan, and for reading this message. I look forward to seeing you at the annual membership meeting in February.

Editor's Note

Even though I am writing this in 2019, the reader will not read this message until 2020. At the end of each year, I think it is both customary and essential to reflect on the year. What follows is my reflection and questions for the reader to answer.

As Editor, I was introduced just one year ago and even though I did not officially start until March, I had been doing reviews of articles and Special Interest Group (SIG) newsletters, and asking questions and interacting with Chris Hughes, *OP* Editor and Sharon Klinski, Managing Editor since early fall of 2018. This past year has been an incredible learning experience for me in this position to see the very talented Academy staff and to get to know and appreciate the leadership. I was invited by the Academy to attend the CSM Board and Committee Chairs meeting, and attended the AOPT's 45th anniversary celebration. CSM 2019 was a time of transition from Outgoing President, Stephen McDavitt to Incoming President, Joseph Donnelly and from *OP* Editor, Chris Hughes to me. As an outsider looking into a new role, I was in awe of Steve's ability to lead and effectively communicate, and I was excited to get to know and learn from Joe Donnelly. The role of leading the largest Academy in our profession and considering all the viewpoints of the Board of Directors, SIGs, Committee chairs, staff, and members is not a part-time job! Our Academy President and Board of Directors are exceptional, dedicated, and definitely hard working. They set the flight plan and our talented staff make sure we all arrive on time. At CSM, I was able to meet and interact with the SIG Presidents and Committee Chairs. Our SIG Presidents represent their area of practice with such enthusiasm and without waver. Their work is showcased at CSM and within this publication in their newsletters and fascinating articles. Our Committee Chairs are integral to our success and represent practice, membership, education, public relations, finance, awards, research, nominations, independent study courses, and the *Journal of Orthopaedic and Sports Physical Therapy*.

In October, I was invited to attend the strategic planning meeting in La Crosse, Wisconsin. All the Board of Directors, Committee Chairs, SIG Presidents, and staff were invited to be part of this process. Our facilitator, Janet Bezner, did an amazing job of engaging all of us and keeping us on track for both days. The dedication to our Academy at this event was fantastic and we now have our vision and mission set to guide us for the future. The reader can learn more about this event from the President's Corner on the previous page. I do not want to steal his thunder.

So, after my first year as Editor, I have questions for you, the reader.

- What can we do to make this publication better?
- What should we emphasize more or perhaps less?
- Should we invite authors, Committee Chairs, and SIG Presidents to do short social media videos to emphasize engagement?

Feel free to contact me directly to provide feedback as I am truly interested in your feedback. I can be reached at john.heick@nau.edu.

A call for participation went out this fall to invite engaged members to join committees and participate in this fantastic Academy.

- Did you receive the call?
- Did you submit your name?
- What can we do to engage you better?
- How can we facilitate your professional success?

Let us know how we can help you as our mission and vision is all about you!

Professionally,
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The Effects of Concussion and the Risk for Subsequent Musculoskeletal Injuries

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ABSTRACT

Background and Purpose: The purpose of this review was to assess the effects of concussion on the risk for subsequent lower extremity musculoskeletal injuries in athletes. **Methods:** PubMed Central, CINAHL, and Google Scholar with the key words concussion, motor control, musculoskeletal injuries and sports were used for the literature review. Articles' methodological rigor was evaluated using the STROBE guidelines. **Findings:** Twelve articles met the inclusion criteria and assessed athletes in a variety of sports. The overall compliance with reporting between articles was 66% and 23 items (68%) yielded >75% agreement. **Clinical Relevance:** Athletes were twice as likely to sustain a musculoskeletal injury one-year post-concussion compared to matched controls. Athletic movements such as quickly changing directions were affected substantially longer and remained impaired after neurological function had returned to baseline. **Conclusion:** Athletes are more likely to be at risk for injury after concussion. This elevated injury risk should be considered when making return to play and rehabilitation decisions.

Key Words: motor deficits, athletes, lower extremity, injury risk

INTRODUCTION

A concussion is a "complex pathological process induced by traumatic forces secondary to direct or indirect forces to the head that disrupts the function of the brain."[1] It is classified as a mild traumatic brain injury where linear and rotational acceleration of the brain occurs relative to the skull, producing shear forces that result in axonal stretching and disruption of cortical and subcortical pathways.[2] Symptoms include altered mental status, headaches, nausea, vomiting, dizziness, diminished balance, fatigue, difficulty sleeping, drowsiness, sensitivity to light or noise, blurred vision, memory deficits, and difficulty concentrating.[3]

An estimated 1.6 to 3.8 million sports-related concussions occur each year, resulting in approximately 250,000 emergency room visits.[4,5] Twenty to 30% of high school football players will sustain at least one concussion;[6] however, this number represents diagnosed concussions, not including the ones unreported due to difficulty recognizing the signs and symptoms.[7]

Short-term complications include second impact syndrome, as an athlete is 3 to 4 times more likely to sustain another concussion within 7 to 10 days. Long-term complications potentially include chronic traumatic encephalopathy and Alzheimer's disease.[8-12]

While there is variability in the recovery statistics, 80% of individuals demonstrate a significant reduction in neurological symptoms within 3 weeks, although children and adolescents may take longer to recover.[6] The average length to return to sport ranges from 9 to 18 days.[13]

In addition to neurological changes, significant motor changes occur post-concussion with gait,[2,4,14-20] balance,[4,18,21-24] and dynamic stability.[18,21-27] These motor changes may increase risk for musculoskeletal injuries if the athlete is not screened properly, rehabilitated sufficiently, or prematurely returns to competition. Therefore, the purpose of this review was to assess the effects of concussion and the risk for subsequent musculoskeletal injuries in athletes.

METHODS

Literature Search Strategy

A literature review was conducted through December 2019 using PubMed Central, CINAHL and Google Scholar. Key words included concussion, motor control, musculoskeletal injuries and sports.

Selection Criteria

The intent of the chosen inclusion criteria was to capture the most articles possible for analysis of methodology and consistency. Inclusion criteria included articles from peer-reviewed, English language journals; retrospective or prospective cohort, case-control or cross-sectional designs with sufficient data to assess the methodology; athletes competing at any level; use of matched controls or a reference injury that tracked the time taken to return to sport; and an assessment of the occurrence of musculoskeletal injuries post-concussion.

The titles and abstracts of all initial hits from the database searches were screened by 1 of the 5 authors and then every potential full text article was reviewed according to the aforementioned criteria. The search generated a total of 12 articles for the final review. Figure 1 depicts the search strategy.

Quality of Reporting

The quality of reporting for each article was evaluated using the STROBE (STrengthening the Reporting of OBservational studies in Epidemiology) guidelines. The evaluation was performed to identify common characteristics and offer a qualitative depiction. The STROBE guidelines provide guidance on how to improve reporting of observational studies, especially cohort, case-control, and cross-sectional studies.[28,29]

Each item on the STROBE checklist is classified as "yes" (met the criteria), "no" (did not meet the criteria), or "not applicable." Articles were reviewed by 1 of the 5 authors and discrepancies were resolved by the senior author.

An electronic database tabulated the reviewer datasets and the compliance rate for every article as well as the overall compliance rate was calculated by dividing the number of "yes" responses by the sum of the "yes" and "no" responses. If an item was not applicable to the checklist, it did not influence the compliance rate.

RESULTS

Observation studies are useful at identifying best clinical practices and can provide the opportunity to establish high external validity in randomized controlled trials, which can be challenging to accomplish. Accounting for risk of bias, confounding, cause and chance improves the reporting of observational studies, thereby improving their usefulness.[30]

The overall compliance with reporting using the STROBE guidelines was approximately 66% (range 0-100%) and 23 items (68%) yielded >75% agreement. Examples

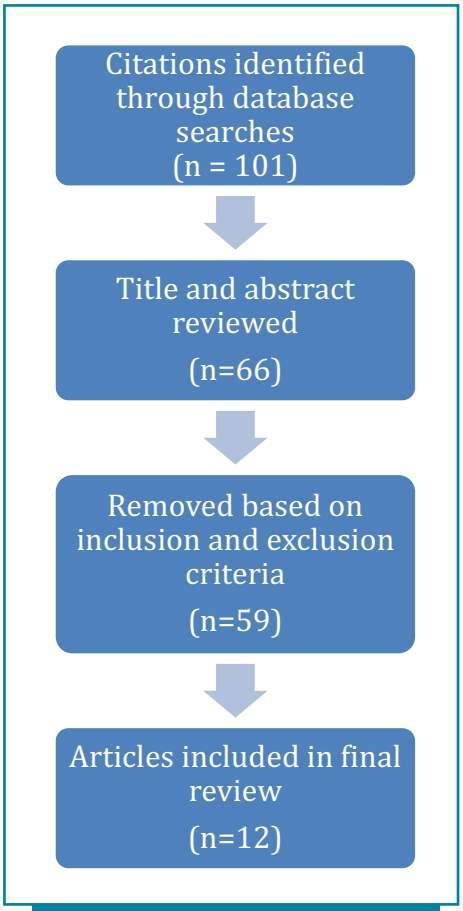

Figure 1. Search strategy results.

Table 1. STROBE Results of Articles included in the Review

Section	Item	Section Score	Percentage
Title and Abstract	1A: Title and abstract	12/12	100.00%
	1B: Balanced summary	12/12	100.00%
Introduction	2: Background/Rationale	12/12	100.00%
	3: Objectives	12/12	100.00%
Methods	4: Study Design	10/12	83.33%
	5:Setting	9/12	75.00%
	6A: Participants: Eligibility Criteria	12/12	100.00%
	6B: Participants: Match Criteria	12/12	100.00%
	7: Variables	12/12	100.00%
	8: Data Sources/Measurement	11/12	91.67%
	9: Bias	1/12	8.33%
	10: Study Size	10/12	83.33%
	11: Quantitative Variables	12/12	100.00%
	12A: Statistical Methods: Overall Description	11/12	91.67%
	12B: Statistical Methods: Subgroups	10/12	83.33%
	12C: Statistical Methods: Missing Data	0/12	0.00%
	12D: Statistical Methods: Loss to follow-up	0/12	0.00%
	12E: Statistical Methods: Sensitivity Analyses	1/12	8.33%
Results	13A: Participants: Numbers	10/12	83.33%
	13B: Participants: Reasons for Non-Participation	6/12	50.00%
	13C: Participants: Flow Diagram	5/12	41.67%
	14A: Descriptive Data: Characteristics	11/12	91.67%
	14B: Descriptive Data: Missing Data	0/12	0.00%
	14C: Descriptive Data: Follow- up	11/12	91.67%
	15: Outcome Data	12/12	100.00%
	16A: Main Results: Unadjusted Estimates	9/12	75.00%
	16B: Main Results: Category Boundaries	0/12	0.00%
	16C: Main Results: Risks	0/12	0.00%
	17: Other Analyses	2/12	16.67%
Discussion	18: Key Results	12/12	100.00%
	19: Limitations	10/12	83.33%
	20: Interpretation	11/12	91.67%
	21: Generalizability	11/12	91.67%
Other Information	22: Funding	7/12	58.33%
	Compliance	8.117647059	67.65%

included study design (100%), eligibility criteria for participants (100%), controls matched to participants (100%), study size (83%), overall description of statistical methods (92%), interpretation of findings (92%), and study limitations (83%).

Three items (9%) had intermediate compliance between 26% and 74%, including reasons for non-participation (50%), diagraming the flow of participation (42%), and source of funding (58%). Seven items (20%) had compliance <25%, including insufficient information regarding risk of bias (8%), the handling of missing data (0%), and an analysis of sensitivity (8%). The percentage of articles addressing STROBE items are provided in Table 1.

Twelve articles met the inclusion criteria and assessed high school, collegiate and professional athletes in a variety of sports including football, soccer, ice hockey, and lacrosse. The overall consensus was athletes who suffered a concussion were up to twice as likely to sustain a subsequent musculoskeletal injury, usually in the lower extremity, up to one-year post-concussion compared to matched controls. Two studies did not use matched controls but instead used a reference injury, such as an ankle sprain, while following the time needed to return to sport.[31,32] Both of these studies found a positive correlation between history of concussion and subsequent lower extremity injuries. Table 2 provides a breakdown of the findings in each study.

DISCUSSION

Several characteristics of motor control are potentially altered due to compromised neural function after a concussion and these can decrease responsiveness of the neurological system well after physical impairments have waned.[15] Examples include joint kine-

Table 2. Summary of Article Results

Author	Design	Population	Matched Controls or Reference Injury Included	Results
Makdissi[33] 2009	Prospective observational cohort	158 professional Australian rules football players	Yes	Injury rate following a concussion was 7.25 per 100 games compared to 3.25 in matched controls
Nordstrom[31] 2014	Prospective observational cohort	46 professional male soccer players	Yes	The concussion group had an increased risk of subsequent injury in the first year after returning from concussion
Lynall[34] 2015	Prospective observational cohort	44 collegiate athletes in various sports	Yes	The concussion group was twice as likely to sustain a lower extremity injury at 180 days and 1 year
Nyberg[35] 2015	Prospective observational cohort	Professional ice hockey players followed over 28 seasons	Yes	Concussed players had significantly more serious subsequent injuries
Burman[36] 2016	Retrospective cohort	281 athletes from various sports	Yes	Concussed athletes were more injury prone compared to the control group
Brooks[37] 2016	Retrospective cohort	75 collegiate athletes in various sports	Yes	Concussed athletes had a 2.48 greater risk of sustaining an acute LE injury at 90 days post-concussion
Gilbert[38] 2016	Cross-sectional design	335 athletes across 13 sports completed an injury questionnaire regarding concussion history and LE injuries	Yes	The risk for LE injuries was 1.6-2.9 times higher for concussed athletes
Cross[39] 2016	Prospective observational cohort	810 concussed and non-concussed athletes in various sports	Yes	Returning during the same season post-concussion had a 60% higher risk of injury. The time between subsequent injuries was significantly shorter following concussion
Fino[15] 2016	Retrospective cohort	The incidence of LE injuries for 1 year before and after a concussion in 110 athletes	Yes	History of concussion had a significantly increased risk of LE injury when adjusting for injury history
Herman[40] 2017	Retrospective cohort	Injury data for 73 collegiate athletes in various sports were followed 90 days after return to play	Yes	Concussed athletes were 3.39 times more likely to suffer an injury
Lynall[41] 2017	Observational cohort	Data from the National Athletic Treatment, Injury and Outcomes Network was assessed for 18,000 athletes across 27 sports	Yes	The odds for sustaining a LE injury significant enough to result in time lost from competition after a concussion increased 34%
Kardouni[42] 2018	Retrospective cohort	Active duty soldiers (11522 concussed and 11522 non-concussed) were compared for incidence of injury	Yes	The risk for of LE injury was >38% after 2 years while the risk at 15 months was >45%

Abbreviation: LE, lower extremity

matics, balance and dynamic stability, gait deviations, navigating obstacles, and dual task performance.

Kinematics

Changes in lower extremity stiffness during a single leg jump or single limb stance activity were noted post-concussion. Dubose used a force plate and 3D motion capture to analyze hip, knee, and ankle kinematics during a single leg jump from a 25 cm step.[30] Concussed athletes had decreased overall leg stiffness and delayed quadriceps activation that potentially suggest an increased risk for knee and ankle ligamentous sprains or meniscal tears due to altered landing mechanics.

Balance and Dynamic Stability

Impaired balance, dizziness, and postural instability are all acute symptoms following a concussion due to somatosensory, visual,

and vestibular impairments.[4,16,18,21-24,26] Intracortical inhibition of the motor cortex has been documented one-year post concussion even after resolution of physical symptoms.[34] Diminished joint proprioception has also been reported and could contribute to changes in balance and stability.[35]

Gait Deviations and Navigating Obstacles

The most common gait deficits were decreased speed followed by increased sway, which were correlated with more time in double leg stance.[4,14-20] During obstacle walking, concussed athletes demonstrated a more conservative control of center of mass 14 and 28 days postinjury, possibly due to increased contraction of the spinal stabilizers as a compensatory measure.[14] Since 80% to 90% of athletes typically return to play after 7 to 10 days post-concussion, these findings suggest the ability to navigate obstacles may still be impaired, leading to an increased risk for another injury.[24] Additionally, cortical resources, or the brain's ability to react quickly, are affected post-concussion. Examples include difficulty with visual field processing, reduction in visual field, and difficulty reacting to changes in the external environment.[36] Swanik determined individuals who suffered noncontact ACL injuries had significantly slower processing speeds and reaction times compared to those uninjured.[37]

Dual-Task Activities

Dual-task performance is often measured by introducing auditory interferences, question and answer tasks, cognitive and obstacle tasks, and changing directions.[15,16,18,38] Noticeable changes during dual-task gait included increased sway, decreased gait speed, and decreased dynamic balance.[17,22,23] Deficits during sports-related activities (ie, cutting, jumping, running, etc) lasted up to one year post-concussion, even after single task gait was normal and the athlete was cleared to play.[14,15,25] Athletes need a high processing rate to meet the demands of sports, but a concussion decreases the ability to perform complex dual-task movements, thereby increasing risk for injury.[37,39]

Research Limitations

This review had limitations that should be considered when interpreting the results. The inclusion of English only studies could have excluded potential articles. Although the majority of the studies were prospective, retrospective data was included in the review.[34,37] Additionally, information on the type of musculoskeletal injury and mechanism of injury was usually not included, making it difficult to investigate correlations. Other limitations included unequal exposure of risk to lower extremity injury, a small sampling of concussed athletes, absence of balance or neurocognitive testing, inconsistent follow-up with subjects, and lack of generalizability.[31,34,36,37]

CONCLUSION

Motor control changes post-concussion can potentially increase the risk of lower extremity injuries. This is relevant considering athletes demonstrate motor control deficits even after being asymptomatic and cleared for return to competition. This underscores the need for evidence-based guidelines and protocols when returning athletes back to sport. Cognitive and neuromuscular testing should be performed as a baseline for comparison, with the selection of assessment tools matched to individual symptoms. This could help with prognosis and return to competition considerations.[42]

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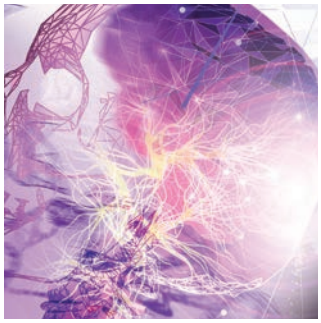
PHYSICAL THERAPY MANAGEMENT OF CONCUSSION

Independent Study Course 28.1



Learning Objectives

1. Describe the signs, symptoms, biomechanics, and pathophysiology of a concussion.
2. Cite key risk factors for sustaining a concussion and indicators leading to prolonged recovery following concussion.
3. Describe common clinical profiles seen following concussion.
4. Discuss the role of biomarkers in the evaluation and management of concussion.
5. Understand negative consequences of poor concussion management.
6. Describe important guidelines for return to play following sport-related concussion.
7. Discuss the advantages and disadvantages of various concussion prevention strategies.
8. Select evidence-based tools and outcome measures for clinical evaluation and treatment of concussion.
9. Apply key examination and assessment methods for cervical/thoracic spine, vestibular/oculomotor system, and exertion following concussion.
10. Appreciate the role of neurocognitive testing in concussion evaluation and management.
11. Identify clinical profiles and treatment strategies for each concussion subtype: cervical, vestibular, ocular, mood, migraine, and cognitive/fatigue.
12. Describe important indicators for return to activity following concussion.
13. Discuss the role of sleep in concussion management, and employ interventions that can be used to modify sleep dysregulation.
14. Appreciate the influence of psychogenic factors in concussion management.
15. Describe common pharmacologic and non-pharmacologic treatment options for specific symptoms following concussion.

Description

This monograph series provides in-depth coverage for the evaluation and treatment of concussion by a physical therapist. The authors are recognized clinical experts in the fi eld of concussion management. The basic pathophysiology underlying concussion is presented and then coupled with essential and advanced examination techniques. Special emphasis is placed on examination of the cervical and thoracic spine as part of concussion assessment and treatment.

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ACADEMY OF ORTHOPAEDIC PHYSICAL THERAPY

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Psychomotor Training for Performance of the Deep Neck Flexor Test

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ABSTRACT

Background and 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 a 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 0.63-0.82. 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 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 tester agreement in performance of the 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 would be aimed at 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 3 subjects. **Results:** The mean scores among the 4 raters in the 3 subjects ranged from 3.39-3.89 (SD 0.29-0.80). The difference in mean ratings across the 3 subjects was calculated according to an average of 4 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 be considered for participation in a larger clinical trial during their clinical internship in the third year of the program. **Conclusions:** The current study suggests practice time, random practice, demonstration, feedback, and reflection led to psychomotor skill acquisition in the performance of the DNFT in 4 DPT students. Their performance allowed them to participate in a clinical trial that includes measurements obtained through the DNFT.

Key Words: deep neck flexors, feedback, psychomotor training

INTRODUCTION

Nonspecific neck pain is a musculoskeletal condition that affects an increasing number of individuals.[1] Neck pain continues to affect about 30% to 50% of the general population with the highest prevalence affecting middle-aged individuals.[2] People who experience spinal pain are 2 to 3 times more likely to report limitations in work, fitness, and social activities demonstrating the debilitating effects of neck pain on overall health.[2]

Physical therapists use a variety of special tests to evaluate people with neck pain. Special tests created to specifically examine the neuromuscular activation and endurance of the deep neck flexor muscles often correlate with functional ability and pain levels for patients who report neck pain. The craniocervical flexion test (CCFT) represents one special test designed to assesses the neuromuscular control of the deep neck flexor muscles.[3,4] Jorgensen et al[3] reported that the intraclass correlation coefficient (ICC) for the inter-rater reliability of the CCFT ranged from 0.63 to 0.82 and the intra-rater reliability of the CCFT ranged from 0.70 to 0.86. They determined that the CCFT is a valid measure due to high minimal detectable change values and results that correlated with outcome scores such as the Numeric Rating Scale and Neck Disability Index.[3] While the results presented for the CCFT seem to support the use of the test, the clinical utility of the test is not practical due to the need for the specialized pressure biofeedback cuff and an extensive amount of trials that most clinicians would not have adequate time to perform. The deep neck flexor test (DNFT) also assesses the neuromuscular activation and endurance of the deep neck flexor muscles (Figure 1).[5-7] Olson et al[6] reported that the inter-rater reliability for 27 individuals without a history of neck pain was 0.83 - 0.88 and the intra-rater reliability for the same group was 0.78 - 0.85 with $p = 0.001$. Harris et al[5] calculated the inter-rater reliability and intra-rater reliability for 20 subjects without and 20 subjects with cervical pain using values determined by 2 separated clinicians. Relative to the group of subjects without cervical pain, Harris et al[5] determined that the inter-rater reliability values were moderate to good ranging from 0.67 - 0.78 and that the intra-rater reliability values were good to excellent ranging from 0.82 - 0.91. For the group with neck pain, the inter-rater reliability value was moderate with a value of 0.67 and the intra-rater reliability was not determined. Although only moderate values are generally reported for the reliability of the DNFT, because it only requires minimal equipment and limited trials, it may be more clinically appropriate. The purpose of this research involved determining the consistency in performance of the DNFT with DPT students and to describe how the process of obtaining reproducibility was incorporated into the student research process. This study was part of a larger research process.

METHODS

In order to conduct the study on human subjects, approval from the Daemen College Institutional Review Board was obtained.

While the didactic research training prepared the DPT students for study design, analysis, and scientific writing, enhanced

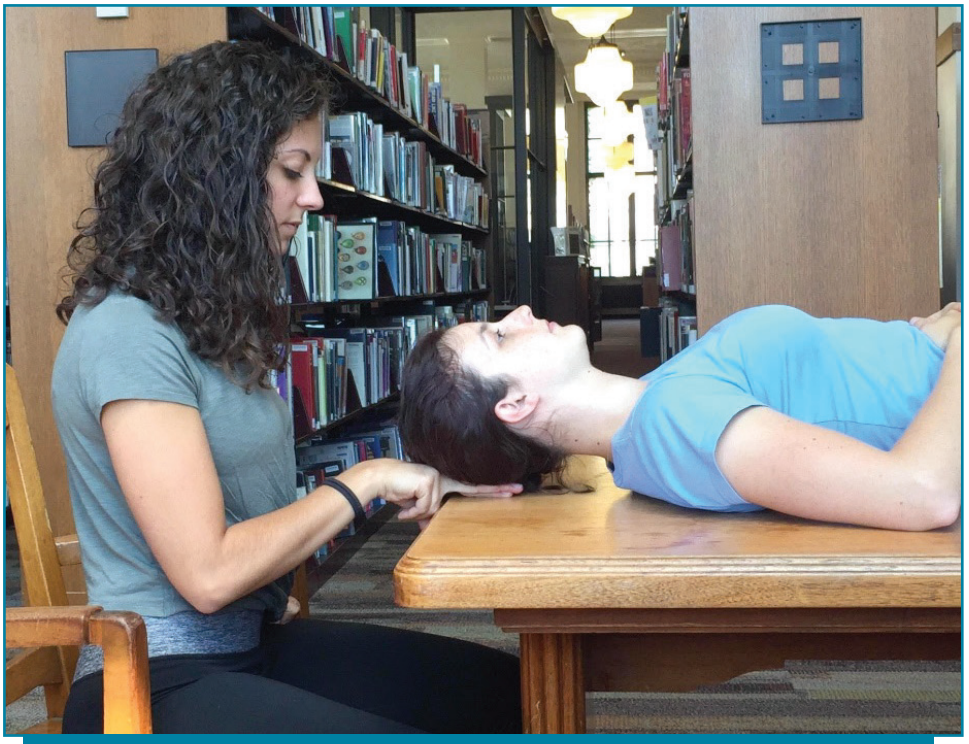

Figure 1. Deep neck flexor test procedure.

psychomotor skill was required to participate in a larger investigation. For the purposes of this study, a model for psychomotor training was adopted from a study conducted by Wise et al[8] on teaching spinal manipulation to DPT students. In that study, a cohort of 15 DPT students in their final semester of entry-level professional training participated in an active training session emphasizing a sequential partial task practice (SPTP) strategy in which participants engaged in partial task practice over several repetitions with different partners. Participants' level of confidence in the performance of these techniques was determined through comparison of pre- and post-training session surveys and a post-session open-ended interview which suggested that this model was effective in changing overall participant perception regarding the effectiveness and safety of these techniques and increasing student confidence in their performance. Interviews revealed that participants greatly preferred the SPTP strategy. A similar process was used to train the DPT students in the performance of the DNFT for this study. Within this model are 3 distinct phases of learning: (1) the preparation for learning phase, which is designed to prepare students for the active learning experience; (2) the active learning phase, which focuses on developing skill through practice; and (3) the evaluation of learning phase, which ensures that psychomotor learning has occurred. Each of the individual learning experiences targets a variety of learning domains and learning phases.[9]

In preparation for clinical testing for reproducibility of the DNFT, the DPT students underwent psychomotor training that included demonstration, blocked, repetitive and random practice, feedback, and reflection. This training took place for 2 hours per week over 3 weeks.

Following the 3 weeks of psychomotor training, the DPT student researchers administered the DNFT with 4 volunteer subjects in the absence of clinician observation. These trials were officially documented and used for analysis of the reproducibility of the DNFT (Table 1).

The test was administered as described in the literature[5-7] as follows: Before testing, the subject was given a detailed explanation of the testing procedure, then was placed in the test position which was crook-lying on a plinth. The subject's head was placed in upper cervical flexion by the examiner who placed stacked fingers under the subject's occiput. The subject was tested twice on the first day of testing, with a 3-minute rest between tests and was given verbal and tactile feedback during the test to help maintain the correct test position, as well as that if any discomfort was produced or increased, the test would be terminated.

In terms of target movement, the subject was asked to gently flex the upper neck and lift the head off the examiner's stacked fingers while maintaining upper neck flexion. Verbal cueing such as "tuck your chin in" or "hold your head up" was given to the subject when the occiput touched the examiner's stacked fingers. The test was terminated if the subject was unable to maintain the position of the head off the examiner's hand or if excessive shaking of the subject's head was seen by the examiner. The holding time was measured in seconds with a stopwatch.

A total of 4 sessions were completed with each of the subjects. In preparation for the task, the students were asked to describe a script to the subject regarding the test procedure to be performed. Peer assisted learning and feedback enhances the accuracy and confidence of psychomotor skills.[10] Therefore, after the recording of each practice session the examiners discussed the criteria for terminating the DNFT that may have included participant discomfort, shaking, or loss of control.

RESULTS

The mean scores among the 4 raters in 3 subjects ranged from 3.39-3.89 (SD 0.29-0.80). The difference in mean ratings across the 3 subjects was calculated according to an average of 4 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.

DISCUSSION AND CONCLUSION

The mean score among the 4 raters in the 3 subjects was considerably lower than that previously described in the literature.[5-7] Harris et al[5] arrived at a significantly different mean deep neck flexor hold time of 38.95 seconds (SD=26.4) for a group without neck pain and 24.1 seconds (SD=12.8) for a group with neck pain. The methods used to determine the reliability of the DNFT with the DPT student raters in this trial included terminating the counting if the subject's head began to excessively shake. Given that the students were aware that all 4 subjects had a history of neck pain (but no present symptoms or treatment), the students may have erred on the side of caution when administering the test. It is noted that during psychomotor training sessions, the DPT students frequently practiced counting out-loud together and discussed what constituted an excessive shake. This may account for the consistency they demonstrated in terminating the test.

Lee et al[11] determined that immediate quantitative feedback via a pressure sensor

Table 1. Deep Neck Flexor Test Trials

Participant 1				
Day 1	Student 1 Examiner	Student 2 Examiner	Student 3 Examiner	Student 4 Examiner
Trial 1	3	2	3	4
Trial 2	4	2	4	4
Trial 3	4	1	3	5
Trial 4	4	1	3	4
Day 2				
Trial 1	3	3	3	3
Trial 2	0	0	0	0
Trial 3	5	4	4	5
Trial 4	3	4	3	4
Day 3				
Trial 1	3	5	5	5
Trial 2	4	4	3	4
Trial 3	6	5	6	7
Trial 4	3	3	3	4
Day 4				
Trial 1	6	4	4	6
Trial 2	10	8	5	7
Trial 3	5	4	5	5
Trial 4	4	3	3	4
Participant 2				
Day 1	Student 1 Examiner	Student 2 Examiner	Student 3 Examiner	Student 4 Examiner
Trial 1	4	2	3	4
Trial 2	2	3	4	3
Trial 3	4	3	3	6
Trial 4	3	2	2	3
Day 2				
Trial 1	4	3	5	6
Trial 2	2	2	4	5
Trial 3	3	3	4	4
Trial 4	5	3	3	4
Day 3				
Trial 1	3	3	3	4
Trial 2	2	4	3	5
Trial 3	2	5	3	5
Trial 4	4	3	3	4
Day 4				
Trial 1	5	4	5	5
Trial 2	3	4	4	4
Trial 3	2	2	3	3
Trial 4	2	3	3	3
Participant 3				
Day 1	Student 1 Examiner	Student 2 Examiner	Student 3 Examiner	Student 4 Examiner
Trial 1	5	3	4	5
Trial 2	3	2	4	4
Trial 3	4	2	4	5
Trial 4	4	1	4	6
Day 2				
Trial 1	4	2	3	4
Trial 2	3	3	4	5
Trial 3	4	3	3	3
Trial 4	1	2	3	2
Day 3				
Trial 1	3	3	3	4
Trial 2	2	2	3	3
Trial 3	2	2	2	2
Trial 4	2	2	3	2
Day 4				
Trial 1	4	3	3	4
Trial 2	2	2	3	3
Trial 3	2	2	3	3
Trial 4	3	1	3	4

provided to DPT students improved their ability to appropriately learn and perform the spinal manipulation. The present study also used quantitative feedback during the trials, which may have been a factor in enhancing technique performance. Practice time was used by the students in preparation for their trials and the literature consistently reflects that the quantity of practice time is a necessary component in the development of a new task.[12]

Correct performance of the test was demonstrated by the clinicians participating in a larger trial. As noted in Wise et al,[8] the typical process for most manual physical therapy lab experiences involves some form of demonstration. Recent literature brings to question whether the demonstration should be done by an expert clinician or a student who is learning. While the expert clinician may provide the most accurate depiction of the skill, research indicates that students gain knowledge by watching a novice attempt the technique and learn from the feedback they receive.[13]

Whether demonstrated by an expert or novice clinician, blocked practice describes a sequence of instruction that allows for repetitive practice of a particular skill or component of the skill until the student achieves mastery.[8] Conversely, random practice involves practice of different tasks on consecutive trials. Although blocked practice is best for acquisition of a new task, such as learning the intricacies of spinal mobilization, random practice has traditionally been considered better for retention and transfer and was the strategy used in the present study.

Aside from the quantity of practice time, feedback is considered to be the most important variable influencing skill acquisition.[14] Intrinsic feedback is provided by sensory systems during performance of a task while extrinsic feedback is provided by the instructor and is supplementary, not inherent, to the task. Extrinsic feedback is considered to be most effective for skill acquisition when the instructor withholds the feedback intermittently.[14] Frequent, immediate extrinsic feedback may actually discourage participants from attending to their own sensory feedback and limit the process of independent solution retrieval that leads to learning. When extrinsic feedback is faded, the instructor provides less and less guidance and direction as the student acquires the skill.[12] The feedback provided in this study most closely resembled the latter.

The final component to skill acquisition is the participant's ability to engage in ongo-

ing self-reflection[15] and in this investigation, the students were given the opportunity to reflect between the practice sessions and also encouraged to continue to learn even after the learning experience. Experts continue to learn even after the conclusion of a learning experience. The results of this study further suggest that physical therapy instructors should consider the value of post-encounter self-reflection and provide mechanisms for learners to continue the process of learning, even after the active learning session is finished.[16]

Another limitation to the study was that the DPT students only recorded results for subjects without current symptoms. Future research studies examining the reliability of DPT students with various examination procedures should include subjects with pain in order to determine the most applicable results to the patient population that the students would be working with in the clinical setting.

The DPT student researchers demonstrated an acceptable level of agreement when administering the DNFT with student volunteers. The DPT student researchers theorized that the reliability occurred initially due to the clinician instruction and quantitative feedback, followed by the combination of repeated and random practice with peer and mentor feedback. The results suggest that further instruction in what constitutes halting of the DNFT will need to be included if the students were to participate in a larger trial.

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Incorporating Lumbar Spine Interventions in the Treatment of Adults with Shoulder Pain: A Case Series

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ABSTRACT

Study Design: Case series. **Background and Purpose:** While shoulder pain is common among adults, short- and long-term outcomes remain inconsistent. The purpose of this case series is to describe how incorporating interventions directed at the lumbar spine in addition to traditional scapulothoracic treatment may lead to improved outcomes in patients with complaints of shoulder pain. **Case Description:** Three adults with complaints of shoulder pain were treated with manual therapy and exercise targeting the lumbar spine in addition to the scapulothoracic region. **Findings:** Each patient demonstrated clinically significant improvements in self-reported pain and perceived functional status allowing for return to prior level of all recreational activities. **Clinical Relevance:** This case series shows the use of lumbar spine interventions in the treatment of three adults with shoulder pain. Conclusion: Positive outcomes with shoulder pain and dysfunction suggest the addition of lumbar specific interventions may be beneficial for patients with shoulder pain.

Key Words: upper extremity, physical therapy, therapeutic exercise

BACKGROUND

Of adults with complaints of shoulder pain to general practitioners, the average age is 47 years old with 65% being female.[1] Successful management of patients with shoulder pain is important in order to restore function and improve long-term outcomes. In order to successfully manage these patients, physical therapists need to consider the influence of lower extremity and lumbar mechanics on upper extremity dysfunction and pain. This association between supposedly separate and unrelated anatomical regions can be explained by the concept of regional interdependence (RI). Regional interdependence is the concept that impairments in distant anatomical regions can be connected to a patient's primary complaints in another body region.[2]

Regional interdependence can be supported by looking at research on the influences of the kinetic chain that shows how treatment in one body region can improve outcomes in an anatomically distant region. One example of the influence of the kinetic chain is the anticipatory postural control. Before voluntary movement of your upper extremities, electromyographic studies have found activation and recruitment of postural muscles in the lower extremities, pelvis, and lumbar spine.[3-6] Proximal hip strength and mechanics are shown to be different in individuals with knee pain and therefore may need to be addressed in the treatment of these patients.[7-9] An association between scapular muscles and the kinetic chain can also be seen with increased serratus anterior muscle activation when coupled with activation of the lower extremity and trunk.[10]

Current recommendations for treatment approaches regarding nontraumatic shoulder pain can include nonoperative management with exercises for the scapular muscles or scapular stabilizers, as well as manual interventions to reduce pain levels.[11,12] Treatment strategies using specific and progressive exercises for the rotator cuff and scapular muscles strengthening is more effective at improving pain and function as compared to general, nonspecific movements of the neck and shoulder.[13] Also, interventions to improve scapular motor control have been shown to help reduce pain and improve function in patients with shoulder pain.[14] These approaches are focused on addressing impairments specifically related to the shoulder while other guidelines and strategies suggest addressing distal segments also within the kinetic chain, at the lower extremities, and trunk in shoulder rehabilitation.[15] With the concept of RI and a treatment approach with the inclusion of the kinetic chain, physical therapists can consider the use of interventions to the lumbar spine for the treatment of a patient's primary complaints of shoulder pain.

The purpose of this case series is to describe how incorporating interventions directed at the lumbar spine were used in the treatment of 3 patients with complaints of shoulder pain.

CASE DESCRIPTION

This case series includes 3 patients seen in an outpatient physical therapy clinic in Marietta, Georgia, from September 2017 to May 2018. All patients provided verbal consent to publish their data. Patients included were adults between 45 and 75 years old with primary complaints of insidious onset of unilateral shoulder pain. Exclusion criteria were patients with a traumatic mechanism of injury, fracture, and signs and symptoms of adhesive capsulitis. Subjective and objective measures were collected on the day of the initial evaluation and day of discharge and post-discharge, follow-up phone call performed in July 2018. Outcome measures included Numeric Pain Rating Scale (NPRS), Focus On Therapeutic Outcomes (FOTO), and Shoulder Functional Status Patient-Reported Outcome Measure (FSPROM). Objective examination was performed with assessment of strength, range of motion (ROM), motor control, and soft tissue quality (Table 1).

The NPRS is an 11-point scale from 0 to 10 of a patient's report of perceived pain intensity. A 0/10 pain rating indicated no pain and a 10/10 pain indicated maximal pain. Inter- and intrarater reliability for NPRS is excellent with 100% agreement between two raters. The minimally clinically important difference (MCID) for NPRS in chronic musculoskeletal pain patients is found to be 1 point and a 2.17-point change in patients with shoulder pain undergoing rehabilitation.[16,17]

The FSPROM is a computerized adaptive test aimed at measuring a patient's perceived functional status. Scores range from 0, low-perceived function, to 100, high-perceived function. Computerized adaptive testing (CAT) uses a computer algorithm that selects subsequent questions based on how the patient answers the previous question, which increases the efficiency of performing the outcome measure and reduces the possibility of floor and ceiling effects.[18] The use of CATs in patients with shoulder impairments is found to be both efficient and precise with producing clinically relevant measures of functional status.[19] In regards to shoulder

Table 1. Objective Outcome Measures of the Three Patients

	Initial Examination	Discharge
Patient A		
NPRS	4/10	0/10
FOTO Score	75%	78%
Patient B		
NPRS	3/10	0/10
FOTO Score	52%	71%
Patient C		
NPRS	5/10	0/10
FOTO Score	62%	72%

Abbreviations: NPRS, Numeric Pain Rating Scale; FOTO, Focus On Therapeutic Outcomes

functional status, the minimal detectable change is 11 points and the minimal clinically important improvement is dependent on baseline scores.[20]

Physical therapy objective examination of strength, ROM, motor control, and soft tissue mobility was performed using manual muscle testing, active and passive ROM assessment, observation, and palpation. Upper quarter strength was assessed using manual muscle testing grades in short sitting. Active shoulder ROM was assessed in short sitting and passive shoulder ROM was tested in supine. Scapular motor control was assessed posteriorly during shoulder elevation in short sitting. Soft tissue mobility was assessed in the upper quarter with the patient in supine.

Patient A

History

Patient A was a 49-year-old male who presented to physical therapy with complaints of an insidious onset of right shoulder pain over a 2.5-year period after moving furniture. Patient reported that he had a dull-ache in his shoulder occasionally with increased sharp pain during certain reaching or throwing movements. Patient's occupation required sitting at a computer for 6 to 8 hours of work a day. Patient had no significant past medical history affecting treatment.

Examination

Upon initial examination, patient had deficits in strength, motor control, and soft tissue mobility (Table 2). The active and passive shoulder ROM was within normal limits and equal to contralateral side. Strength deficits were noted in shoulder external and internal rotators and scapular retractors and upward rotators. Patient had impaired scapular upward rotation and aberrant movement with eccentric scapular control on the right compared to left. Impaired soft tissue mobility and irritability was noted in bilateral upper trapezius and right long head of biceps.

Patient B

History

Patient B was a 70-year-old female who presented to physical therapy with complaints of an insidious increase of right shoulder pain beginning 7 months prior after lifting a heavy suitcase up onto an overhead shelf. Patient reported increases in sharp pain with certain reaching movements. Patient was retired and spent her days occupied with various activities including reading, shopping, and travelling. The past medical history affecting treatment included osteoporosis.

Examination

Upon initial examination, patient had deficits in ROM, strength, motor control, and soft tissue mobility (Table 3). Impaired and painful active and passive right shoulder ROM. Strength deficits noted in shoulder flexors, abductors, internal and external rotators, and scapular retractors and upward rotators. Patient also demonstrated poor scapular motor control with impaired upward scapular rotation and scapular winging during right shoulder elevation. Soft tissue mobility deficits noted in bilateral upper trapezius, levator scapulae, supraspinatus, and infraspinatus.

Patient C

History

Patient C was a 65-year-old male presenting to physical therapy with complaints of insidious onset of right shoulder pain over a 1-year period without a known mechanism of injury. Patient reported a gradual progression of sharp pain with lateral and overhead reaching activities. Patient's occupation required 7 to 9 hours of sitting and paperwork activities. The only significant past medical history reported was allergies and previous prostate surgery.

Examination

Upon initial examination, patient had deficits in ROM, strength, motor control, and soft tissue mobility (Table 4). He exhibited deficits in active functional shoulder external and internal rotation and also decreased passive external rotation motion. Strength deficits were noted in shoulder flexors, abductors and internal and external rotators, and scapular retractors and upward rotators. Scapular motor control deficits with bilateral scapular winging and aberrant movement with eccentric right scapular control from elevation, as well as soft tissue mobility deficits in bilateral upper trapezius and right supraspinatus and infraspinatus were noted.

Treatment

Prior to initiating physical therapy, each patient provided signed informed consent for evaluation and treatment. Each physical therapy session consisted of a combination of manual therapy and exercise interventions. Manual therapy interventions were directed at homeostatic points and trigger points to assist in improving mobility and decreasing irritability. Exercise interventions were used to decrease irritability, improve motor control, and increase active mobility and strength.

Specific application of manual therapy techniques were individualized and dependent on how each patient presented to the physical therapy session. Homeostatic points assessed included spinal accessory, dorsal scapular, suprascapular, lateral antebrachial cutaneous, and deep radial. Soft tissue mobilization to trigger points was addressed in cervical and thoracic paraspinals, upper trapezius, levator scapulae, rhomboids, and infraspinatus. Thrust manipulation was used in the thoracic region for patient A, but not for patient B due to osteoporosis or patient C due to patient age and patient preference.

To address impairments found in the shoulder and scapular regions, specific exercise strategies are shown to be more effective than unspecified neck and shoulder exercises.[13] These specific exercises consisted of interventions for recruitment and strengthening of scapular stabilizers including the serratus anterior, middle trapezius, lower

Table 2. Patient A – Objective Measures

	Initial Examination		Discharge	
	Right	Left	Right	Left
Shoulder Active ROM				
Flexion	180 °	180 °	180 °	180 °
Abduction	180 °	180 °	180 °	180°
Function ER	C6	C6	C6	C6
Functional IR	T7	T7	T7	T7
Shoulder Passive ROM				
Flexion	180 °	180 °	180 °	180 °
Abduction	180 °	180 °	180 °	180 °
ER	100 °	90 °	100 °	90 °
IR	60 °	70 °	60 °	70 °
Shoulder/Scapular Strength				
Flexion	5/5	5/5	5/5	5/5
Abduction	5/5	5/5	5/5	5/5
ER	4/5	4/5	5-/5	5-/5
IR	5-/5	5-/5	5/5	5/5
Middle Trapezius	3+/5	3+/5	4+/5	4+/5
Lower Trapezius	3+/5	3+/5	4/5	4/5

Abbreviations: ROM, range of motion; ER, external rotation; IR, internal rotation

Table 3. Patient B – Objective Measures

	Initial Examination		Discharge	
	Right	Left	Right	Left
Shoulder Active ROM				
Flexion	110 °	180 °	180 °	180 °
Abduction	100 °	180 °	180 °	180°
Shoulder Passive ROM				
Flexion	160 °	180 °	180 °	180 °
Abduction	90 °	130 °	180 °	180 °
ER	80 °	110 °	110 °	110 °
IR	50 °	50 °	50 °	50 °
Shoulder/Scapular Strength				
Flexion	3-/5	4-/5	4+/5	4+/5
Abduction	3-/5	4-/5	4+/5	4+/5
ER	3-/5	3+/5	4/5	4/5
IR	4-/5	4-/5	4+/5	4+/5
Middle Trapezius	2+/5	2+/5	4/5	4/5
Lower Trapezius	2+/5	2+/5	4-/5	4-/5

Abbreviations: ROM, range of motion; ER, external rotation; IR, internal rotation

trapezius, and all rotator cuff muscles. Specific interventions included open-chain shoulder protraction, closed-chain shoulder protraction, banded horizontal abduction and overhead lower trapezius, weighted rows, latissimus pull downs, shoulder external rotation, scaption, and farm carries.

Incorporation of lumbar spine interventions focused on mobility, motor control, and muscle recruitment of lumbar multifidi and hip musculature in supine, prone, sitting, and standing. Specific exercises included supine bridging, band resisted hip abduction in standing, prone hamstring isometrics, seated instability with upper extremity perturbations, and seated hamstring isotonics. These combined interventions of lumbar spine and scapular strengthening focused on functional progression for reaching, lifting overhead, and away from center of mass.

RESULTS

Patient A was seen in physical therapy for 19 visits over a 12-week period. Objectively, he demonstrated increases in shoulder/scapular strength bilaterally (see Table 2). At the time of discharge, he reported 0/10 pain with all daily and recreational activities. He was able to return to work duties, fitness activities, and household activities with no reported limitations. The Shoulder FS score improved by 3 but still exceeded the MCID for patients with intake scores of 61 to 100.[20] Eight months after discharge, the patient was contacted by phone for follow-up. Patient reported no recurrence of pain with work duties, fitness activities, or daily household activities.

Patient B was seen in physical therapy for 22 visits over a 13-week period. Objectively, she demonstrated increases in shoulder active and passive ROM, and shoulder/scapular strength (see Table 3). At discharge, she reported 0/10 pain with all daily activities and was able to return to all lifting, carrying, and reaching duties for light and heavy household activities without limitations. Her Shoulder FS increased by 19, which exceeded the MCID for patients with intake scores between 44 and 52.[20] Six months after discharge, the patient was contacted by phone for follow-up. Patient reported no episodes of shoulder pain since discharge and was able to perform all daily and household activities.

Patient C was seen in physical therapy for 39 visits over a 29-week period. He had an extended length of physical therapy care compared to Patient A and Patient B due to a lapse and set back in plan of care after having abdominal surgery 8 weeks after initiating treatment. Objectively, he demonstrated increases in function shoulder active and passive ROM, and shoulder and scapular strength (see Table 4). At discharge, he had 0/10 pain with all daily activities and was able to return to all work duties, household activities, and recreational sporting activities without limitations. His Shoulder FS increased by 10, which exceeded the MCID for patients with intake scores between 61

Table 4. Patient C – Objective Measures

	Initial Examination		Discharge	
	Right	Left	Right	Left
Shoulder Active ROM				
Flexion	180 °	180 °	180 °	180 °
Abduction	180 °	180 °	180 °	180°
Function ER	C5	C7	C7	C7
Functional IR	L4	T10	T12	T10
Shoulder Passive ROM				
Flexion	180 °	180 °	180 °	180 °
Abduction	180 °	180 °	180 °	180 °
ER	90 °	105 °	100 °	105 °
IR	70 °	70 °	70 °	70 °
Shoulder/Scapular Strength				
Flexion	3+/5	4/5	5-/5	5-/5
Abduction	3/5	4/5	5-/5	5-/5
ER	3+/5	4/5	4-/5	4+/5
IR	4-/5	4/5	4+/5	4+/5
Middle Trapezius	3/5	3/5	4/5	4/5
Lower Trapezius	3-/5	3-/5	4-/5	4-/5

Abbreviations: ROM, range of motion; ER, external rotation; IR, internal rotation

and 100.[20] Two months after discharge, the patient was contacted by phone for follow-up. Patient reported occasional recurrence of pain with tennis activities but is able to do all daily activities without pain or difficulty.

DISCUSSION

The purpose of this case series was to describe how incorporating interventions directed at the lumbar spine in the treatment of 3 patients with complaints of shoulder pain. All 3 patients were treated with manual therapy and therapeutic exercise interventions based on impairments in the shoulder girdle and scapular regions along with interventions targeted at the lumbar spine. Over the course of treatment, all 3 patients demonstrated improvements in pain, function, soft tissue health, shoulder ROM, scapulothoracic and shoulder strength.

The 3 patients in this case series were adults with goals of return to performing functional activities of daily living without implementation. Though there is evidence to support the association between trunk dysfunction and upper extremity function during daily activities,[21] the current literature lacks high quality evidence for the incorporation of lumbar spine interventions to improve normal daily activities. Impairments in the lumbar spine may affect progression and full functional capabilities of the upper extremity may be in order to fully rehabilitate a patient with primarily shoulder complaints.

Addressing the lumbar spine in this patient population can potentially influence outcomes and recovery. There are numerous studies that show how thrust manipulation directed at the cervical and thoracic spine can influence pain and function of the shoulder.[22-24] Thrust manipulations and other manual therapy interventions work by initiating neurophysiological, peripheral, spinal, and supraspinal mechanisms in order to produce widespread clinical outcomes.[25] All 3 patients in this case series were treated with manual interventions that would have influenced their outcomes through the above proposed mechanism. Another potential influence is through biomechanical connections of the lumbar spine and shoulder. There are muscular and myofascial connections between the two body regions that influence the muscular activation of the scapular region.[10]

There are multiple limitations of this case series. One limitation is the small number of patients and no randomization and no control group. Thus, the study can show possible association but cannot establish any causation between interventions and results. Another limitation is the outcome measures used in the report. There were no objective measures used to document lumbar dysfunction throughout the plan of care. It would have been useful to monitor lumbar dysfunction and improvement throughout the progression and return to function of these patients when lumbar interventions were used in treatment. While follow-up communication post-discharge was completed for all 3 patients, the timeframe varied (2, 6, and 8 months). Contact was made at the time of writing this article and an established timeline was not prospectively determined prior to onset of care or once the patients were discharged. Future research may benefit from a structured follow-up assessment to analyze long-term outcomes.

Future research for patients with shoulder pain will be beneficial to determine kinetic chain incorporation and approaches to improve impairments and maximize functional recovery in adult populations wanting to return to daily activities including sports participation. Randomized controlled trials looking at intervention strategies incorporating the lumbar spine and lower extremities to improve shoulder pain and function are needed in order to determine the best and most efficient rehabilitation approaches. This case series shows that 3 patients with shoulder pain were successfully managed with the incorporation of lumbar spine interventions in conjunction with manual therapy and shoulder and scapulothoracic exercises.

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Bilateral Functional Performance in Recreationally Active Females Three Months After Hip Preservation Arthroscopy: A Case Series

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ABSTRACT

Background: Postsurgical timeframe is used to inform return to sport decision-making for patients after hip surgery. Understanding individual differences in lower extremity functional performance and patient-reported outcomes at 3 months postsurgery may provide guidance for return to sport decisions. **Methods:** A prospective case series describing lower extremity functional performance (four hop test battery of single hop for distance, 6-meter timed hop, triple hop for distance, and crossover hop for distance, and the Star Excursion Balance Test and Vail Hip Sport Test), hip abductor strength, and patient-reported outcomes in 3 recreationally active women at 3 months following hip preservation arthroscopic surgery. **Findings:** At 3 months postsurgery, there was considerable variability and deficits in lower extremity functional performance and strength across participants as well as variability in patient-reported outcomes. **Clinical Relevance:** Assuming that a 3-month postsurgical time point for return to sporting activities is appropriate for recreationally active individuals post hip arthroscopy may not be a valid assumption. **Conclusion:** Based on the patient-reported outcomes and lower extremity functional performance of 3 recreational athletes, the authors suggest that patients following arthroscopic hip surgery may require more than 3 months to return to sporting activity.

Key Words: hip preservation, femoroacetabular impingement, return to sport, physical therapy

BACKGROUND AND PURPOSE

Over the past decade, the number of hip preservation arthroscopic procedures performed has increased from 3.6 per 100,000 in 2005 to 16.7 per 100,000 in 2013.[1] Rehabilitation typically follows hip arthroscopic surgery although there is considerable variability in recommended postoperative physical therapy protocols.[2] Thus, it is not surprising that a systematic review of physical impairments and activity limitations in individuals presenting with femoral acetabular impingement concluded that rehabilitation protocols targeted at restoring postoperative functional impairments need to be re-evaluated, especially with respect to developing evidence-based rehabilitation programs and return to sporting activities.[3]

In contrast with criterion-based rehabilitation protocols,[4] return to sport decision-making may rely instead on postsurgical time, commonly between 12 and 20 weeks after surgery.[5] However, significant individual variation complicates return to sport activity decisions based on the extent of injury, surgery performed, and the rehabilitation process. Understanding individual patient differences may provide guidance for return to sport decision-making as well as provide guidance for rehabilitation protocol development. Variability in performance following hip arthroscopy was the topic of a recent clinical commentary that outlined an impairment-based rehabilitation protocol for use postsurgery that is currently under testing in a multicenter, international randomized controlled trial.[6] This protocol is designed to target known postsurgical deficits and provides clinicians with a systematic approach to treatment progression through return to sport.

Recreationally active women are a population at risk for future osteoarthritis if not appropriately managed.[7] Identifying functional deficits in this population at 3 months may be useful in elucidating outcome variability among individuals to help physical therapists modify such impairment-based programming as it becomes validated for individuals facing return to sport decisions. The purpose of this case series was to describe lower extremity functional performance, hip strength, and patient-reported outcomes in 3 recreationally active women 3 months following hip preservation arthroscopy and to identify variability in outcomes across individuals. Findings from this study will help health care professionals such as physical therapists, athletic trainers, and orthopedic surgeons to inform coaches and individuals regarding appropriate time points for allowing return to sporting activities.

METHODS

Patient Description

Three female recreationally active participants, 3 months (±2 weeks) following primary, unilateral hip preservation arthroscopy volunteered to participate in this study. Table 1 details their demographic information, diagnosis, and surgical procedures. The Institutional Review Board at Midwestern University, Downers Grove, IL, approved this study, and participants provided written consent to participate. Recreationally active was defined as engaged in mild, moderate, or high-intensity physical activity for at least 2.5 but not more than 10 hours per week (prior to injury).[8] Participants were patients of an orthopedic surgeon specializing in hip preservation surgery. Inclusion and exclusion criteria are listed in Table 2. The first 3 patients to meet criteria via the surgeon's chart review were asked to participate. Participants underwent a standard rehabilitation protocol with their respective physical therapists prior to enrollment into the current study.

Testing Protocol

Each participant attended one 90-minute testing session in an outpatient physical therapy clinic. Lower extremity functional performance was assessed using four hop tests (single hop for distance, 6-meter timed hop, triple hop for distance, and crossover hop for distance),[9] the Star Excursion Balance Test (SEBT), and the Vail Hip Sport Test (VHST). In addition, hip abductor strength was measured as well as 3 patient-reported outcome scores. Testing order was consistent across all 3 subjects to maintain testing consistency given the small sample

Table 1. Demographic Data of the Three Recreationally Active Female Participants

Variable	Participant 1	Participant 2	Participant 3
Age (years)	25	33	40
Body Mass Index (BMI)	21.5	22	26.5
Weeks Postoperative	13	11.5	14
Preoperative Diagnosis	Labral tear Hip flexor tendinitis Internal snapping hip Pincer lesion Cam lesion Instability	Labral tear Hip flexor tendinitis Pincer lesion Cam lesion Instability	Labral tear Loose body Pincer lesion Cam lesion Instability
Postoperative Diagnosis	Labral tear Iliopsoas bursitis Hip flexor tendinitis Pincer lesion Cam lesion Instability	Labral tear Iliopsoas bursitis Hip flexor tendinitis Pincer lesion Cam lesion Instability	Labral tear Loose body Ligamentum teres tear Iliopsoas bursitis synovitis Pincer lesion Cam lesion Instability
Surgical Procedure	Labral debridement Acetabuloplasty Iliopsoas bursectomy and fractional lengthening Femoroplasty Capsular plication	Labral repair Acetabuloplasty Iliopsoas bursectomy and fractional lengthening Femoroplasty Capsular plication	Removal of loose body Labral repair Ligamentum teres reconstruction Acetabuloplasty Iliopsoas bursectomy Synovial biopsy Femoroplasty Capsular plication
Prior Level of Activity	3-5 hours/week running, hiking, snowboarding	2.5 hours/week flag football, recreational softball	10 hours/week walking, swimming, biking

size. Patient-reported outcomes were the Hip Outcome Score – Sports Subscale (HOS-SSS), Nonarthritic Hip Score (NHS), and the International Hip Outcome Tool (iHOT-12). Collectively, results from the functional performance tests, strength test, and patient-reported outcomes were compared bilaterally for each participant and across participants.

1. Hop tests. Four hop tests (single hop for distance, 6-meter timed hop, triple hop for distance, and crossover hop for distance) were measured using standardized testing methods.[10] Although there have been no published reports on hop testing following hip arthroscopy, the 4 hop tests used in this study have been shown to be reliable in patients after anterior cruciate ligament reconstruction surgery and are typically used together.[11] Participants performed all hop tests bilaterally, beginning with the non-surgical limb. Two trials for each limb were measured with rest allowed as needed. Means and standard deviations were calculated from the two trials. The participants were free to swing their arms to aid in completing the jump and for balance. During the single hop for distance, triple hop for distance, and crossover hop for distance tests participants were required to maintain balance on the test limb until prompted to relax. Failure to maintain balance resulted in an invalid trial. A toe-to-toe measure was used for all tests requiring measurements of the total distance hopped. Means were calculated for two trials. Limb symmetry index (LSI) was then calculated for each test mean and expressed as a percentage (surgical limb/nonsurgical limb x 100).[10] An LSI score of at least 90% was considered as passing.[12]
2. Star Excursion Balance Test (SEBT) was measured bilaterally using established methods.[13] Participants performed 4 practice trials to stabilize

Table 2. Inclusion and Exclusion Criteria

Inclusion	Exclusion
Primary unilateral hip arthroscopy	Prior knee or ankle surgeries
Unilateral hip pathology	Evidence of arthritis Tönnis grade 2 or greater based on pre-operative radiograph by the orthopedic surgeon
Self-reported recreationally active	Gluteus medius tear based on pre-operative MR arthrogram by the orthopedic surgeon
20-40 years old	Labral reconstruction surgery
Body mass index 18.5-29.9	Microfracture hip procedure
Cleared by physician for jumping and pivoting activities	Current hip incidence related to workers' compensation injury case
	Vestibular or balance disorders
	Current concussion or mild traumatic brain injury

excursion distances.[14] To decrease fatigue, one reach distance was measured in 4 directions (anterior, posteromedial, posterolateral, and medial) on the fifth trial. Reach distance measurements were normalized by limb length and expressed as a percentage score (excursion distance/limb length x 100).[15] A composite score was calculated (mean of the normalized reach distances in the anterior, posterolateral, and posteromedial directions). A passing score of at least 94% for each reach direction or the composite score was considered as passing.[16]

3. The Vail Hip Sport Test (VHST) is a safe method to observe muscular strength, endurance, and the ability to produce and absorb multi-planar forces without kinetic collapse.[4] Each portion of the test battery is designed to stress the hip joint and identify functional deficits. The VHST consists of 4 dynamic functional activities using the resistance of a Sportcord®. Participants performed tests bilaterally using methods previously reported[4] and earned points for the successful completion of 4 functional tasks over time. Although the reliability of this test battery using the above scoring system has not been reported, an earlier study suggested that a VHST score of 17/20 or better during the final phase of rehabilitation following hip arthroscopy was necessary for athletes to return to unrestricted practice to train and prepare for competition.[17] Therefore, a passing score was set at 17/20.
4. Isometric hip abduction strength was measured using a hand-held dynamometer (Power Track II™ Commander; JTech Medical, Midvale, UT) using established methods.[18] The mean of 3 trials was calculated and a LSI of strength was determined. A passing strength LSI score of 90% was set.[4]
5. Patient-reported Outcome scores were the Hip Outcome Score – Sports Subscale (HOS-SSS), Nonarthritic Hip Score (NHS), and International Hip Outcome Tool (iHOT-12). The maximum score for all patient-reported outcomes scores was 100. The HOS has strong content and construct validity,[19] reliability, and responsiveness[20] in younger active patients with nonarthritic intra-articular hip pain.[21] The NHS is used to assess younger active patients with nonarthritic hip pain and has content and construct validity and reliability.[22] The iHOT-12 measures health-related quality of life in young, active patients with hip disorders and is reliable, shows face, content, and construct validity, and is responsive to clinical change.[23]

FINDINGS

Each of the participants varied in their functional and patient-reported abilities. Participant 2 was unable to complete any of the hop tests on the surgical limb at 3 months postsurgery while the other two participants achieved passing LSI scores on some but not all hop tests (Table 3). All 3 participants were able to perform the SEBT but passed fewer portions of the SEBT on the surgically operated limb (Table 4). No participant achieved a passing SEBT composite score. Considering the nonsurgical limb, participants 1 and 2 were able to attain a passing score on one component of the SEBT (Table 4). No participant achieved a passing score on the VHST (Table 5). Hip abductor muscle strength also varied among participants (Table 6) with participant 1 the only participant to show a passing LSI. Participants 2 and 3 demonstrated LSI hip abductor muscle weakness. Patient-reported outcomes also demonstrated large variability among participants, with 3-month postsurgical scores ranging from 14 to 89 (Table 7). When compared with presurgical scores, the majority (7/9 scores) of outcome scores had improved 3 months postoperatively for the 3 participants. Only the HOS-SSS score for participants 2 and 3 was worse at 3 months compared to the presurgery scores. A score of 100 on any of the patient-reported outcomes indicates no self-reported limitation. There is limited evidence to aid interpretation of any score less than 100 on these self-reported measures. However, a self-reported normal score on the HOS-SSS in a small group of individuals status post hip arthroscopy has been shown to be 94/100 (range 78-100).[19] The highest score achieved on the HOS-SSS at 3 months in the current study was 63/100 (Participant 1).

DISCUSSION

The purpose of this case series was to describe the functional performance of 3 recreationally active women 3 months after hip preservation arthroscopic surgery and to identify variability in outcomes across individuals. There were two main findings. First, variability across participants was a common finding in all domains of assessment with the least variability between participants' ability to pass the VHST (none passed) and the most variability in their ability to complete hop testing. Second, residual deficits in functional performance and patient-reported outcomes were still present at 3 months postsurgery. However, hip abductor strength asymmetry was present in 2 of the 3 participants at 3 months follow-up. These findings highlight the need for a thorough assessment of lower extremity function using tests and measures that represent multiple domains of function to assist in decision-making regarding return to sporting activity even in recreationally active women and to inform the need for additional rehabilitation visits to achieve that goal.

Variability in Performance

Variability in lower extremity functional performance and patient-reported outcomes was present among the participants, suggesting that a 3-month postsurgical time point cannot be expected to lead to stable performance outcomes in all patients. Specific to hop testing, participant 2, who was tested earliest in her recovery (1½ to 2½ weeks earlier than the other participants) and had the lowest presurgery activity level, was unable to perform any hop tests. In comparison, participant 3 with the highest presurgery activity level achieved a passing score on 3 of 4 hop tests. Variability in performance and outcomes among participants is consistent with a previous study that showed bilateral impairments in individuals who performed single hop testing 12 to 24 months following hip arthroscopy.[24] Even in the nonsurgical limb, participants in the current study showed hop distances lower than those seen in healthy women of similar age to participants in this study.[25] Kollock et al[25] assessed young, healthy recreationally active women whose hop distances were 15% to 70% greater than the averages recorded for our participants' nonsurgical limbs. These differences may be a result of subjectively reported pain in the surgical hip during the nonsurgical hop tests in our participants, possibly due to the non-stance leg helping to propel the body forward when hopping. Differences could also be a result of contralateral weakening of the nonsurgical limb due to inactivity during the months prior to or following surgery. The results of the current study also support that a battery of hop tests may be necessary to show

Table 3. Results for the Hop Tests (passing scores in bold type)

Test Categories/Specific Tests	Participant	Surgical limb	Nonsurgical limb	Limb Symmetry Index
Hop Tests (passing score is ≥ 90% LSI)				
Single hop for distance (cm)	1	90.3	101.3	89.1
	2	Unable to complete	85.3	0.0
	3	85.0	89.8	**94.7**
6 meter timed hop (sec)	1	2.8	2.6	**92.9**
	2	Unable to complete	3.1	0.0
	3	3.7	3.1	83.8
Triple hop for distance (cm)	1	267.3	286.5	**93.3**
	2	Unable to complete	96.5	0.0
	3	260.8	264.0	**98.8**
Cross-over hop for distance (cm)	1	Unable to complete	253.5	0.0
	2	Unable to complete	244.0	0.0
	3	252.0	221.8	**113.6**

Abbreviation: LSI, Limb Symmetry Index

Table 4. Results for the Star Excursion Balance Test (passing scores in bold type)

Test Categories/Specific Tests	Participant	Surgical limb	Nonsurgical limb
Star Excursion Balance Test (passing score is ≥ 94% of limb length)			
Anterior (% limb length)	1	92.3	**99.0**
	2	85.6	88.6
	3	86.0	85.5
Medial (% limb length)	1	83.5	87.0
	2	**95.8**	92.8
	3	93.6	90.3
Posteromedial (% limb length)	1	78.0	89.0
	2	**99.4**	**100.6**
	3	90.3	88.2
Posterolateral (% limb length)	1	76.9	78.0
	2	83.8	86.2
	3	80.7	81.7
Composite (% limb length)	1	82.4	88.7
	2	89.6	91.8
	3	85.7	85.1

deficits at 3 months. Participant 1 was unable to complete the crossover hop for distance test but was able to pass two of the other 3 hop tests and came close to passing the third. It is not clear whether the crossover hop for distance test is testing a different aspect of functional performance than the other hop tests or is simply more challenging. This should be explored in future studies.

Variability in performance was also present in the SEBT. The youngest participant, participant 1, demonstrated the lowest SEBT scores over most of the reach directions. On the other hand, participant 2, who was unable to perform any of the hop tests, scored highest in the medial and posteromedial SEBT reaches. Regardless, all participants in the current study would be classified as having a higher risk of injury based on their SEBT scores.[13] The participants also had less than a 94% composite reach for their nonsurgical limbs, identifying a bilateral factor to their functional performance deficits. Variability among participants was also seen in the VHST scores. None of the participants in the current study was able to reach the established passing score suggesting that the participants were not yet ready to begin dynamic multi-planar activities, a finding consistent with the hop and SEBT measurements. Interestingly, the hop test scores and the VHST scores mapped well together with participant 2 scoring lowest and participant 3 scoring highest on both tests. The VHST may therefore capture similar functional constructs as the hop tests and this should be

Table 5. Results for the Vail Hip Sport Tests

Test Categories/Specific Tests	Participant	Surgical limb
Vail Hip Sport Tests (passing scores is ≥ 17 points)		
Single Knee Bends (6 max points)	1	6
	2	2
	3	2
Lateral Agility (5 max points)	1	2
	2	1
	3	5
Diagonal Agility (5 max points)	1	0
	2	1
	3	5
Forward Lunge on Box (4 max points)	1	4
	2	2
	3	4
Total Score	1	12
	2	6
	3	16

explored since hop testing can be quite arduous for patients to complete postsurgically.

Variability among participants was also present for hip abductor strength. Two out of 3 participants demonstrated isometric hip abduction weakness. A recent study by Cobb et al[26] of 108 healthy men and women using the same strength testing method used in the current study found a mean of 0.82 ± 0.20 Nm/kg hip abduction strength. All participants in the current study demonstrated much lower bilateral strength means (see Table 6). Therefore, caution should be taken when comparing isometric hip abduction strength bilaterally. A therapist using limb symmetry index in the presence of bilateral hip strength weakness might underestimate strength deficits. Thus, use of normative values rather than a limb symmetry index for interpreting strength deficits may be more valid for clinical decision-making.

The variability in performance among participants may partly be explained by demographic variability of the participants themselves. However, while it is tempting to attribute variance in performance to a single factor such as age or surgical repair, it is likely that a complex interaction among factors influenced postsurgical performance. This complex interaction may impact healing rate and the need for additional rehabilitation before recommending return to sport activity. Careful consideration of such factors and their potential influence should be a focus in future studies with a larger cohort of subjects but should be considered when making discharge decisions for individual patients.

Return to sporting activity decision-making

Although protocols have been described to guide postoperative rehabilitation following hip arthroscopy,[4,17,27-33] understanding the appropriate time at which to allow any athlete to return to higher level sporting activities continues to be challenging. Readiness for return to sport specific activities is further complicated by the lack of evidence regarding functional performance in patients following hip arthroscopy. Differences between the operated and nonoperated limb were found across participants in the current study and were highlighted by non-passing scores on the majority of hop tests and the SEBT. Asymmetry is thought to be a driving factor for poor functional performance in athletes following surgery[34,35] and may be an important factor to evaluate before returning to sport. For example, components of the SEBT have been shown to be valid predictors of lower extremity injury[16] and to be influenced by variations in hip joint kinematics and muscle function.[36] Female high school basketball players with decreased normalized composite reach distances of less than 94% have been shown to be 6.5 times more likely to have a lower extremity injury.[16] However, an acceptable threshold of asymmetry across multiple domains of functional performance before allowing an athlete to return to sport activity remains unknown. While future studies may offer insight into return to sport as a function of the specific sport itself, the small sample and diversity of recreational sport activity engaged in by these participants (eg, swimming, running, softball, snowboarding) precludes any recommendation at this time.

Using pre- and postoperative comparisons of both patient-reported outcomes and sports-specific activity may provide valuable information in comprehensively assessing successful return to sport activity.[37] Overall, participants in the current study reported varying scores on each outcome tool. In addition, when compared with preoperative scores, the majority of patient-reported outcome scores had improved at 3 months. The two scores that decreased were from the HOS-SSS for participants 2 and 3. The

Table 6. Results for Hip Abduction Isometric Strength (passing scores in bold type)

Test Categories/Specific Tests	Participant	Surgical limb	Nonsurgical limb	LSI
Hip Abduction Isometric Strength (passing score is ≥ 90% LSI)				
Normalized hip abduction strength (Nm/kg)	1	0.52	0.45	**115.6**
	2	0.41	0.55	74.5
	3	0.37	0.49	75.5

Abbreviation: LSI, Limb Symmetry Index

Table 7. Patient-reported Outcomes Pre- and Postsurgery

Test Categories/Specific Tests	Participant	Presurgical Scores	3-month Scores
Patient Reported Outcomes			
Non-Arthritic Hip Score	1	51	89
	2	58	68
	3	25	54
Hip Outcome Score – Sports Subscale	1	19	63
	2	42	36
	3	17	14
International Hip Outcome Tool	1	12	87
	2	37	38
	3	1	29

HOS-SSS represents a patient's self-reported ability to perform sports movements such as cutting and lateral movements. These scores highlight the participants' perception that they were unable or unprepared to perform these sports-related movements 3 months postoperatively, which was consistent with hop and SEBT test results. However, the 3 participants had completed their structured rehabilitation protocols. Further elucidation of the instructions and activities that should fill the gap between the end of structured physical therapy and return to sport activities is needed to help guide return to sport decisions.

Limitations

A limitation of this study lies in the nature of a case series and that participants were female. However, participation of females in sports continues to increase.[38] To improve generalizability, further research should consider a more diverse sample that would include patients from more than one surgical practice. A second limitation is that participants in this study completed all functional performance and strength tests in the same testing order. This was chosen to maintain consistency across subjects in the case series. However, it is possible that consistently performing the hop test first may have negatively impacted performance on the other tests.

CLINICAL RELEVANCE

The current study identified varying bilateral functional abilities in 3 recreationally active women 3 months after hip preservation arthroscopy, suggesting that a strict 3-month timeframe may not be appropriate to inform return to sport decisions for patients. To potentially decrease the likelihood of reinjury, physical therapists, athletic trainers, and orthopedic surgeons should recognize that strict adherence to a 3-month postsurgical timeframe for allowing return to sporting activities may not be appropriate for all individuals. Further studies are recommended to examine an appropriate time period needed for rehabilitation for patients after hip preservation arthroscopic surgery.

CONCLUSION

This study suggests that lower extremity functional performance deficits and patient-reported outcomes are quite variable 3 months post hip arthroscopy in recreationally active females. Further studies are warranted to explore this in larger samples, across sports, gender, and age groups.

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Evidence-based Evaluation and Treatment of a Patient with Plantar Heel Pain: A Case Report

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ABSTRACT

Background: Plantar heel pain (PHP) is a common musculoskeletal complaint treated by physical therapists. Though clinical practice guidelines exist for evaluation and treatment of PHP, a dearth of case-specific studies describe the clinical application of these guidelines. In this case report, the various physical, pathoanatomical, and social features of PHP are presented with a multimodal, evidence-based treatment approach. **Description:** The patient is a 63-year-old female presenting with a complaint of chronic unilateral plantar heel pain. The initial onset of symptoms was 6 months prior to the examination. Using recent clinical practice guidelines, orthopedic physical therapy management was applied. **Outcome:** After 7 visits, the patient reported significant improvement in pain and function, and returned to her baseline activity. These improvements were maintained or improved at 7-month follow-up. **Conclusion:** A multimodal approach informed by the best available evidence was successfully used for management of PHP.

Key Words: clinical reasoning, exercise, plantar fasciitis, manual therapy

BACKGROUND

Plantar fasciitis is a common musculoskeletal impairment that results in heel and arch pain in both the athletic population[1] and the general population.[2] Plantar fasciitis involves a degenerative irritation[3] of the plantar fascia that leads to heel and arch pain, primarily after a period of nonweight bearing.[4] Roughly 2 million Americans suffer from plantar fasciitis, and approximately 10% of the population will seek treatment for it in their lifetime.[5] An understanding of the contributing factors involved in the pathomechanics can aid clinical decision-making for conservative intervention.

The plantar fascia is a flat band of dense connective tissue with a proximal attachment on the medial calcaneal tuberosity. The fascia fans out into 5 distinct strands at the mid-metatarsal level as it extends to the distal aspect of the forefoot where it attaches to the plantar skin, the plantar plate at the base of the proximal phalanges, and ligaments of the metatarsophalangeal (MTP) joints.[2] The fascia can be anatomically divided into 3 bands: the medial, the lateral, and the central. The central band is considered the most important in terms of function and structure.[4] The plantar fascia has a variety of functions in the foot. The fascia supports the medial longitudinal arch of the foot during weight bearing. During weight bearing, the tibia internally rotates and the arch lengthens and flattens. The plantar fascia resists this arch motion and helps to maintain arch height. The arch is also supported by the windlass mechanism, first described by Hicks.[6] In short, dorsiflexion of the toes in weight bearing causes the plantar fascia to wind tighter around the metatarsal heads. This results in increased tension in the plantar fascia that in turn increases the height of the arch. The activation of the windlass mechanism stabilizes the arch to prepare the foot for propulsion during ambulation.[4] The intrinsic muscles of the feet can reduce loading of the plantar fascia and are also active during the propulsion phase of gait.[4] Extrinsic muscles of the foot including the flexor hallucis longus, flexor digitorum longus, peroneus longus and brevis, and posterior tibialis also have tendons that enter the plantar arch and provide additional truss support. These biomechanical implications highlight potential identifying factors and treatments of plantar fasciitis.

Common etiological factors in the development of plantar fasciitis are those associated with mechanical overload of the plantar fascia, and can be delineated into intrinsic and extrinsic variables.[4] Intrinsic factors include decreased height of the medial longitudinal arch, increased rate of tissue loading, or both.[4] Individuals with a greater body mass index (BMI) transmit a greater tibial loading force into the dorsal talus at the convex aspect of the medial longitudinal arch of the foot. Equal and opposite ground reaction force is imposed on the plantar aspect of the foot at both ends of the longitudinal arch at the calcaneus and the MTP joints of the forefoot. The increased 3-point bending of the foot places greater tensile stress on the plantar fascia. This mechanism describes why individuals with a greater BMI experience greater tensile stress within the plantar fascia during ambulation.[7] Prichasuk, in a heel pad thickness and plantar heel pain correlation study reported, that individuals with a greater BMI were more likely to experience plantar heel pain compared to those with lower BMI.[8]

Individuals with a flattened, elongated arch known as pes planus place greater tensile stress on the plantar fascia.[9] Excessive subtalar pronation and insufficient talocrural dorsiflexion are also intrinsic factors that place greater tensile stress on the plantar fascia. Studies by Irving et al[10] and Cornwall and McPoil[11] support that individuals with a pronated foot including subtalar pronation posture were more likely to develop plantar fasciitis. Solan et al[12] reported that shortening and tightness of the plantar flexor muscles, such as the gastrocnemius, imposed increased strain on the Achilles tendon and the plantar fascia. Additionally, Riddle et al[13] determined reduced ankle dorsiflexion and obese BMI levels were each independent risk factors for developing plantar fasciitis. For normal ambulation, 10° of ankle dorsiflexion with the knee extended is required. If dorsiflexion is limited, excessive subtalar pronation and midfoot dorsiflexion may be used as a compensatory mechanism to allow forward progression of the leg, thus increasing the stress on the plantar fascia. Additionally, the presence of forefoot varus may drive foot pronation and be a factor in the development of plantar fasciitis. With the distal aspect of the foot inclined towards the midline, the lateral ground reaction force may cause an eversion moment that increases foot pronation, thereby increasing the tensile stress imposed on the plantar fascia.[14]

The extrinsic factors that contribute to the development of plantar fasciitis include improper footwear or a rapid increase in the frequency, duration, or intensity of weight-bearing activities. Footwear that

lacks ample cushioning and arch support can cause increased stress to the plantar fascia.[15] Females may be at even greater risk given the popularity of women's footwear that does not provide cushioning or arch support.[16] Finally, a drastic increase in the frequency, duration, or intensity of an activity that requires repetitive loading of the foot can lead to fatigue of the muscles that support the arch, thereby overstraining the plantar fascia.[13]

Conservative treatment is the first step for treating plantar fasciitis and generally includes multiple interventions such as plantar fascia and triceps surae stretching,[17] ankle dorsiflexion night splints,[18] anti-pronation taping,[19] improved footwear,[20] use of foot orthoses,[21] and manual physical therapy to increase ankle dorsiflexion.[5] Wolgin et al[22] reported 82 of 100 patients treated conservatively for plantar fasciitis had good long-term results. In this study, the conservative treatments included triceps surae and plantar fascia stretching, custom orthoses, nonsteroidal anti-inflammatories (NSAIDs), injections, heat, ice, and night splints.[22] Similarly, Davis et al reported favorable outcomes following conservative treatment that consisted of relative rest, NSAIDs, heel cushions, Achilles tendon stretching, and injections in 89.5% of patients at an average follow-up of 29 months.[23] In the majority of cases, conservative treatment leads to resolution of symptoms in less than 12 months.[24]

If conservative treatment fails, additional treatment options include corticosteroid injection and surgery. Corticosteroid injection for the plantar fascia remains controversial, with numerous reported instances of plantar fascia rupture and additional long-term side effects that can be difficult to treat.[25] Surgical intervention involves partial to complete resection of the plantar fascia and the removal of any existing heel spurs.[26] Complete resections lead to more pronounced biomechanical consequences, such as loss of medial longitudinal arch height, decreased arch stiffness, the possibility of developing midfoot osteoarthritis in the future, and increase in pes planus foot position. Therefore, individuals with pronounced pes planus may not benefit from surgical resection. Otherwise, positive outcomes have been reported in both short- and long-term follow-up.[27] A recent update of Clinical Practice Guidelines (CPGs) provides evidence based examination procedures and interventions for the conservative treatment of plantar fasciitis.[5] The purpose of this case report is to describe the application of evidence from the CPGs to examination findings, clinical reasoning, and conservative treatment for a patient with plantar fasciitis.

CASE DESCRIPTION

The patient was a 63-year-old female who worked as a housing program coordinator and was required to wear dress shoes while at work. She was diagnosed with plantar fasciitis of the left foot by her primary care physician and was prescribed stretches for ankle dorsiflexion, intrinsic foot muscle strengthening, and advice to roll her foot on a frozen water bottle. At her 6-month follow-up appointment, her symptoms had not resolved and she was referred to outpatient physical therapy. At the physical therapy evaluation, the patient described symptoms as a sharp left heel pain when taking the first steps in the morning or after long periods of nonweight bearing. The patient was morbidly obese, with a BMI of 41.16 kg/m^2. She had not experienced any foot pain previously and did not report any sudden increase in her activity level when her symptoms began. Aggravating factors included walking or standing for longer than 30 minutes and participating in Zumba exercise classes. At the time of evaluation, she was not able to participate in exercise classes and was limited with walking longer distances throughout her work day due to her heel pain. The patient noted that wearing tennis shoes seemed to help decrease her heel pain but using simple store bought plantar fasciitis insoles had no effect on her heel pain. She rated her current pain as 2/10 on the 11-point Numerical Pain Rating System (NPRS). She reported her worst pain as 8/10 in the mornings and her least pain was 0/10. No diagnostic medical imaging had been performed on the patient's left foot. The patient's goals for physical therapy were to decrease her left heel pain, improve her standing and walking tolerance, and participate in her Zumba exercise class.

The patient's review of systems to identify red flag symptomology that might suggest cancer or systemic infection was negative. She denied recent bowel or bladder changes, history of cancer, night pain, saddle anesthesia, recent weight loss, nausea, vomiting, or fever.[28] Following the subjective interview, a physical examination was performed. Differential diagnoses included plantar fasciitis, calcaneal stress fracture, tarsal tunnel syndrome, proximal plantar fibroma, and fat pad atrophy throughout the examination procedure.

SELF-REPORTED OUTCOME MEASURES

The patient completed the Lower Extremity Functional Index (LEFS) to measure her perception of heel pain's influence on her ability to perform activities of daily living (ADLs). The LEFS is a 1-page questionnaire that consists of 20 questions, with lesser scores demonstrating greater disability. A recent systematic review established the LEFS as having excellent psychometric properties, including test-retest reliability (ICC = 0.85 – 0.99) and responsiveness (effect sizes > 0.8).29 The minimal clinically important difference (MCID) for the LEFS has been reported as 9 points in patients with lower extremity musculoskeletal conditions.[29] The patient completed the LEFS with a score of 41/80 on initial examination.

Additionally, the patient completed the Foot and Ankle Ability Measure (FAAM) to assess physical performance affected by her foot pain. The FAAM consists of an ADL Subscale with 21 items and a Sports Subscale with 8 items that are each scored on a Likert system. Greater scores represent an increased level of physical ability. Each subscale asks the patient to rate their current level of function subjectively from 0 to 100%, with 100% representing their level of function prior to their foot or ankle problem. The FAAM has excellent test-retest reliability for the ADL (ICC = 0.87) and the Sports (ICC = 0.89) subscales.[30] The MCID for the FAAM has been reported as 8 points for the ADL Subscale and 9 points for the Sports Subscale.[30] The patient completed the FAAM with an ADL score of 76.2% and self-rated ability of 80%. Her sports score was 31.3% with a self-rated ability of 50%. The Sports Subscale of the FAAM was administered due to her goal of returning to Zumba exercise classes.

PHYSICAL EXAMINATION

A body weight squat was used as a functional movement assessment, which revealed bilateral genu valgus and bilateral subtalar joint pronation that was greater on the left foot compared to the right. The patient was unable to balance for more than one second on her left foot due to pain. Gait analysis revealed an antalgic gait favoring her right side and overt pronation of her left foot. She was positioned in prone to test for triceps surae extensibility by passively dorsiflexing her ankle. Substantial soft tissue restriction limited dorsiflexion of the left ankle. Significant forefoot varus of the left foot was visualized in this position. She exhibited decreased active ankle dorsiflexion range of motion

(ROM) of 0° bilaterally and passive dorsiflexion range at 2° bilaterally. Ankle dorsiflexion was measured with the knees extended to mimic the functional position during gait. Her ankle plantar flexion, inversion, and eversion ROM measurements were within normal limits for each ankle.

Plantar fibroma was included in the differential diagnoses based on the location of pain. Palpation of the plantar aspect of the calcaneus to the mid-tarsal region of the foot was performed to identify any thickened nodules.[31] No nodules were present. Palpation revealed tenderness of the medial plantar aspect of her calcaneus. Calcaneal fracture was a differential diagnosis and was screened using the Ottawa Ankle Rules. The patient was not tender to bony palpation at the base of the fifth metatarsal or at the navicular. She could bear weight on her left foot while ambulating in the clinic. Therefore, a calcaneal fracture was ruled out.[32] Her lower extremities and ankles were tested for muscle strength using manual muscle testing procedures. She scored 5/5 globally with this testing.

Tarsal tunnel syndrome was included in the differential diagnosis due to complaints of medial plantar pain and worsening of symptoms during weight-bearing activities.[33] The tarsal tunnel test was performed to rule out tarsal tunnel syndrome.[34] In sitting, the patient's ankle was maximally dorsiflexed and everted with full extension of all 5 toes. This position was maintained for 10 seconds while the tarsal tunnel was percussed repeatedly. Her symptoms were not reproduced, nor did the patient experience any local tenderness. The Windlass Test was performed in weight bearing to rule in plantar fasciitis.[35] She stood on a 4-inch box with the head of the first left metatarsal head resting on the box with the edge of the box aligned with the first MTP joint line. She was instructed to bear weight equally through each foot as the therapist passively extended the first MTP joint. Her heel pain was reproduced during the Windlass Test on her left foot. Finally, the Foot Posture Index (FPI) was used to identify the contribution of pronated foot posture on the patient's chronic heel pain.[10] She scored a +10 on the FPI (Table 1), indicating significant pronation of the left foot that could exacerbate plantar fasciitis.[10] Figures 1-6 depict the patient's specific postural elements that were scored on the 6 criteria for the FPI.

CLINICAL WORKING DIAGNOSIS

Following the subjective history and the objective physical examination, plantar fasciitis of the left foot was established as a working diagnosis. Subjective reports consisting of heel pain with the first step in the morning, after a period of inactivity, and after prolonged weight bearing supported this diagnosis.[5] Objective findings including tenderness to palpation of the insertion of the plantar fascia at the medial calcaneal tubercle, a positive Windlass Test, limited active and passive ankle dorsiflexion ROM, a greater FPI score, and a greater BMI, further supported this clinical working diagnosis.[5] The absence of a dense nodule at the mid-tarsal level of the plantar aspect of the foot suggested that plantar fibroma could be ruled out.[31] A negative tarsal tunnel test suggested that tarsal tunnel syndrome could likely be ruled out.[34] Fat pad atrophy was ruled out due to the absence of complaints of pain at rest, pain at night, and bilateral foot pain.[36]

INTERVENTIONS

Based on the working diagnosis and the lack of formal conservative treatment to date, physical therapy intervention was deemed appropriate. To address the identified soft tissue restrictions, the patient was prescribed a stretching routine that targeted the posterior muscles of the leg, Achilles tendon, and plantar fascia of the left foot. She was instructed to face a wall and step forward with her right foot while leaving her left knee fully extended to promote more effective stretching of the gastrocnemius muscle. Importantly, the plantar fascia was stretched in this position by placing a small towel beneath the left toes to activate the windlass mechanism (Figure 7). She was instructed to keep both feet facing forward and to lean into the wall with her arms while bending her front knee until she felt a gentle stretch in her posterior leg and the plantar aspect of her foot. She was instructed to hold this stretch for 3 sets of 45 seconds, 3 times daily. A second stretch was prescribed as described above, except the back leg was to remain bent as the patient leaned into the wall to promote more effective stretching of the soleus muscle. The patient was also prescribed a stretch to be performed in bed before she took her first step in the morning. She was instructed to assume a long sitting position, wrap a towel around the ball of her foot, and pull her forefoot towards her while keeping her knee straight. This stretch was to be held for 3 sets of 30 seconds each morning. Additionally, the patient was prescribed a plantar fasciitis night splint to be worn every night (Figure 8).

Instrument assisted soft tissue mobilization and cross friction massage were performed to areas of soft tissue restriction at the left medial head of the gastrocnemius muscle and directly to the plantar fascia.[37] Both Looney et al[37] and Cleland et al[38] demonstrated the benefits of soft tissue work in these areas to decrease pain and improve function in individuals with plantar fasciitis. To improve the patient's talocrural dorsiflexion restriction, a grade IV anterior-to-posterior talocrural joint mobilization was performed during the first 4 visits. The patient was positioned in supine as the therapist used one hand to stabilize the lower leg and grasped the anterior, medial, and lateral talus with the other hand to apply an anterior-to-posterior force to the talus as the therapist passively dorsiflexed the ankle with his thigh (Figure 9).[38] Additionally, a joint mobilization with the patient in half kneeling was used to improve her left ankle dorsiflexion. The patient knelt with her right knee on a pillow and assumed a lunge position with her left hip and knee flexed to 90° with her left foot flat on the ground. The therapist applied a stabilizing anterior-to-posterior force over the anterior talus while the patient shifted her weight forward into painfree ranges of ankle dorsiflexion and the therapist imposed an anterior glide of the distal leg (Figure 10). This was repeated for 3 sets of 10 repetitions.

From a mechanistic view, intrinsic plantar muscles decrease the stress placed on the plantar fascia during mid-stance and propulsion of the gait cycle by providing dynamic support to the medial longitudinal arch of the foot.[38-40] The FPI, administered with the patient in standing, and gait analysis revealed the patient had a flattened arch. Therefore, strengthening of the intrinsic plantar muscles of her foot was prescribed to reduce stress on the plantar fascia.[39] A hand towel was placed on the ground beneath the patient's foot. The patient was instructed to repeatedly pull the towel towards her heel using her toes while keeping her foot on the ground. This was performed for 3 sets of 10 repetitions. At the second visit, a trial of anti-pronation taping using kinesiotape was performed on the left foot. The skin was cleaned and free of oils or lotions. A strip of approximately 5 inches of kinesiotape was cut with the ends rounded off to increase wear time.[41] The tape was placed beginning on the dorsum of the left foot, wrapped and circled laterally around the left foot to resist subtalar pronation using 75% tension. The tape was anchored by finishing the wrap around the ankle at the level of the medial malleoli. The patient wore the tape for approximately 5 days and reported

Table. Foot Posture Index (FPI).[53] Underlined items represent the patient's left foot score for each item (+10 total).

	-2 points (supinated)	-1 point	0 points (neutral)	+1 points	+2 points (pronated)
Talar Head Palpation	Talar head palpable on lateral side/but not on medial side	Talar head palpable on lateral/ slightly palpable on medial side	Talar head equally palpable on lateral and medial side	Talar head slightly palpable on lateral side/palpable on medial side	Talar head not palpable on lateral side/but palpable on medial side
Supra and infra lateral malleoli curvature	Curve below the malleolus either straight or convex	Curve below malleolus concave, but flatter/more than the curve above malleolus	Both infra and supra malleolar curves roughly equal	Curve below the malleolus more concave than curve above malleolus	Curve below the malleolus markedly more concave than curve above malleolus
Calcaneal frontal plane position	More than an estimated 5° inverted (varus)	Between vertical and an estimated 5° inverted (varus)	Vertical	Between vertical and an estimated 5° everted (valgus)	More than an estimated 5° everted (valgus)
Bulging in the region of the TNJ	Area of TNJ markedly concave	Area of TNJ slightly, but definitely concave	Area of TNJ flat	Area of TNJ bulging slightly	Area of TNJ bulging markedly
Congruence of medial longitudinal arch	Arch high and acutely angled towards the posterior end of the medial arch	Arch moderately high and slightly acute posteriorly	Arch height normal and concentrically curved	Arch lowered with some flattening in the central position	Arch very low with severe flattening, arch contacts ground
Abduction/ adduction of forefoot on rear foot	No lateral toes visible. Medial toes clearly visible	Medial toes clearly more visible than lateral	Medial and lateral toes equally visible	Lateral toes clearly more visible than medial	No medial toes visible. Lateral toes clearly visible

Abbreviation: TNJ, talonavicular joint

no decrease in symptoms. Therefore, anti-pronation taping was not used during the remainder of the treatment sessions. After 5 weeks of treatment, the patient was fitted for custom orthoses by another physical therapist in the same clinic. Sulcus length foot orthoses with increased arch fill were fitted to the patient. Due to the patient's need to wear dress shoes at work, the orthoses were not full length. Ideally, medial forefoot posting would have been added to the full-length orthoses to address her forefoot varus. Education on wearing supportive footwear that could accommodate the custom orthoses was provided at this time.

The patient's home exercise program throughout treatment included the following:

- triceps surae/plantar fascia stretching for 3 sets of 45 seconds, 3 times per day;
- seated towel stretches before first step in the morning, 3 sets of 30 seconds, every morning;

Figure 1. Observation of talar head position. Small circle indicative of the lateral talar head position and the larger circle indicates the weight-bearing position of the talar head medially.

Figure 2. Observation of the supra and infra lateral malleolar curvature of the involved left lower extremity in weight bearing. A more acute curve is visualized inferior to the lateral malleolus due to the abduction of the foot and eversion of the calcaneus.

Figure 3. Observation of the calcaneal frontal plane position. More than an estimated 5° everted (valgus).

Figure 4. Observation indicating bulging in the region of the talonavicular joint represented by the circled area. Rearfoot pronation demonstrated by adduction of the head of the talus.

Figure 5. Observation of the height and congruence of the medial longitudinal arch of the involved lower extremity. A low arch is observed with severe flattening.

- towel scrunches for 3 sets of 10 repetitions, 1 time per day;
- wearing the night splint every night; and
- wearing the custom foot orthoses with supportive footwear during any weight bearing.

OUTCOMES

The patient was seen for a total of 7 visits over the course of 7 weeks. At 2 weeks follow-up, she described her morning foot pain as greatly reduced after wearing the night splint consistently. At discharge from physical therapy, the patient showed improvements on the NPRS, the LEFS, the FAAM, and subjective performance of daily activities. Specifically, the patient reported use of the custom orthoses decreased pain with walking from 8/10 to 0/10 on the NPRS. Her LEFS score improved from 41/80 to 73/80 at discharge from physical therapy. Her FAAM score improved from 76.2% to 87.5% for the ADL Subscale and from 31.3% to 50% for Sports Subscale and her self-rated ability on the FAAM also improved from 80% to 90% for ADLs and from 50% to 80% for sports. An MCID was achieved on every patient-reported measure. Her left ankle active dorsiflexion ROM improved from 0° at evaluation to 5° at discharge. The patient was able to perform yoga in her home and was able to walk for more than 30 minutes at a time without any increase in her left heel pain. Overall, she reported a subjective improvement of "at least 90%" and demonstrated independence with her home exercise program.

At 7-month follow-up, patient reported outcomes remained favorable. Her NPRS score remained 0/10 with minimal flare ups of left heel pain that returned to 0/10 after performing her stretches. Her LEFS score improved from 73/80 to 75/80 and her FAAM ADL and Sports Subscales improved to 97.6% and 84.4%, respectively. Her self-rated ability on the ADL and Sports Subscales also improved to 95% and 90%, respectively. The patient had been able to continue practicing yoga without heel pain. It should be noted the patient was not participating in activities that required running or jumping. She completed the outcome measures based on her perceived ability to complete the activity items listed.

DISCUSSION

This case study describes the examination, clinical reasoning, and conservative treatment approach for a patient with heel pain caused by plantar fasciitis. Secondary to the complexity of multiple contributing factors to the diagnosis of heel pain, a thorough subjective interview and objective physical examination are needed to differentiate plantar fasciitis.[36] Conservative treatment should be the first line treatment in managing plantar fasciitis. Wolgin et al[22] and Davis et al[23] have demonstrated conservative treatment leads to good outcomes for most patients. The current CPG for the treatment of plantar fasciitis[5] with strongest evidence level (A) were informative in treatment considerations. The primary interventions used for this patient had grade A-level evidential support from the CPG including soft tissue and joint mobilization, targeted calf and plantar fascia stretching, the use of a night splint, the fabrication of a custom foot orthosis, and taping.

Manual therapy for plantar fasciitis is highly recommended by the CPG. Cleland et al showed patients with heel pain who received manual therapy including anterior to posterior ankle mobilizations, as well as soft tissue mobilizations of the plantar fascia and triceps surae, had better functional outcomes at 4-week and 6-month follow-up.[38] Gastrocnemius muscle tightness can affect ankle dorsiflexion ROM because it crosses the knee and the ankle joint. The gastrocnemius muscle is at its longest length and thus at its maximal tension with the knee in full extension just prior to heel-off. Knee flexion reduces the influence of the gastrocnemius muscle on ankle dorsiflexion as the length of the muscle is shortened. Baumbach et al[42] reported gastrocnemius muscle tightness does not affect ankle dorsiflexion at 20º of knee flexion. The patient's ankle dorsiflexion was only measured with the knee in full extension. A comparison of ankle dorsiflexion ROM with the knee extended versus flexed to 20º may have provided a more specific choice for intervention targeting joint mobilizations versus soft tissue mobilizations. Future research should seek to distinguish the difference between soft tissue- and joint-related ankle ROM restrictions.

The CPG cites numerous studies that suggest stretching of the triceps surae and the plantar fascia are beneficial. Rompe et al demonstrated that plantar fascia-specific stretching improved foot function at 2- and 4-month follow up.[17] Sweeting et al determined that plantar fascia-specific stretching may be more beneficial than Achilles tendon stretching only.[43] Digiovanni et al described a distinct improvement in pain and function of patients who performed both Achilles tendon and plantar fascia-specific stretching versus only plantar fascia stretching over their 16-week course of care.[44] Often, these components are stretched using different exercises. In this case, a novel stretching approach simultaneously addressed tightness of the triceps surae, the Achilles tendon, and the plantar fascia (see Figure 7). It is possible this stretch could lead to greater patient compliance as it reduces the amount of time spent performing home exercises. Although other interventions were used, stretching is the most cost effective and is an active treatment strategy the patient can incorporate throughout the day.

The CPG recommends patients who consistently have pain with the first step in the morning should use a night splint for 1 to 3 months.[5] Sheridan et al demonstrated night splints that provide a low load, prolonged ankle dorsiflexion stretch led to greater reductions in plantar fascia-related pain compared to those who did not use the night splints.[18] Lee et al used night splints in addi-

tion to foot orthoses and reported decreased pain at 2- and 8-week follow-up compared to use of foot orthoses alone.[45] Beyzadeoğlu et al reported a significant improvement in pain and function in those who used a night splint versus those who did not after 8 weeks.[46]

The use of prefabricated versus custom foot orthoses for plantar fasciitis is somewhat controversial. Hawke et al[47] found that custom orthoses were no more beneficial than prefabricated foot orthoses in terms of pain and function. Uden et al, however, demonstrated that custom foot orthoses led to reductions in pain and improvement in overall function for patients with plantar fasciitis.[21] A review by Hume et al reported moderate improvements of pain and function in favor of prefabricated versus sham foot orthoses.[48] The same review also found that custom semi-rigid foot orthoses had moderate positive effects compared to anti-inflammatories and stretching.[48] Prefabricated orthoses cost less and are easier to access for most patients. Since prefabricated orthoses provided no relief for this patient, she was fitted with custom sulcus length foot orthoses with increased arch fill. Given the patient's significantly pronated foot posture, the custom orthoses likely provided the external support needed to offload the tensile stress in her painful plantar fascia. The CPG recommends either option and does not state a preference between the two. Further studies are needed to determine if custom foot orthoses could serve as an improvement in care when prefabricated foot orthoses fail.

The CPG recommends that anti-pronation taping be used for immediate pain relief of up to 3 weeks.[5] Van Lunen et al demonstrated an immediate decrease in pain with walking and jogging using anti-pronation taping.[19] A systematic review by Landorf and Menz found strong evidence that taping reduced pain at 1 week and was of additional benefit when combined with stretching.[49] Another systematic review by van de Water and Speksnijder found taping reduced first step pain compared to no taping and overall pain reductions after 1 week compared to sham taping.[50] Tsai et al reported elastic taping of the gastrocnemius and plantar fascia led to decreased pain after one week compared to ultrasound and electrotherapy alone.[51] A trial of anti-pronation taping using kinesiotape was not effective in reducing the patient's heel pain with walking. The therapist had limited experience with this style of taping, which may have played a role in the absence of this treatment for the patient.

The evidence is weak at grade C in the CPG for the use of footwear such as rocker-bottom shoes and a rotation of shoes for those who work on their feet. Rocker-bottom shoes lessen the loading of the plantar aponeurosis.[52] Fong et al found that combining a rocker-bottom sole with foot orthoses immediately reduced plantar heel pain significantly more than using either intervention in isolation.[20] Sullivan et al determined that females may face greater difficulty with selection of footwear that is supportive of plantar heel pain.[16] Due to the dress code at the patient's work, she was required to wear dress shoes. The patient was educated on footwear selection that would accommodate her foot orthoses that also met her work's dress code. Changing her shoes to work-approved athletic shoes appeared to have been the most beneficial for the patient in terms of both pain reduction and improvement of function, as it allowed her to consistently wear her foot orthoses.

Intrinsic foot strengthening is not specifically recommended in the CPG. Cleland et al demonstrated strengthening of the plantar intrinsic muscles led to a reduction of heel pain.[38] Cheung et al identified greater atrophy of the intrinsic muscles in patients with plantar fasciitis compared to asymptomatic patients.[39] The patient was instructed in strengthening of the intrinsic muscles to improve dynamic arch support and decrease tensile stress on the plantar fascia during weight bearing.

Figure 6. Observation of abduction of the forefoot on the rearfoot for the involved left lower extremity.

Figure 7. Demonstration of the stretch for the involved posterior left leg muscles, Achilles tendon, and the plantar fascia with a towel roll under the toes so that the metatarsophalangeal joints are in extension to take advantage of the windlass mechanism.

CONCLUSION

The highest quality research regarding conservative treatment for heel pain caused by plantar fasciitis has been recently updated.[5] A combination of evidence-supported conservative interventions from the recent update to the CPG for plantar fasciitis are likely more effective than any one intervention on its own. This case highlights the importance of performing a thorough subjective history and detailed examination of the foot to identify a patient's exacerbating factors for plantar heel pain. The use of best available evidence to address patient-specific intrinsic and extrinsic factors led to a favorable outcome for this patient at discharge and at 7-month follow-up.

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Figure 8. Ankle dorsiflexion night splint used by the patient.

Figure 9. End range, anterior-to-posterior talocrural joint mobilization with ankle dorsiflexion over-pressure.

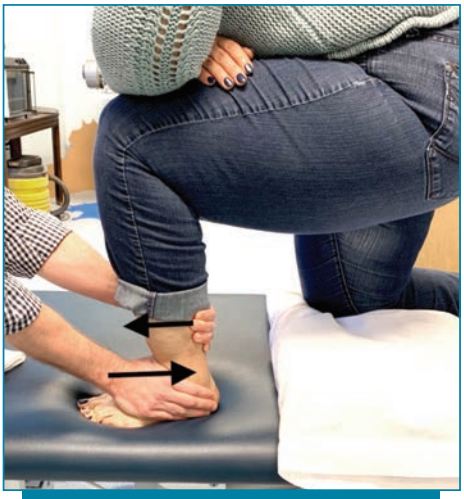

Figure 10. End range, anterior-to-posterior talocrural joint mobilization with stabilizing force over the anterior talus combined and a posterior-to-anterior directed force of the distal leg with patient in half-kneeling to improve ankle dorsiflexion.

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Wooden Book Reviews

Rita Shapiro, PT, MA, DPT
Book Review Editor

Book reviews are coordinated in collaboration with Doody Enterprises, Inc.

Fundamentals of Tests and Measures for the Physical Therapist Assistant, Jones & Bartlett Learning, 2020, $69.95
ISBN: 9781284147131, 403 pages, Spiral Cover

Author: Fruth, Stacie J., PT, DHSc, OCS; Fawcett, Carol, MEd

Description: This book presents an extensive foundation of patient care skills for physical therapist assistants (PTAs). It also provides in-depth coverage of methods for gathering objective data using standard tests and measures by physical therapists (PTs) as well as PTAs. **Purpose:** The book is not only abundant with information that is crucial to fostering the competence of a clinician, it specifically covers the topics of emotional maturity and levels of excellence that PTAs should be aware of. **Audience:** According to the authors, the intended audience is students, but both physical therapists and physical therapist assistants in my clinic have used it as reference on several occasions. It serves as a valued resource beyond its intended audience. **Features:** The book covers not just tests and measures, but also the interworkings of the clinic itself, including the relationships among the PTA, the supervising PT, and the patient. The book does an excellent job of preparing the scene for a proper cultivation of data and trust-building that must be present to maximize the potential of not only the patient's healing experience, but also the efficacy of the PT/PTA team. **Assessment:** This book offers the best of several popular books used in physical therapy education programs. Having the best information in one resource is advantageous.

Chris Noland, PTA, BS
Restore Therapy Services

Text and Atlas of Wound Diagnosis and Treatment, 2nd Edition, McGraw-Hill, 2019, $90
ISBN: 9781260440461, 541 pages, Soft Cover

Editor: Hamm, Rose L., PT, DPT, CWS, FACCWS

Description: This comprehensive book on wounds stands alone! The four major sections include the integumentary system, wound diagnosis, wound bed preparation, and biophysical treatment options. Illustrations accompany the text to provide additional information and enhance understanding. The second edition includes updated interventions and diagnostic methods and is an improvement over the 2015 first edition. **Purpose:** The purpose is to incorporate current, gold standard evidence so medical staff can work as a team and optimize patient care for the best outcomes. **Audience:** The book targets medical professionals who are at any stage of their career, from entry-level to experienced clinicians. Students can benefit greatly from using this as a reference or primary textbook. Contributing authors include an RN, five MDs, two researchers, and six PTs, each of whom contributes knowledge. **Features:** The first section covers anatomy, which serves as a foundation for explaining the healing process and conducting an evaluation. Wound diagnosis is covered extensively for accurate determination of the underlying cause. Wound treatment includes mechanical debridement, dressings, and in-depth explanations of biophysical agents. Numerous photographs, algorithms, and tables supplement the text. Case studies and chapter questions are tools to stimulate thinking. **Assessment:** This second edition provides updated information for clinicians to optimally and accurately assess and treat wounds. The authors encourage critical thinking and collaboration with other professionals. The inclusion of so many illustrations is appreciated for improved understanding.

Karin J. Edwards, MSPT
Providence Health & Services

Joint Structure and Function: A Comprehensive Analysis, 6th Edition, F. A. Davis Company Publishers, 2019, $139.95
ISBN: 9780803658783, 535 pages, Hard Cover

Editor: Levangie, Pamela K., PT, DPT, DSc, FAPTA; Norkin, Cynthia C., PT, EdD; Lewek, Michael D., PT, PhD

Description: Now in its sixth edition, this classic book has been a staple in physical therapy education for almost 40 years. This edition reflects the changes in the understanding of adult learning and learning preferences and includes enhanced images to support current concepts, chapter outlines with page numbers at the beginning of the chapter for more efficient navigation, and enhanced anatomy overview tables for quick review. It also has new chapter contributors, reflecting a renewed commitment to reaching out to a new generation of research educators, and a new member of the editorial team, Dr. Michael Lewek, associate professor in the physical therapy division at the University of North Carolina. This edition also includes a subscription to an interactive website, Kinesiology in Action, along with an ebook version. **Purpose:** The authors remain steadfast in their commitment to providing a strong, contemporary, and evidence-based foundation in the principles needed in the understanding of human movement and structure. For many years this book has served targeted the void in evidence-based kinesiological foundations upon which the understanding of typical and impaired movement should be based. The additions to this update and the integrated Kinesiology in Action site respond to the needs of contemporary students, while continuing the tradition of providing a preferred resource for those seeking current concepts in human movement. The changes add tremendous value for both students and instructors and allow for clinician understanding of clinical concepts and applications. **Audience:** The intended audience is those studying the science of human movement, which includes, but is not limited to, those studying physical therapy, kinesiology, biomechanics, and bioengineering. The book and the accompanying website meet the needs of these students. The authors along with the chapter contributors are all well-known and respected in the field of kinesiology, physical therapy, and biomechanics. **Features:** This well-organized book is divided into five sections and 14 chapters covering foundational concepts of human movement, functional anatomy, and

the complexity of human joint design. The book is well written, in depth, clear, and organized. The accompanying site engages students and allows for integration through practical application of the concepts. Although the book is complete, the Kinesiology in Action site is a positive addition that helps students understand clinical relevance with foundational concepts, expansion of these concepts through narrated videos, and patient application. This book is complete, covering all the relevant material needed for the study of human movement. **Assessment:** This is a very well-designed and well-written book on the relevant concepts of human movement. It has been, and will continue to be, the go-to book on joint structure, function, functional anatomy, and human movement and its clinical relevance and application. This edition is a necessary update and I highly recommend it for both new and seasoned clinicians. We can all learn more by staying up to date with the current, evidence-based concepts this book presents.

William Martinez, PT, OCS, FAAOMPT, CSCS
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Netter's Moving AnatoME: An Interactive Guide to Musculoskeletal Anatomy, Elsevier, 2020, $39.99
ISBN: 9780323567336, 188 pages, Soft Cover

Author: Marango, Stephanie, MD, RYT; McCulloch, Carrie, MD, RYT

Description: This book describes anatomy using yoga and Pilates movements to deliver the information in a functional manner. It also provides an introduction to yoga and Pilates and acts as a primer of movement describing kinesiology and muscle actions. It comes with an ebook and corresponding videos. **Purpose:** The authors' purpose is to use yoga and Pilates to study the body. According to the authors, both yoga and Pilates rely upon knowledge and functional anatomy as a mind and body connection. Incorporating these two practices into anatomy not only creates a better understanding of the human body, but also promotes an awareness of one's own body. The ebook and videos definitely enhance the book. **Audience:** The book appears to be written for clinicians at all skill levels, although having prior experience in yoga and Pilates is definitely helpful. Both authors are physicians and yoga/Pilates instructors who are cofounders of the functional anatomy for movement and injuries workshop. **Features:** Chapters detail the structure and function of each joint and muscle and its movements. They also discuss the range of motion, the muscles responsible for each movement, and the nerve innervation of these muscles. They then describe a Pilates or yoga exercise, with an accompanying video in the ebook. Some of the chapters have a clinical focus showing an example of a particular disorder or a box giving more specific information about a particular joint. A chapter at the end applies the principles discussed to sitting posture as well as dynamic posture for lifting and bending. **Assessment:** This book does a good job of presenting anatomical diagrams with practical applications for disorders and specific functional movement patterns. I don't do yoga or Pilates, which initially made me wary about this book, but the authors do a tremendous job of simplifying these movements. Hence, having access to the videos is a must for non-yoga/Pilates enthusiasts. This book serves as a basic and more functional version of the traditional Netter Anatomy books.

Christopher D. Blessing, MS, MPT, OCS, CSCS
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Procedures and Patient Care for the Physical Therapist Assistant, Slack Incorporated, 2019, $89.95
ISBN: 9781630914530, 222 pages, Soft Cover

Author: Memolo, Jennifer, MA, PTA

Description: This book describes patient care concepts and physical therapy procedures for physical therapist assistant (PTA) students and clinicians. It covers legal and ethical concerns as well as documentation and best practice issues. **Purpose:** The purpose is to provide a body of clinical application concepts for building students' initial knowledge base in school and in preparation for the licensure examination, as well as a reference for working clinicians. The author addresses specific patient care methods and procedures and notes current best practices as well as APTA's Code of Ethics. **Audience:** The specific audience is physical therapist assistant students who also may reference the book postgraduation for clinical application. It also could be useful by physical therapists who delegate patient care to physical therapist assistants to be aware of learning resources, such as this one, that detail their competencies. The introduction notes that other healthcare practitioners could certainly use this book to learn about patient care techniques. The author is a physical therapist assistant with inpatient rehabilitation, skilled nursing facility, and acute care clinical experience and is currently an educator in the physical therapist assistant and nursing programs at Clarkson College in Omaha, Nebraska. **Features:** Each of the 13 chapters has learning objectives, key terms, illustrations, and review questions. There are also bullet-point boxes throughout highlighting important guidelines and considerations. The first chapter is a reference to the overall logistics of the role of the PTA in patient care and in tandem with a physical therapist. It addresses various areas of compliance as well as the value of evidence-based practice. Chapter two focuses on body mechanics from the perspective of the clinician's understanding and use of proper movement technique with the goal of being able to instruct and educate patients as well as for their own injury prevention. Chapters 2-12 end with a section on red flags/safety and the related documentation with a few examples of each. Chapters 3-13 cover basic patient care procedures, many of which are universally applicable, although more focus on acute settings and less on higher level ambulatory care. Topics such as taking vital signs, infection control, wound care, equipment, and patient positioning and transferring are covered. The last chapter is dedicated to describing the Americans with Disabilities Act. (Answers to review questions as well as case studies, lab activities and PowerPoint presentations are reported to be included in an accompanying instructor's manual.) **Assessment:** This book is a great reference for specific patient care considerations, written by a PTA for PTAs. It is well organized and presents concepts with practical examples and scenarios. The topics are covered in detail with plenty of easy-to-read bullet-point boxes and charts. The attention to patient safety and promotion of the PT/PTA team is prominent throughout. This book is a blend of adequately referenced best practices and anecdotal experiences, which is valuable to students as a base knowledge reference. There are few editorial issues that could easily be remedied in a second edition: possibly some procedural guidelines and recommendations for higher level ambulatory care and highlights of current evidence-based practice for biomechanics applications to accommodate the body mechanics chapter would round out this already solid book.

Jason R. Oliver, PTA
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Physical Rehabilitation, 7th Edition, F. A. Davis Company Publishers, 2019, $139.95
ISBN: 9780803661622, 1476 pages, Hard Cover

Editor: O'Sullivan, Susan B., PT, EdD; Schmitz, Thomas J., PT, PhD; Fulk, George, PT, PhD

Description: This seventh edition of a book on adult rehabilitation is organized into three sections. The first has chapters on decision-making and the evaluation/assessment of basic systems and the examination of function. The second section addresses many diseases (CVA, ALS, Parkinson's, etc.), disorders (TBI, vestibular, etc.) and health conditions (heart disease, COPD, etc.) as well as assessment and treatment strategies for them. The third section focuses on orthotics, prosthetics, and wheelchair mobility. The sixth edition was published in 2013. **Purpose:** The purpose, as stated by the authors, is to provide a comprehensive approach to rehabilitation management of the adult patient. This book accomplishes this objective in an intense, but clear manner, incorporating the evaluation and treatment of each disorder while providing current resources for further inquiry. **Audience:** The book "is intended to serve as a primary textbook for professional level physical therapy students and as an important resource for practicing therapists as well for other rehabilitation professionals." The audience includes practicing and student rehabilitation professionals (PT, OT, etc.). This has been a staple of curriculum since I was a student in 1997-98, and the authors continue to improve on this masterful textbook for all clinicians. **Features:** Each chapter begins with learning objectives and a chapter outline. The chapter proceeds with multiple color figures, clinical notes, tables, and boxes that all clearly highlight important aspects as well as references for further research into each topic. Some of the figures have sample assessment forms and tables have definitions of pertinent terminology. Chapters end with questions for review and case studies to help apply the concept just reviewed. Each chapter has numerous references and supplemental readings for further learning. Some of the chapters also have appendixes such as sample assessment forms, web-based resources for families and patients, and functional measures for clinical use. I was unable to access the accompanying online material because the website required information regarding current academic status (i.e. what school I was currently attending or teaching at). **Assessment:** This is the all-encompassing book for adult rehabilitation and is a must-have for all clinicians (especially student rehabilitation professionals) treating adults.

Christopher D. Blessing, MS, MPT, OCS, CSCS
Penn Medicine - Princeton Health

Diagnostic Musculoskeletal Ultrasound and Guided Injection: A Practical Guide, Thieme Medical Publishers, Inc., 2018, $114.99
ISBN: 9783132203815, 175 pages, Soft Cover

Author: Resteghini, Peter, PhD

Description: Musculoskeletal ultrasound as a method to diagnosis and manage various musculoskeletal disorders has seen a considerable surge in popularity and usage in recent years. There are several advantages to musculoskeletal ultrasound including cost-effectiveness, no exposure to ionizing radiation, a highly portable technology, and the way it enables certain interventional procedures to be performed with great accuracy, such as therapeutic injections of local anesthetics and/or corticosteroids into areas of complex anatomy. This book provides an in-depth analysis of ultrasound imaging of anatomic areas, followed by summaries of ultrasound-guided injections into those areas, including the requisite equipment. **Purpose:** According to the author, the purpose is to provide "a pragmatic and accessible guide for the use of ultrasound in both the diagnosis and management of musculoskeletal and sports pathologies." The book also aims to provide detailed descriptions of all common musculoskeletal injection procedures that may be facilitated by ultrasound imaging. **Audience:** The audience includes healthcare clinicians from a wide variety of backgrounds including chiropractic, orthopedics, osteopathy, physical therapy, radiography, rheumatology, sonography, and sports medicine. The book is appropriate as a reference for both novice clinicians who have recently started to incorporate ultrasound imaging into their clinical practice and experienced clinicians who are already skilled in ultrasound imaging. **Features:** After introductory chapters on local anesthetics and corticosteroids and the principles of diagnostic ultrasound and guided injections, the book organizes the anatomic areas (i.e., shoulder, elbow, wrist/hand, hip, knee, ankle/foot) into chapter pairs. The first part of the chapter provides an in-depth description of ultrasound imaging of that area so that an examiner can adequately obtain the standard images necessary for reliable evaluation. The second part of the chapter expertly describes the ultrasound imaging-guided injection techniques, commonly juxtaposing normal and pathological anatomy to enable better understanding. Furthermore, in the sections on guided injection techniques, the book provides brief clinical presentations for each condition, as well as some anatomical considerations. The recommended medications, dosages, and volumes are also provided. A "Notes" section in each clinical condition contains clinical pearls that can assist with patient management and clinical decision making. Throughout the book, high-quality ultrasound images supplemented by appropriate line drawings and arrows highlight relevant sonoanatomy, clinical photographs depict proper probe and needle placement, and excellent anatomical images are accompanied by well-written and concise figure legends. A comprehensive, up-to-date reference list supplements the text. **Assessment:** This is a valuable resource that is well-suited for physical therapists and physical therapist students who are interested in musculoskeletal ultrasound imaging and guided injections. This book would also serve as a valuable reference for physical therapy orthopedic or sports fellowship or residency programs and hospital or university libraries, where it can be accessed by several different medical disciplines.

Michael Ross, PT, DHSc, OCS, FAAOMPT
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Dr. Vodder's Manual Lymph Drainage: A Practical Guide, 2nd Edition, Thieme Medical Publishers, Inc., 2019, $84.99
ISBN: 9783132411449, 143 pages, Soft Cover

Author: Wittlinger, Hildegard; Wittlinger, Dieter, PT; Wittlinger, Andreas, PT; Wittlinger, Maria, MT

Description: This is the second edition of a concise book that outlines manual lymph drainage and describes treatment indications and techniques. This update revises the content and updates the scientific evidence from the 2010 first edition. The website ebook replicates the print version. **Purpose:** The authors' purpose is to provide updated information and support for therapists to improve skills and satisfaction using the described techniques. The book successfully covers

treatments to advance therapeutic application. The authors encourage research to substantiate manual lymph drainage as an effective technique. **Audience:** The audience is practitioners and students interested in manual lymph drainage who wish to further their education. Clinicians trained in lymphedema management get an excellent resource for clinical use. The authors lead the world in their command of Dr. Emil Vodder's techniques and serve as CEOs and directors of the Dr. Vodder Academies in Austria. **Features:** The book provides a clear and detailed explanation of the involved anatomy, as well as Indications and contraindications, complementary treatments, and historical background. The section on techniques used for specific body parts provides outstanding practical treatments. Numerous illustrations support the text and improve the potential for understanding the material. Each page of the treatment section includes multiple pictures, explanations, and blank areas to add personal notes. Throughout the book, reference notes in blue with a Q and a number refer to questions listed at the end of the first section. Answers follow on the next pages with associated page numbers for more complete information. **Assessment:** This short book is as a top-notch addition to any clinician's library. Outstanding illustrations, new evidence, and improved information update this edition. The book offers practical treatment techniques, is easy to follow, and stands out among other books because of the authors' qualifications.

Karin J. Edwards, MSPT
Providence Health & Services

Thank You!

We would like to take this opportunity to thank our *OPTP* Book Reviewers. Member volunteer involvement is important to our success. We appreciate your dedication and expertise in providing these timely reviews. Again, thank you very much!

VICE PRESIDENT'S MESSAGE

Brian Murphy, PT, DPT, OCS, MTC

This is an exciting time to position your practice for specialization in Occupational Health Physical Therapy. Employers are seeking preferred providers with expertise to keep their workforces healthy and productive though prevention of injuries, promotion of safe physical activity, and safe therapies to alleviate musculoskeletal pain and dysfunction. It has been an honor to serve as your OHSIG Vice President and Education Chair over my 3-year term. We still have much more to be done to empower and position our members for excellence in occupational health physical therapy and prevention. We have many exciting projects moving forward and will be looking for volunteers to assist as we implement a new strategic plan in 2020. We are making great progress with our mentorship program and Work Rehab CPG initiatives. I also want to thank everyone that attended and assisted with our last Webinar on Exoskeletons, particularly our speaker, Matthew Marino.

As we move forward to the upcoming Combined Sections Meeting in Denver, I am excited to promote the OHSIG's general programming session, Friday, February 14th from 8 a.m. to 10 a.m. This will be preceded by a continental breakfast for OHSIG networking that starts at 7:15 a.m. This course is titled *Best Practices in Functional Capacity Evaluation: Raising the Bar*, presented by Steve Allison and David Hoyle. It will be a great opportunity to learn from leaders in Occupational Health Physical Therapy.

If you have any ideas or suggestions for us to consider, please reach out to me or any of our officers listed on the OHSIG web page: https://www.orthopt.org/content/special-interest-groups/occupational-health. Your active involvement helps us continue to advance our mission. This issue of *OPTP* includes the release of the newly updated *Current Concepts on Regulatory Compliance in Occupational Health*. An electronic version of this document with active reference links to more information may be accessed at https://www.orthopt.org/content/special-interest-groups/occupational-health/current-concepts-in-occ-health. Enjoy!

Current Concepts in Occupational Health: Regulatory Compliance

Drew Snyder, PT, DPT; Rick Wickstrom, PT, DPT, CPE; Gwen Simons, Esq, PT, OCS, FAAOMPT; Alison Helmetsie, PT, DPT, OCS; Sean Bagbey, PTA, MHA, ATC

PREFACE

This document for Current Concepts in Occupational Health Regulatory Compliance was created to inform physical therapy professionals about key regulations that impact services to promote workplace safety, health, and job accommodation. This document is retitled and represents a major update to replace "Occupational Health Physical Therapy: Legal and Risk Management Issues Guidelines" that was adopted on July 11, 2011.

Hyperlinks are provided to underlined text throughout this document to enable navigation access to more in depth information on key regulations and interpretive guidance, rather than including a reference list. If these links are not present or active, then the user is encouraged to download the electronic pdf version of this document and other OHSIG documents for Current Concepts in Occupational Health of interest at: https://www.orthopt.org/content/special-interest-groups/occupational-health/current-concepts-in-occ-health.

INTRODUCTION

The role of physical therapy professionals in Occupational Health has continued to expand and evolve to prevent injuries and improve employee health and productivity. This supports the vision of the American Physical Therapy Association (APTA) to transform society by optimizing movement to improve the human experience. Below are references to key regulations that impact practice; however, the readers should be aware that individual state laws may have additional restrictions that relate to employment discrimination and occupational health practice. Health care services provided to an employee that is disabled or working with restrictions are more complex, because the employer is a third party that should be engaged through an integrated care process to address job-specific return to work barriers.

REFERENCES TO KEY REGULATIONS

1. **Workers' Compensation Insurance Programs** are governed by state and federal laws whose central feature is the creation of "no fault" insurance coverage for injured workers. While coverage varies from state to state, Workers' Compensation programs generally cover injuries that "arise out of, and in the course of" employment by providing wage replacement and medical payments to cover a worker's injury. Generally, Workers' Compensation claims are managed according to rules and regulations that are set by state or federal regulatory bodies. Decisions about compensation awards also may be appealed through the court systems. Some states allow the employer to direct care to preferred treatment providers, whereas others allow for choice by the injured worker. There are 4 monopolistic states remaining for workers' compensation insurance in the U.S.—North Dakota, Ohio, Wyoming, and Washington. Two states, Texas and Oklahoma, have laws that allow employers to opt out from having Workers' Compensation coverage.
2. **Social Security Amendments of 1956** modifies the Social Security Administration (SSA) program that began in 1935 to provide for monthly benefits to permanently and totally disabled workers aged 50-64; to reduce the age to 62 as the retirement age for benefits to certain women; and to provide for continuation of a child's insurance benefits who are disabled before attaining 18 years of age.
3. **Title VII of the Civil Rights Act of 1964** prohibits employment discrimination based on race, color, religion, sex, and national origin by federal agencies and businesses with 15 or more employees. Title VII permits employment tests as long as they are not "designed, intended or used to discriminate because of race, color, religion, sex or national origin." Em-

ployers are not permitted to (1) adjust the scores of, (2) use different cutoff scores for, or (3) otherwise alter the results of employment-related tests on the basis of race, color, religion, sex, or national origin.

4. **Age Discrimination in Employment Act of 1967 (ADEA)** protects certain applicants and employees over the age of 40 from employment discrimination based on age.
5. **Occupational Safety and Health Act of 1970**, or "OSH Act," was enacted to assure safe and healthful working conditions for working men and women; by authorizing enforcement of the standards developed under the Act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health; and for other purposes. The OSHA Act contains a general duty clause requires each employer to provide a place of employment that is free from recognized hazards that are causing or are likely to cause death or serious physical harm to employees.
6. **Section 501 of the Rehabilitation Act of 1973** prohibits federal government agencies from discriminating against job applicants and employees based on disability, and requires affirmative action for employment of persons with disabilities.
7. **The Pregnancy Discrimination Act of 1978** amends Title VII of the Civil Rights Act of 1964 to forbid discrimination based on pregnancy when it comes to any aspect of employment, including hiring, firing, pay, job assignments, promotions, layoff, training, fringe benefits, such as leave and health insurance, and any other term or condition of employment.
8. **Part 1607 Uniform Guidelines for Employment Selection Procedures** were issued by the Equal Employment Opportunity Commission, or "EEOC," in 1978 to incorporate a single set of principles that are designed to assist employers, labor organizations, employment agencies, and licensing and certification boards to comply with requirements of Federal law prohibiting employment practices that discriminate on grounds of race, color, religion, sex, and national origin. They are designed to provide a framework for determining the proper use of tests and other selection procedures that are used as a basis for any employment decision.
9. **The Americans with Disabilities Act of 1990**, or "ADA," prohibits discrimination against people with disabilities in employment (Title I), in public services (Title II), in public accommodations (Title III), and in telecommunications (Title IV). **Title I of the ADA** prohibits private businesses with 15 or more employees from discriminating against a "qualified individual with a disability" who, with or without reasonable accommodation can perform the essential functions of the job. This law protects persons that (1) have a physical or mental impairment that substantially limits one or more life activities, (2) have a record of such an impairment, and (3) are regarded as having such an impairment.
10. **Family and Medical Leave Act of 1993**, or "FMLA", provides certain employees with up to 12 weeks of unpaid, job-protected leave per year and requires that group health benefits be continued during FMLA leave, if the employee is unable to perform the essential functional of the job due to having a serious illness or must take leave to care for a family member under specific circumstances and qualifying criterion.
11. **Health Insurance Portability and Accountability Act of 1996 (HIPAA)** and subsequent privacy and security rules required HHS to adopt national standards for electronic health care transactions and code sets, unique health identifiers, and security.
12. **ADA Amendments Act of 2008 (ADAAA)** amended the ADA and section 705 of the Rehab Act to make a number of significant changes to the meaning and interpretation of the ADA definition of "disability" to ensure that definition would be broadly construed and applied without extensive analysis by the courts.
13. **Genetic Information Non-disclosure Act of 2008**, or "GINA," restricts employers and other entities from requesting, requiring, or purchasing genetic information, and strictly limits the disclosure of genetic information.
14. **2010 ADA Standards for Accessibility Design** are revised regulations for Titles II and III of the Americans with Disabilities Act of 1990 "ADA" in the Federal Register on September 15, 2010. This sets minimum requirements for newly designed and constructed or altered State and local government facilities, public accommodations, and commercial facilities to be readily accessible to and usable by individuals with disabilities.
15. **Title I of the Affordable Care Act of 2010**, or "ACA," provides coverage in Sec. 2713 for Preventive Health Services. A group health plan and a health insurance issuer offering group or individual health insurance coverage shall, at a minimum provide coverage for and shall not impose any cost sharing requirements for— "(1) evidence-based items or services that have in effect a rating of 'A' or 'B' in the current recommendations of the United States Preventive Services Task Force.
16. **Incentives for Nondiscriminatory Wellness Programs in Group Health Plans** was enacted in 2013 for implementation of the ACA increased the maximum permissible reward under a health-contingent wellness program offered in connection with a group health plan (and any related health insurance coverage) from 20% to 30% of the cost of coverage. The final regulations further increase the maximum permissible reward to 50% for wellness programs designed to prevent or reduce tobacco use. These regulations also include other clarifications regarding the reasonable design of health-contingent wellness programs and the reasonable alternatives they must offer in order to avoid prohibited discrimination. Note: Further guidance about incentives is expected to be issued soon.
17. **EEOC Final Rule 29 CFR 1630** was enacted in 2016 to implement Regulations under the ADA to address the extent to which employers may use incentives to encourage employees to participate in wellness programs that ask them to respond to disability-related inquiries and/or undergo medical exams.
18. **EEOC Final Rule 81 FR 31143** was enacted in 2016 to implement GINA to address the extent to which an employer may offer an inducement to an employee for the employee's spouse to provide information about the spouse's manifestation of disease or disorder as part of a health risk assessment (HRA) administered in connection with an employer-sponsored wellness program.
19. **Affirmative Action for Individuals With Disabilities in Federal Employment** are new regulations introduced by EEOC in 2018 for federal agencies to set employment goals to have 12% of its workforce become individuals with disabilities,

and 2% of its workforce be people with "targeted" disabilities such as blindness, deafness, paralysis, convulsive disorders, and mental illnesses among others. The regulation does not apply to the private sector or to state or local governments.

20. **Part 60-741 Affirmative Action and Nondiscrimination Obligations of Contractors and Subcontractors Regarding Individuals with Disabilities** was enacted in 2019 to promote compliance with section 503 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 793). This requires Federal contractors and subcontractors with government contracts in excess of $15,000 to take affirmative action to employ and advance employment qualified individuals with disabilities. Contractors are expected to review all physical and mental job qualification standards to ensure that, to the extent qualification standards tend to screen out qualified individuals with disabilities, they are job-related for the position in question and consistent with business necessity. This regulation established an affirmative action goal of 7% of the workforce for employment of qualified individuals with disabilities for each job group in the contractor's workforce, or for the contractor's entire workforce.

RELEVANCE TO OCCUPATIONAL HEALTH SERVICES

Employment Medical Examinations

The employer and physical therapy provider should ensure that employment medical exams are consistent with regulatory requirements, best practices, and business necessity. The medical exam process should be uniformly applied to all entering employees in the same job category. An employer's decision to reject a job candidate based on medical reasons must be justified by information that is directly related to the candidate's job fitness-for-duty. Examiners should therefore be aware of essential job functions and job qualification criteria before administering a post-offer employment screen. The ADA requires employers to treat any medical information obtained from a disability-related inquiry or medical exam as a confidential medical record that is stored in a separate location from the employee's file. A good practice by employers is not to acquire additional information from the examiner that is not relevant to job fitness, insurance purposes, or mandated health surveillance programs. Physical therapy professionals may be called upon by the employer to perform a functional job analysis to validate the physical demands for essential job functions. For example, verifying the loads and methods for materials handling required to perform essential job functions may be used as evidence to demonstrate that passing criteria for a lift or carry task is valid.

Title I of the ADA of 1990 and related case law has prompted employers to take a more job-relevant and functional approach to medical exams that are administered to job candidates. The ADA prohibited most disability-related inquiries and medical exams until after a job applicant accepts a conditional offer of employment. Tests for illegal drug use and federally-mandated exams for certain industries such as Department of Transportation (DOT) physicals are exceptions that may be administered pre-employment before extending a job offer. Before extending a job offer, an employer may also ask a job applicant whether he/she can perform job-related functions or ask him/her to perform an agility test to demonstrate the ability to perform representative job tasks (such as climbing a ladder or lifting a weight), provided no medical exam or monitoring is performed. If an accommodation is requested at any point of the hiring or medical exam process, the employer is expected to engage with the job candidate in an interactive process to evaluate whether the requested accommodation is reasonable and would not impose an undue hardship to perform the essential functions of the job.

In 2000, EEOC issued Enforcement Guidance: Disability-Related Inquiries and Medical Examinations of Employees Under the Americans with Disabilities Act. During the post-offer phase of employment, the scope of the medical exam remains relatively unrestricted, provided the scope of exams are consistent for all workers in the same category of jobs. For example, a post-offer employment exam may include a common set of health questions or biometrics to establish a baseline for health history, movement deficits, or other risk factors. One exception is that GINA regulations issued in 2008 specifically prohibit medical inquiries or tests that relates to genetic or family history during employer-mandated medical exams. Since most medical inquiries and exams are prohibited until after a conditional job offer, employers must be prepared to justify withdrawal of the job offer based on information that is functional and relevant to job performance or business necessity.

It is important to recognize that job candidates in protected categories such as females, older workers, and persons with disabilities may demonstrate lower performance results on employment tests that assess fitness for jobs with higher physical demands. The employer must be prepared to justify business necessity when the exam process or pass/fail criteria have an adverse impact on categories of persons who are protected by the Civil Rights Act, ADEA, and ADA. EEOC's Uniform Guidelines for Employment Selection of 1978 state that where cutoff scores are used, they should normally be set to be reasonable and consistent with normal expectations of acceptable proficiency within the workforce.

EEOC Enforcement Guidance on Disability Inquiries and Medical Exams states that once an employee is doing the job, his/her actual performance is the best measure of ability to do the job. After employment begins, the employer may make disability-related inquiries and require medical exams only if they are job-related and consistent with business necessity. A worker may be required by the employer to submit to an employment medical exam under only limited circumstances after employment begins. If an employee is applying for a new job, an employer should treat the employee as an applicant for the job, thus following the same medical exam process that is required for all job applicants that are considered for the same category of jobs.

Employees do not need to be treated as applicants when they are non-competitively entitled to the new position based on seniority or satisfactory performance, unless the new position has different medical standards or physical requirements than the previous position.

The employer may also require an employee to undergo a medical exam if the employer has a reasonable belief that an employee's ability to perform essential job functions will be impaired by a medical condition. A fitness-for-duty evaluation is a medical evaluation performed by a health care professional at the request of the employer. Common circumstances that justify the need for a fitness-for-duty evaluation include:

- Application for pay or compensation as a result of an on-the-job injury or disease.
- Return from absence due to a work-related or non-occupational injury or illness.
- Exceeding employer policy limits for temporary restricted duty.
- Request for job accommodation.

- Reports of worker' difficulty performing work duties.
- Documentation of declines in expected job performance.
- Evidence that the worker may pose a direct threat of serious harm to him/herself or others.

The ADA and FMLA regulations permit the employer to require clearance from the employee's personal physician for the employee to perform medical exam tasks or return to job activities that require physical exertion, e.g., heavy lifting. A best practice for this is to develop and apply a uniform policy or practice that requires all similarly situated employees with the same job category or health issue to obtain and present a certification by the employee's health care provider that clears the employee to resume work and perform all essential job functions. For workers who experience physical difficulty due to a temporary health condition such as pregnancy, accommodation may be warranted to avoid strenuous exertion during job or medical exam tasks until the worker is medically stable after the pregnancy is over. In addition, periodic medical exams and other monitoring may be provided under specific circumstances such as OSHA medical screening and surveillance of workers exposed to high noise levels or chemicals, Department of Transportation Physical Examinations to medically-certify fitness-for-duty of commercial motor vehicle drivers, or Federal Aviation Administration medical certification of pilots.

Job Accommodation

Employment discrimination against qualified individuals with a disability is prohibited for agencies of the Federal Government by Section 501 of the Rehabilitation Act of 1973 and for private businesses with 15 or more employees by the ADA of 1990. Additionally, state-specific regulations may provide additional protections or remedies to protect the rights of persons that (1) have a physical or mental impairment that substantially limits one or more life activities, (2) have a record of such an impairment, and (3) are regarded as having such an impairment. These regulations encourage the implementation of reasonable accommodations to enable a person with a disability to perform the essential functions of an employment position. The EEOC provides employers with guidance to frequently asked questions such as "How are essential functions determined" and other frequently asked ADA questions at the web page: The ADA: Your Responsibilities as an Employer. Federal contractors and federal government employers have affirmative action goals to employ a percentage of the workforce that have disabilities. EEOC Guidance to common questions by job applicants with disabilities is available at: Job Applicants and the Americans with Disabilities Act (https://www.eeoc.gov/facts/jobapplicant.html#potential).

The ADAAA broadened the statutory definition of disability for the ADA and rejected the holdings in several Supreme Court decisions to make it easier for an individual seeking protection to establish that he or she has a disability. The critical inquiry under the ADAAA is no longer based on whether the individual has a disability, but whether the covered entities have engaged in an interactive process to support reasonable accommodation of qualified applicants or employees who report having a disability. If a job accommodation is requested by a job candidate or incumbent employee, physical therapy professionals may be consulted by the employer or other parties to assist with functional job analysis of physical demands of essential and marginal job functions, worker evaluation to assess functional limitations, and implementation of reasonable accommodations to enable safe and productive job performance.

Workers' compensation claims are generally exempt from HIPAA privacy rules; however, HIPAA privacy rules would apply to medical records requests and communications with other stakeholders when addressing job accommodation requests for employees with non-occupational health conditions. The FMLA regulations also apply to job accommodation requests for reduced work schedule or need for additional rest breaks.

Once a person is hired and has started work, an employer generally can only ask medical questions or require a medical exam if the employer needs medical documentation to support an employee's request for an accommodation or if the employer believes that an employee is not able to perform a job successfully or safely because of a medical condition. Medical exams may be challenged for their validity and whether they were performed in accordance with business necessity.

The EEOC's website (www.eeoc.gov) contains a number of documents addressing various ADA issues, including the following:

- Definition of Disability
- Reasonable Accommodation and Undue Hardship
- Preemployment Disability-Related Questions and Medical Examinations
- The ADA and Psychiatric Disabilities
- Pregnancy Discrimination

Functional Capacity Evaluation

A functional capacity evaluation (FCE) is a performance-based medical assessment of an individual's physical and/or cognitive abilities to safely participate in work and other major life activities. In a Job/Occupation Specific FCE, the worker's functional abilities are matched directly to the physical and/or cognitive demands of a specific job(s) or a specific occupation(s). This provides a more comprehensive assessment job fitness-for-duty than physician estimates of work restrictions based on worker self-reports or physical exam findings. An emerging trend for best practice in workers' compensation is to authorize physical and occupational therapists to recommend work restrictions. For example, the State of Washington has implemented a Job Analysis form that includes a review section for the FCE Therapist and treating occupational/physical therapist to recommend return to full duty, return with modifications, etc. This is consistent with research that supports the use of performance-based FCEs to provide more objective and accurate evidence to substantiate worker restrictions.

An "Any Occupation FCE" may be requested to justify the need for disability benefits in long term disability claims, Social Security disability claims, or Workers' Compensation claims when it is known that the worker will not be returning to his/her specific job. Social Security regulations define disability as the inability to engage in any substantial gainful activity by reason of any medically determinable physical or mental impairment(s) that can be expected to result in death or has lasted or can be expected to last for a continuous period of not less than 12 months. Objective evidence about functional limitations of claimants with severe impairments must be compared to the functional demands of representative occupations in the national economy to determine if substantial gainful employment opportunities exist.

Currently, the Social Security Administration (SSA) uses data for Selected Characteristics of Occupations defined in the Dictionary of Occupational Titles (DOT) to make this determination; however, the DOT has not been updated in more than 20

years. The worldwide acceptance of the DOT as a taxonomy for job demands has prompted occupational health professionals to use similar terminology when recommending physical work restrictions for workers. The SSA is implementing a new Occupational Information System to replace the DOT that will incorporate changes in methods for collecting job demands through the Occupational Requirements Survey (ORS). The Bureau of Labor Statistics (BLS) is conducting the ORS to provide the SSA with job-related information regarding physical demands; environmental conditions; education, training, and experience; as well as cognitive and mental requirements of work in the national economy. The new terminology and methods described in the Occupational Requirements Survey (ORS) Collection Manual Version 4.1 is a new reference for physical therapists and other occupational health professionals to consider when doing a job analysis and performing worker exams to relate worker abilities to job demands.

Physical therapists who perform FCEs for workers' compensation, disability, and legal cases should be well-versed in the ADA and applicable state workers' compensation laws when designing FCE procedures and evaluating worker restrictions. For workers' compensation claims, the physical therapist may be asked to clarify which functional work restrictions are based solely on allowed conditions for the claim and determine the prognosis for functional improvement with therapy. In contrast, an employer's response to requests for job accommodation requests must consider health-related limitations from both work-related and non-occupational health conditions. The OHSIG provides additional resources to promote clinical excellence, accountability, and consistency of an FCE through their document "Current Concepts in Functional Capacity Evaluation: A Best Practices Guideline."

Musculoskeletal Injury Prevention and First Aid

Enforcement to discourage unsafe work practices is justified primarily by the General Duty Clause of the OSH Act of 1970 that requires employers to provide "a place of employment which [is] free from recognized hazards that are causing or are likely to cause death or serious physical harm." Employers with more than 10 employees (with some exemptions) must keep a record of serious work-related injuries and illnesses. OSHA specifies recordkeeping criteria that detail how and when employers must report injuries as "recordable." Minor injuries that require only first aid and no lost time or work restrictions do not need to be recorded.

Physical therapists must be aware of whether their provision of on-site early intervention services may be considered "first aid" or recordable as medical treatment that is beyond the scope of first aid. Standard Interpretations are letters or memos written by OSHA officials in response to public inquiries or field office inquiries regarding how some aspect of or terminology in an OSHA standard or regulation is to be interpreted and enforced by the agency. For example, in May 2019 the APTA obtained a Letter of Interpretation from OSHA for Clarification of Soft Tissue Massage. This states that physical therapists may perform soft tissue massage as a first aid measure without being recordable, since soft tissue massage is considered first aid and "OSHA considers the treatments listed in [the regulation in question] to be first aid regardless of the professional status of the person providing the treatment." Additional OSHA standard interpretations impacting first aid can be found at https://www.osha.gov/laws-regs/interlinking/standards/1904.7(b)(5)(ii)/standard_interpretations.

Physical therapy professionals consult with employers to support workplace ergonomic programs to prevent and manage musculoskeletal disorders: Service options include:

- Job analysis to identify and reduce physical demands and musculoskeletal risk factors/hazards.
- Physical exam and triage of workers that report musculoskeletal symptoms.
- Delivery of OSHA-compliant First Aid services as an early intervention for work-related musculoskeletal conditions.
- Assignment and progression of workers to physically suitable work during recovery.

The OHSIG also provides resources related to ergonomics through their Current Concepts document: "Current Concepts in Occupational Health: Work-Related Injury/Illness Prevention and Ergonomics Guidelines." OSHA's ergonomics website provides other helpful resources to encourage best practices for ergonomics programs.

Managing Injuries that Limit Work Participation

Work-related injuries that result in death, days away from work, restricted work or transfer to another job, medical treatment beyond first aid, or loss of consciousness must be recorded based on the criteria set forth in OSHA Standard 1904.7.

The investigation process for work-related injury claim has several steps. Specific requirements exist in each state, but, in general, the first step is for the employee to notify the supervisor (company) of the injury. This notification should include the time, date, location, and activity of the injury. Proper notification is required to be completed within the timeline outlined by the jurisdiction where the injury occurred. The employer is responsible for providing the employee with the proper forms to file a work injury claim and for conducting an accident investigation as outlined by OSHA. After the employer submits the claim, all pertinent accident and medical information is reviewed by the insurance company and a determination is made to either accept or reject the work-related injury claim. Physical therapy professionals should be aware that the HIPAA Privacy Rule regulations may apply throughout this process.

The process for managing an injury that results in lost-time or work restrictions should follow a similar process for work-related and non-occupational injuries. The physical therapist should be aware that the employer may have a duty to make reasonable accommodations under state workers' compensation laws and/or the ADA regulations, regardless of whether the worker has temporary, episodic, or permanent restrictions due to a work-related or non-occupational health-related condition. In order to help reduce lost productivity after the onset of an injury or illness, a physical therapist may be asked to assist by helping to define the essential functions, physical demands, and identify accommodation options for the job by conducting a functional job analysis. This information can assist both the employer and the employee, by expediting the transition back to work after an injury.

The physical therapist's knowledge and expertise with primary care of musculoskeletal conditions, evidence-based rehabilitation, functional abilities of the employee, and functional demands of the job will assist the employer in reducing productivity loss through early intervention during recovery. The OHSIG provides additional guidance on this topic in Current Concepts in Occupational Health: Managing an Acute Injury that Limits Work Participation.

Wellness Program Consultation

Employer-sponsored wellness programs have become increasingly popular as employers attempt to reduce health care costs and promote employee health and productivity. These wellness programs can vary widely in scope, from smoking cessation programs, to providing for gym memberships, to programs requiring health risk assessments that provide medical care interventions. Wellness programs are governed by extensive rules and regulations that physical therapists should be aware of if they are involved in designing or delivering these programs.

Section 2713 of the Patient Protection and Affordable Care Act of 2010 requires group and individual health insurance plans to provide minimum coverage without cost sharing requirements on a number of preventive health services. One of the mandated prevention services included in current recommendations by the United States Preventive Services Task Force is coaching to inspire behavioral change for healthy physical activity. This recommends offering or referring adults who are overweight or obese and have additional cardiovascular disease (CVD) risk factors to intensive behavioral counseling interventions to promote a healthy diet and physical activity for CVD prevention. Physical therapists are leaders in examining fitness and promoting healthy physical activity because of expertise in alleviating musculoskeletal pain and dysfunction that limits participation in physical activities.

The ACA made space for employers to provide incentives that allow for limited rewards or penalties for those who participate in non-discriminatory wellness programs in group health plans. Employers may offer financial incentives to enhance employee participation in wellness programs that include disability-related inquiries and medical exams. Many programs obtain medical information from employees by asking them to complete a health risk assessment and/or undergo biometric screenings for risk factors (such as high blood pressure or cholesterol). Participation in such assessments must be voluntary and disclosure of medical information obtained through an HRA is subject to final rules under GINA, the ADA, and the Incentive Programs for Nondiscriminatory Wellness Programs in Group Health Plans.

The scope of information that may be collected during health risk appraisals and biometrics is not specified as long as the program complies with the applicable rules. For example, physical therapy professionals may offer movement screens and follow-up behavioral coaching to promote suitable physical activity to supplement or replace traditional approaches to HRA and biometric screening. Musculoskeletal movement screening to identify risk factors and promote suitable physical activity may also be provided as a wellness program benefit to workers who report musculoskeletal symptoms or difficulties with physical activity progression.

Wellness programs also must comply with the ADA and the GINA if the wellness program asks participants to respond to inquiries regarding disability, require medical exams, or provide information about a spouse's manifestation of a disease or disorder as part of an HRA. Specifically, the HRA must disclose which questions might solicit genetic information and employees must not be *required* to answer such questions. Responses to an HRA cannot be shared with employers unless the data is de-identified in accordance with the rules in order to protect the privacy of individual participants. The EEOC issued a final ruling in 2016 for compliance with the ADA and GINA that outline the requirements for wellness program compliance.

There have been a number of court challenges on how the 30% reward/penalty provision has been implemented for participants in employer-sponsored wellness programs. In August 2017, a U.S. district judge found that the EEOC did not adequately justify the 30% reward/penalty provision for participating in employer-sponsored wellness programs and ordered a timely reconsideration of these provisions by the EEOC. Before providing consultation services to employers on workplace wellness programs, check the EEOC's website (https://www.eeoc.gov/) to make sure you know what the current rules are and obtain legal advice before designing or recommending wellness programs that include incentives or disincentives to participate.

CONCLUSION

This document introduces key regulatory compliance issues that impact services by physical therapy professionals that relate to employment. The information referenced in this document is not an all-inclusive for rules and regulations. Individual states often have specific rules and regulations that impact regulatory compliance during physical therapy services. As always, you should seek legal advice if you are unsure of how these rules and regulations affect the services that you provide in your role as a physical therapy professional. More in depth information on these topics is available in the OHSIG independent study course, "The Injured Worker" (https://www.orthopt.org/content/education/independent-study-courses/browse-archived-courses).

President's Letter

Annette Karim, PT, DPT, PhD
Board-Certified Orthopaedic Clinical Specialist
Fellow of the American Academy of Orthopaedic Manual Physical Therapists

It has been a wonderful 6 years as your PASIG President. Thank you for electing me! I will complete my service at CSM 2020 and continue committee work for both the PASIG and the AOPT. I am pleased to say we have a nice amount of PASIG-AOPT programming at CSM. I would like to invite you to join us at the following events:

Wednesday, 2/12 7:00 p.m. - 8:30 p.m. AOPT SIG Meet and Greet

Learn about the AOPT's Special Interest Groups! AOPT members are welcome to join any-and-all of our SIGs. Join us for refreshments and networking!

Thursday, 2/13, 1:00 p.m. - 3:00 p.m. Poster Session 1

Does Dance Improve Quality of Life in Older Adults? A Systematic Review. *Kevin Jones, PT, DPT; Alex Wright Aker, SPT; Merissa Denning, SPT; Michael Alan Gorze, SPT; Mary Jo Westendorf, SPT*

Influences of Continuous Physical Activity on Muscle Recruitment: Findings from Rate-Controlled Sauté Jumps in Dancers. *David Ortiz, MSPO, MSc; Christopher Laine, Hai-Jung Shih, PT, BS; Amanda* Christine Yamaguchi, PT, DPT; Kornelia Kulig, PT, PhD, FAPTA

Risk Factors for Stress Fractures in Female Dancers: Report of an Online Survey. *Therese E. Johnston, PT, MSPT, MBA, PhD; Alison Clodfelter, SPT; Maria DiNenno, SPT; Lynne Eisenberg, SPT; Kelsey Ann Kreider, SPT; Ifunanya Nwanonyiri, SPT*

Functional Movement Screen and Y-Balance May Not Predict Short-Term Injury Risk in Modern Dancers. *Mackin Noelle D'Amico, SPT; Kelsey Alexa Pelletier, SPT; Caleb Thomas Kutsche, SPT; Elizabeth Saluke Dalal, SPT; Liang-Ching Tsai, PT, PhD; Kimberly Meyer Morelli, PT*

Differential Diagnosis and Conservative Management of Iselin's Disease in an Adolescent Dancer: A Case Report. *Amy Humphrey, PT, DPT*

Rehabilitation of Musculoskeletal Disorders in Musicians: Optimization of a Program Combining Exercise and Education. *Marianne Roos, PT; Jean-Sébastien Roy; Marie-Eve Lamontagne*

Inter- and Intra-Rater Reliability of Hand Held Dynamometry for Lower Extremity Strength in Pre-Professional Dancers. *Marissa Tamar Schaeffer, PT, DPT; Shaw Bronner, PT, PhD; Laurel Daniels Abbruzzese, PT, EdD; Zoe Tawa, SPT; Kynaston Schultz, SPT; Joanna Raine Binney, SPT; Jessica Boyle, SPT*

Normative Criteria for Baseline Screening in Young Competitive Gymnasts. *Duane M. Scotti, PT, DPT, PhD; Lindsay Cochefski, SPT; Jenna Corkery, SPT; Gianna Corso, SPT; Emily Mullen, SPT; Richard Feinn, PhD*

Using Blood Flow Restriction in the Post-Operative Rehabilitation of a Professional Ballet Dancer. *Teresa Smith, PT, DPT; Patrick Gerard Jacobs*

Shoulder Range of Motion and Strength Norms and Variations in Circus Acrobats. *Carlie Bromer Huberman, PT, DPT; Melissa Hildebrand Scales, PT, DPT; Srikant Vallabhajosula*

Musculoskeletal Injuries in Pre-Professional and Professional Circus Artists: A Prospective Pilot Study over One Year. *Stephanie Jones Greenspan, PT, DPT*

Multi-Segment Assessment of Ankle and Foot Kinematics during Elevé Barefoot Demi-Pointe and En Pointe. *Kimberly Perrella Veirs, PT, MPT, ATC; Josiah R Rippetoe; Jonathan D Baldwin; Kaitlin Lutz, SPT, DPT; Amgad M Haleem; Carol Pierce Dionne, PT, DPT, PhD*

Thursday, 2/13, 3:00 p.m. - 5:00 p.m. Educational Session

Hanging in Thin Air: Pushing and Pulling in Rock Climbers', Circus Artists', and Gymnasts' Shoulders. *Jared Spencer Vagy, PT, DPT; Duane M. Scotti, PT, DPT, PhD; Stephanie Jones Greenspan, PT, DPT*

Gymnasts, circus artists, and rock climbers primarily use their shoulders in the closed kinetic chain. How would assessment and treatment be different in this population than with throwing athletes? In this session, the speakers will use movement examples from gymnastics, aerial circus arts, and rock climbing to highlight closed kinetic chain function of the shoulder. These assessment and treatment considerations can be applied to other activities that involve pushing and pulling movements.

Friday, 2/14 (Valentine's Day!), 7:00 a.m. - 7:45 a.m. PASIG Membership Meeting

You do not need to be a member to join us at this early meeting. We would LOVE for you to become a PASIG member, but all are welcome. Please contact me if you have any questions.

Friday, 2/14, 8:00 a.m. - 10:00 a.m. Educational Session

Movement Assessment and Return to Playing for the Instrumental Musician. *Janice C. Ying, PT, DPT; Erin Hayden, PT, DPT; Lori Michener, PT, ATC, PhD, FAPTA*

The physical demands of the instrumental musician can be comparable to those of upper extremity endurance athletes. While there is evidence for return-to-sport criteria and injury prevention screening of upper extremity athletes, there is a paucity of evidence for the instrumental musician. This presentation will explore the methods and clinical decision-making process of return to play and injury reduction, with application to a task-specific and precision-oriented population of instrumental musicians. The speakers will describe a systematic approach for the assessment of relevant

impairments that reduce the functional ability of musicians. A case-based learning approach will be used to describe return-to-play programs and screenings for musicians. Current evidence will be integrated from performing arts and other types of upper extremity athletes. Specific topics will include optimal playing positions, functional movement analysis, instrument set-up/modifications, neurodynamics, and pain neuroscience education. These concepts of prevention and rehabilitation will incorporate principles of tissue healing and psychosocial factors in order to enable the artist to return to play. This session is a must for physical therapists interested in developing their toolset for rehabilitation and injury prevention of patients with high-level performance goals.

Friday, 2/14, 10:00-11:00 a.m. Fellowship Task Force

Friday, 2/14, 11:00 a.m.-12:00 p.m. Dancer Screening

Friday, 2/14, 11:00 a.m.-1:00 p.m. AOPT Platform 5

Dancers with Flexor Hallucis Longus Tendinopathy Maintain Performance Despite Altered Lower Extremity Dynamics. *Hai-Jung Shih, PT, BS; K. Michael Rowley, PhD; Kornelia Kulig, PT, PhD, FAPTA*

Friday, 2/14, 3:00 PM- 4:00 PM AOPT Rose Award Platforms

Friday 2/14, 5:00-6:30 PM AOPT Membership Meeting

Friday 2/14, 6:30-7:30 PM AOPT Awards Ceremony

Friday 2/14, 7:30-11:00 PM AOPT Membership Appreciation Party

Saturday, 2/15, 8:00 a.m. -10:00 a.m. Educational Session

Evaluation and Treatment of the Shoulder Girdle of Aerial Artists from a Movement Systems Perspective. *Emily Sarah Scherb, PT, DPT; Lynnette Ching-Ling Khoo-Summers, PT, DPT*

Participation in circus arts is growing in popularity as a recreational hobby and performance art form. These artists have large demands on their bodies, often with repetitive patterns and at end range. As more of these artists present for physical therapy, clinicians need to be able to understand the specific demands of their art form. In this session, clinicians will become familiarized with this unique population, their injuries, and movement patterns. The speakers will discuss the movement system syndrome diagnostic categories of the shoulder girdle that are pertinent to these athletes and how to use them to help educate and treat. Using case studies to illustrate a progression of a treatment plan, the presenters will show examples of how to get them safely back in the air.

The following meetings will be held in our AOPT bonus room.
PASIG Fellowship Taskforce (Contact Laurel Abbruzzese, Fellowship Taskforce Chair)
PASIG Outreach (Contact Marissa Schaeffer, Outreach Chair, or Dawn Muci, Communications Chair)
PASIG Dancer Screening (Contact Mandy Blackmon, Dancer Screening Chair)

The PASIG was very active at the International Association of Dance Medicine and Science conference in Montrèal, Canada and many of our leadership and members provided educational, research, and movement sessions. We also sponsored a PASIG-AOPT table. Here is a list of what we did, and some photos to enjoy.

Sessions

Injury rate calculations: comparison between units of exposure measure. Sarah Edery-Atlas, DPT, OCS for Marijeanne Liederbach PhD, PT; Nick Dill, BFA, MS; Lauren McIntyre ATC

Sleep disturbance prevalence and risk of injury in collegiate dancers. Andrea Lasner DPT; Rajwinder Deu, MD

Upper extremity taping techniques for dancers across all genres. Emma Faulkner, PT, DPT; Amanda Blackmon, PT, DPT; Abigail Misenheimer, SPT, ATC

Heightening relevé performance: myofascial, joint mobilization and exercise techniques to restore full relevé after ankle injury. Amanda Greene, DPT, BA; Andrea Lasner, DPT

Statistical significance vs clinical significance? Andrea Kozai, MSc, CSCS; Dawn Muci DPT, ATC

Technology – good or evil? Sylvie Fortin, PhD; Marisa Hentis, PT, DPT; Duane Scotti, DPT, PhD

Pelvic floor stiffness in pelvic floor dysfunction of dancers vs. non-dancers. Brooke Winder DPT, OCS; Tina Wang, MD; Andrea Cordova-Caddes, DPT, OCS; Kazuyoshi Gamada, PhD, PT

Posters

Differences in force production between barefoot and pointe shoe jump landings. Emily Sandow, DPT, OCS; Sarah Edery-Altas, DPT, OCS; Marijeanne Liederbach, PhD, PT; Faye Dilgen DPT

Health-Related Quality of Life (HRQOL) of older women who tap dance as compared to age-matched non-dancers. Annette Karim, DPT, PhD

Take the lead with ballroom dance techniques as a balance intervention: a case report. Jonathan Mackin, SPT; Annette Karim, DPT, PhD

The development of ballet exercises with PNF for a Parkinson's Disease patient: a case report. Christina Del Carmen, BA; Annette Karim, DPT, PhD

What don't we know about dancers? Ellie Kusner, MSc; Marissa Schaeffer, PT, DPT

The familiarity, interest, and utilization of complementary healthcare treatments among dancers presenting to an academic medical center. Rosalinda C. Canizares, DPT; Victoria Banner Vice, SPT; Daniel Schmitt, PhD; Ashley Lea, SPT; Daniela Ortiz, SPT; Mikela Nylander-French, SPT; Carolyn E. Keeler, DO

The diagnosis and treatment of adolescent dancers with fibularis (peroneus) tertius dysfunction limiting plantar flexion range of motion: a case report. Victoria Hove, SPT; Amanda Blackmon, PT, DPT; Emma Faulkner, PT, DPT

Mechanisms of ACL tears and dancers: what's the difference? Abigail Misenheimer, SPT, ATC/L; Amanda Blackmon, PT, DPT; Emma Faulkner, PT, DPT

Normative criteria for baseline screening in adolescent competitive dancers. Duane Scotti, PhD, DPT; Richard Feinn, PhD; Katharina Greco, DPT; Kelsey Hart, DPT; Carolyn O'Leary, DPT; Erica Peters DPT

Bend it, twist it, assess it: a review of medical screening for the performer's spine. Jessica Waters, DPT, OCS

Anticipating a PASIG President Pass-Off!

PASIG table at IADMS. Left to right: Duane Scotti, Sarah Edery-Altas, Rosie Canizares, Annette Karim, Laurel Abbruzzese, Jessica Waters, Marissa Schaeffer, Mandy Blackmon

It is with great pleasure that I introduce Lynn Batalden, DPT, CAPP, OCS, author of the following study. Thank you, Lynn, for your contribution to our profession!

Pointe-Readiness Screening and Exercise for the Young Studio Dancer

Lynn Batalden, PT, DPT, CAPP, OCS

Earlier this year, I wrote a critically appraised topic (CAT) for the Performing Arts Special Interest Group (PASIG). The CAT "Assessing Pointe Readiness in Young Dancers," involved looking for research related to determining a dancer's ability to successfully transition from ballet slippers to point shoes. There are currently no tests that can predict a dancer's ability to dance en pointe. Determination to dance en pointe in the United States is mostly based on age, with age 12 being a typical benchmark.[1] Ballet instructors also use number of years in training as an indicator for readiness.[1] However, as Richardson et al[2] points out, duration of training does not necessarily produce a standardized level of proficiency among dance students. In Richardson's study, 3 tests were found to correlate with ballet instructors' ratings of dancers whom they considered ready to dance en pointe.[2] These tests are the Single Leg Saute test, the Airplane test, and the Topple test and are described in the Appendix. These tests speak to the dancer's muscular power and ability to maintain strong trunk control, and stable joints.

As a follow-up to writing the CAT, I endeavored to use the tests described as a screening test for a local dance studio as a community service. Additionally, I included measurement of plantar and dorsiflexion passive ROM and repetition testing of single leg heel rise. Ninety degrees of plantar flexion is needed to lock the subtalar joint en pointe in order to avoid ankle ligamentous injury.[3] Dorsiflexion was also included with a standard of 15°. In a study by Yocum et al,[4] the heel rise test mean for 5 to 8 year olds was found to be 15.2 repetitions and 27.7 repetitions for 9 to 12 year olds.

This article is a description of the process of providing a free screening for a local dance studio for dancers who are pre-pointe or currently en pointe. I initially reached out to the studio to find out if they were interested. We arranged two dates, one for the actual screening and one as a follow-up to the screen. I crafted a parent letter outlining the intent and releases were signed for the testing including a photo/video release. The screening was done in an evening and took about 2 hours to screen 12 dancers. The screen was done during a regularly held dance class and the dancers came over to my corner of the room when it was their turn. This was my first time doing the screen. I was learning a new app used for evaluating athletes (Coach's Eye), I created a form for the tests, and I had an idea of how to proceed, but really, I was just getting my feet wet and was ready for the unexpected.

A therapist in our network of clinics recommended I try the Coach's Eye app for ease of use and because it is inexpensive to purchase. Coach's Eye includes features such as being able to measure angles and to make a voice recording over the video in order to verbally explain the body mechanics being analyzed. The resulting analysis can be shared by email, text, or on YouTube, so the commentary can be recorded and sent to the dancer or dance instructors. Half the videos were taken on an Android phone using a tripod, and when I ran out of storage, the rest were taken on an iPhone. I downloaded the Coach's Eye app to my laptop computer thinking it would be easier to view and work with on a laptop, but it turned out to be much quicker to toggle back and forth using the smart phone instead of the laptop. Conversely, on the phone it was harder to place a precise point on the joint with my finger to be able to draw lines and record valgus angles, my finger being too large and often missed the center of the joint on the phone, though using a stylus might have remedied this issue. On the laptop I was

able to draw an easy axis point, but the overall process was slow. I think with repeated use it would be an easy tool to use (Figure 1).

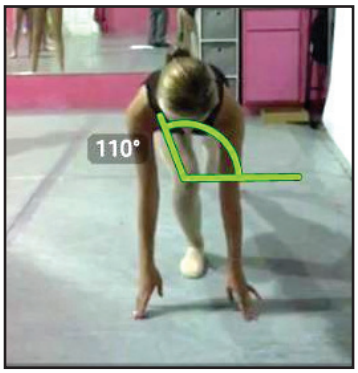

Figure 1. Airplane Test with the Coach's Eye App.

During the initial testing, passive ROM was measured with a goniometer and the single leg heel rise was tested. Then the video recording was started for the Topple test, the Airplane test, and the Single leg Sauté test. It was important that the Single leg Sauté test not be preceded by the single leg heel rise test as they both involve primarily calf muscle strength. I also observed that it would be very difficult to correctly score any of the three tests in real time and that slow motion analysis is necessary to capture the many criteria for each test–especially considering the Sauté test is 16 consecutive jumps with 7 different criteria. During the video analysis, I found that I needed to focus on one criterion for each of the 16 jumps and then rewind for the next criteria. Some criterion paired better than others--for example, level pelvis with still coupe leg—and I arranged the form so that the more experienced reviewer may be able to score two criteria at once.

Regarding the results of the tests, none of the dancers were able to pass the Sauté test or the Airplane test. The highest score on the Sauté tests were two jumps that met the criteria, and the highest on the Airplane test was one repetition. Poor performance on the Sauté test was reflected in many of the dancers' low repetitions on the heel rise test. The lowest score was 3 repetitions and the highest score was 18 repetitions. Hip strength and stability deficits were observed on the Sauté test and the Airplane test. The dancers performed best on the Topple test probably due to how much time the dancers spend working on pirouettes.

On the follow-up visit, the dancers were briefly taught some essential components of body mechanics and the exercises that use these mechanics. The educational concepts were chosen based on observations during testing and the exercises were based on deficits most noted in the results. Due to busy parents' schedules and how much time the dancers were devoting to dance (4-5 classes weekly), I had only about 40 minutes to deliver all the exercises and concepts. A hand-out was provided with pictures and frequency/repetitions of the exercises.

List of exercises:

1. Plantar flexion stretching 3 repetitions, with 30-second holds
2. Dorsiflexion stretch in squat using a TheraBand on the tibia to exert a posterior force, knee positioned forward from toe and pressing hands down on knee 3 repetitions, with 30-second holds
3. Box jump up with soft landing–3 sets of 10 jumps 3 times weekly[6]
4. Box jump down with soft landing and correct knee position–3 sets of 10 jumps 3 times weekly[6]
5. Single leg Romanian Deadlift (RDL) holding 5-10 lb. weights, 5 high quality repetitions per side, progress to 10-20
6. Quadruped bird dog hip against the wall, 5 high quality repetitions per side
7. Single heel raise-work up to 27 consecutive repetitions, three times weekly[4]

Education concepts:

1. hip hinge in lumbar neutral–mirror and dowel for feedback
2. unilateral heel raise without anterior/posterior sway
3. identifying knee valgus in closed chain in mirror and with video feedback
4. identifying level pelvis with mirror (Figure 2)
5. soft landing with jump up and jump down

Figure 2. Identifying a level pelvis.

These dancers were eager observers and participants. We did not have time for everyone to be coached in the exercises so the dancers revolved through or I asked for volunteers who thought they might need the exercise. I encouraged the dancers to observe each other and use each other for assistance multiple times during the session especially for identifying pelvic alignment during the single leg RDL, bird dog, and jumping form. After the 40-minute session, each dancer came out to the foyer to discuss the individual results with me and their exercise corrections were emphasized. Several dancers expressed an interest in having me return for follow-up.

When speaking to the dancers, the first question I asked was if they were nervous about the testing or the results. All but one of the older dancers expressed feeling nervous. I made sure to emphasize that it did not matter how they did on the test and the intention was to help them all improve. I also explained that the test is meant to be difficult because dancing en pointe is very difficult. I did not rank them or tell them who did the best. I told them where they were strong and where they needed to improve and what exercises related best to their deficits.

Reflecting on the experience, I think the dancers would benefit the most from a few more follow-up dates with dedicated time to answering questions, progressing the exercises and the plyometric program and ultimately re-testing. This was a huge commitment, but in many ways did not feel like work, especially when working directly with the dancers. It was very evident to me that the information presented can have a big impact on the quality of the dancer's future skills, though this is yet to be proven in the literature for either injury prevention or improving dance performance.[5]

Questions that come to mind when working with dancers include what natural accommodations of pelvic asymmetry occur with scoliosis and how do dancers compensate? What are the best training exercises for the dancer with flat feet? And of course, can a training program for dancers help prevent injury? Special

Appendix. Description of Pointe-Readiness Tests Listed in the Literature

Single Leg Sauté Test[7] The single leg Sauté test evaluates dynamic trunk control and lower extremity alignment. The dancers began in coupé derriere with the gesturing leg and standing leg turned out as if they had just completed a jeté ordinaire. Hands were placed on the hips. The participants then jumped into the air and had to demonstrate the following: 1. A neutral pelvis; 2. An upright and stable trunk; 3. A straight standing leg in the air; 4. A pointed standing foot in the air; 5. No movement in the leg maintaining the coupé; and 6. A controlled landing in plié, rolling toe-ball-heel through the foot. Participants attempted up to 16 Sautés on each leg. The test was video recorded and replayed in slow motion for analysis. Each jump that met technical criteria was counted toward the total score. Right and left sides were then added together for the total score.

Topple Test[7] The topple test assesses the dancer's ability to perform a clean single pirouette. For the pirouette to be considered "clean" the dancer must demonstrate the following properties: 1. Proper beginning placement (square hips, the majority of weight on the forefoot, turned out, pelvis centered, and strong arms; 2. Leg brought up to passé in one count; 3. Supporting leg straightened; 4. Torso turned in one piece; 5. Strong, properly placed arms; 6. A quick spot; and 7. A controlled landing. The dancers were allowed three attempts on each leg. One point was given for each technical criterion that was met, and the best pirouette on each leg was scored. Right and left scores were combined for the total score. The test was recorded using a Samsung Galaxy S5 video camera (Ridgefield Park, NJ). Videos were replayed in slow motion to enhance precision of analysis.

Heel Rise Test[7] A heel rise test determines endurance of the calf musculature. The dancers stand on one leg with the contralateral leg held in a parallel coupé. They performed as many relevés without plié as possible to a set beat of 120 beats per minute, or 30 heel raises per minute. The test ended when the dancer could no longer keep time with the metronome or chose to stop. For practical considerations, if a dancer performed 75 relevés the test was stopped. Both left and right legs were tested and the number of relevés for both legs were added together for the total score.

Airplane Test[2,7] The dancer stands on one leg while bending over at the waist and extending the other leg backward such that it and the trunk are parallel to the floor. In this position, then, the dancer is facing downward at the floor. The upper extremities are extended outward from the shoulders, also parallel to the floor. The dancer then lowers herself by flexing the knee of the support leg, simultaneously keeping the trunk and nonsupport leg parallel to the floor and bringing the fingertips of both hands downward, while maintaining extended elbows, to touch the floor in front of the face. The dancer then extends the knee and upper extremities to return to the starting position. Four out of five consecutive trials performed are required to pass the test in Richardson's study and 2 high quality repetitions in DeWolf's study. An unsuccessful attempt is defined by pelvic drop, hip adduction, hip internal rotation, knee valgus, or foot pronation during the movement. DeWolf details a point scoring system for various aspects of motor control that he suggests should be further researched.

thanks to Mark Mattson for photography and video, Samantha Eakes, DPT, and Mike Reuland, DPT, for consultation and advice regarding exercises. For copies of the screen, contact the author at lynnbat26@gmail.com

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FOOT & ANKLE SIG

AOFAS Allied Health Symposium attendees (back row, left to right): Thomas Hearty, DPT, MD; Christopher Neville, PT, PhD; Karen Stevens, DPT, OCS; Walter Wilson, BS; Jeff Houck, PT, PhD; Rob Siegler, DPT, OCS; Stephanie Albin, DPT, PhD, OCS; Kathryn Bohnert, MS; Mary Hastings, PT, DPT, MSCI, ATC; Kalyani Rajopadhye, PT, MHS, OCS; (front row left to right) Frank DiLiberto, DPT, PhD; Megin John, DPT, OCS

This edition of *Orthopedic Physical Therapy Practice (OPTP)* will be landing on your desk right around the time of the Combined Sections Meeting (CSM) 2020 and there are a lot of Foot and Ankle highlights you should be aware of for your consideration to attend. Plan to check out some of the programming while at the meeting, online following the meeting, or by tuning into the FASIG Facebook page. In addition to sharing CSM highlights, the FASIG was active at the American Orthopaedic Foot and Ankle Surgeon (AOFAS) meeting this past September.

The CSM meeting will include 3 talks delivered during primary AOPT sessions and includes a broad range of topics. As a general starting point, Drs Neville, McClinton, and Pettineo will share an overview of assessment and treatment strategies that are fundamental to the care of many of our foot and ankle patients in a talk titled, *What Assessment and Intervention Strategies Are Essential for Great Foot and Ankle Care?* Beginning with patient reported outcomes using the Patient-Reported Outcome Measurement Information System (PROMIS), the talk will then focus on the assessment of ankle dorsiflexion and improving ankle plantar flexion performance. Next, Drs Chimenti, Willy, Chang, and Cuddeford will provide an innovative look at managing tendinopathy with a focus on how tendon pathology and pain drive changes in motor control in a talk titled, *New Considerations for Exercise Prescription in Treating Achilles and Patellar Tendon Pain.* Last, we have an update on the revised, *Ankle Stability and Movement Coordination Impairments: Ankle Ligament Sprains Clinical Practice Guideline Updat*e by speakers, Drs Martin, Kivlan, Fraser, Sawdon-Bea, and Carroll. In addition to these 3 great presentations there are numerous other great talks that you should be sure to attend or get the handouts online following the meeting.

- *The Impact of Foot Arch Characteristics on Cadence and Running Mechanics in Youth Runners* Claire McKeone, PT, DPT; Micah C. Garcia, Jeffery Allen Taylor-Haas, PT, DPT; Jason Long, PhD; Kevin R. Ford
- *Role of Foot and Ankle Joint Mobility on Heel Rise Performance in People with Diabetes* Hyo-Jung Jeong, PT, MS; Michael Jeffrey Mueller, PT, PhD, FAPTA; Jessica Loren Stumpf, SPT; Mary Kent Hastings, PT, DPT, ATC
- *Science Meets Practice 10: Keeping Runners in the Game: Management of Foot Pain in Runners* Michael John Mullaney, PT, DPT; Carol Marie Mack, PT, DPT; Bryan C. Heiderscheit, PT, PhD, FAPTA
- *Foot and Ankle: The Often-Forgotten Component of Fall Prevention* Christopher Glenn Neville, PT, PhD; Mariana Wingood, PT, DPT; Anne M. Reilley, PT, DPT, MS; Sandra Heald Sublett, PT, DPT
- *Evaluating the Diabetic Foot With Diabetic Foot Ulcers* Theresa Biven, PT, DPT; Emily Anne Green, PT, DPT; Leia D. Richardson, PT
- *What Is All the Hype About Running Shoes? Practical Implications for the Running Tactical Athlete* Nancy C. Henderson, PT, DPT; Haley Shea Worst, PT, DPT
- *Are We Underserving the Pediatric Ankle? Supporting Development through a Multisystem Approach* Amanda Hall, PT, MPT

In addition to great CSM programming, the FASIG has a growing presence at the AOFAS meeting. The 2019 annual meeting was in Chicago this past September. The FASIG co-sponsored 5 sessions of programing, 1 hands-on lab session, and 1 keynote talk listed below. The FASIG would like to formally thank each of the speakers and excellent foot and ankle experts that shared their expertise during this great meeting!

- **Session 1: The Foot and Ankle Exam**
  Anatomy and Biomechanics of the Foot and Ankle
  Jennifer A. Zellers, DPT, PhD

  The Foot and Ankle Exam
  Thomas Hunt, PA-C
- **Session 2: Returning to Sports/Recreation for the Active Person**
  Operative Management and Imaging
  Casey Jo Humbyrd, MD

  Nonoperative Management: Achilles
  Erik Martinez, PT, DPT, OCS, FAAOMPT

  Nonoperative Management: Ankle Sprain and Plantar Fasciitis
  Robert Sigler, PT, DPT, OCS
- **Session 3: Trauma: Post Traumatic Return to Function**
  Operative Management and Imaging
  Lauren E. Geaney, MD

  Nonoperative Management of Fractures
  James A. Sabetta, MPAS, PA-C

  Postoperative Management
  Stephanie Albin, PT, DPT, PhD, OCS, FAAOMPT
- **BREAKOUT SESSION**
  Hands-on Foot and Ankle Exam
  Leaders: Craig Hensley, PT, DPT, OCS, FAAOMPT; Alison Chang, PT, DPT, MS
- **KEYNOTE TALK**
  The Compression Wrapping Program: Postoperative Care After Foot and Ankle Reconstruction
  Carol Lynn Meyers, PT
- **Session 4: Degeneration: Managing the Older Patient**
  Operative Management and Imaging
  Cesar de Cesar Netto, MD, PhD

  Nonoperative Management: Arthritis and Posterior Tibial Tendon Dysfunction
  Craig P. Hensley, PT, DPT, OCS, FAAOMPT; Alison Chang, PT, DPT, MS
- **Session 5: Forefoot**
  Operative Management and Imaging
  Paul G. Talusan, MD

  Forefoot Ulcer Management
  Mary K. Hastings, PT, DPT, ATC

If these topics look interesting to you consider being a part of next year's AOFAS annual meeting to be held September 9-12 in San Antonio, TX. It is a whole weekend of just foot and ankle care!

(See page 50)

President's Message

Carolyn McManus, MPT, MA

Greetings members! The Pain SIG Board continues to advance our priority initiatives. In October 2019, Derrick Sueki, PT, DPT, OCS, along with 8 physical therapy pain leaders from across specialty areas met with consultant Jeannie Bryan Coe, PT, DPT, PhD, at the Academy of Orthopaedic Physical Therapy office in LaCrosse, WI to begin to develop a Description of Specialty Practice. This document will provide a framework to develop a survey to determine the need and elements involved in pain specialty practice and those required for residency and fellowship training. The target goal is to have a pilot survey ready for distribution in Spring 2020. In addition, Education Chair, Mark Shepherd, PT, DPT, OCS, is leading an initiative to develop a DPT Pain Curriculum course, manual, and resource packet for educators consistent with the International Association for the Study of Pain Physical Therapy Curriculum Guidelines.

At CSM 2020, the Pain SIG will sponsor an educational session on *Assessing and Classifying the Challenging Patient With Maladaptive Pain Behaviors* with presenters Yannick Tousignant-Laflamme, PT, PhD; Chad Edward Cook, PT, MBA, PhD, FAPTA; and Timothy H Wideman, PT, PhD.

In addition, a multidisciplinary team from the AOPT and the Academy of Physical Therapy Education has completed their systematic literature review and developed best practice recommendations for including education and counseling in the treatment of patients with musculoskeletal pain. Members of the guideline development team, David Morrisette, PT, ATC, PhD; Joel Bialosky, PT, PhD; Derrick Sueki, PT, DPT; and Joseph Godges, PT, DPT, MA, will present a summary of the process along with evidence-informed recommendations in the educational session, *Clinical Practice Guideline for Education as an Intervention for Individuals with Musculoskeletal Pain*. More information on all of these programs can be found at: https://www.apta.org/csm/. Hope to see you there!

As I reach the final weeks in my role as Pain SIG President, I find myself filled with gratitude for the assistance and guidance I received from several colleagues over the past 3 years. I want to especially thank Scott Davis, PT, EdD, OCS, and Joe Donnelly, PT, DHSc, OCS, who served as my AOPT Board liaisons. They provided me with advice and encouragement as I learned the ropes of SIG leadership and led our group through the development of our strategic plan and the efforts to accomplish our goals. I would also like to send a special thanks to Derrick Sueki, PT, PhD, OCS, and Katie McBee, PT, DPT, OCS, who, during my first year when I felt especially green in my role, were always checking in and cheering me on. I want to thank the entire Pain SIG Board who have both been in my corner and taken leadership roles. I am forever grateful for your energy, efforts, and kindness. And of course, I could not have had a successful term without the wonderful support of the AOPT administrative team. Finally, I want to thank the full membership for this opportunity to serve you.

In this, my closing message, I would like to encourage us all to take a broad view of pain treatment. Although some in our field may shy away from adopting treatment strategies that require expanding their skill set beyond a biomedical model, the evidence that pain is a perception resulting from complex sensory, cognitive and affective processes is indisputable and invites a diagnosis and treatment approach that addresses all contributing components, while remaining within our scope of practice. To be successful, we need to be open to models of psychologically informed care, body awareness training, relaxation and stress self-regulation, as well as health coaching skills and motivational interviewing for those patients identified to be at high risk for developing chronic pain conditions and those already suffering from these conditions. I was recently struck by a comment made by a participant in my preconference course at NEXT 2019. He owns a private practice with multiple offices and tracks patient outcomes. He said, "The practitioners with the best outcomes are not the ones with the advanced manual therapy training. The ones with the best outcomes have better therapeutic relationship skills." Again, this comment speaks to the importance of recognizing and valuing the elements essential for successful treatment that are outside biomedical factors. As we go forward in developing models of treatment, we need to be willing to take a broad view, stepping out of our comfort zone when necessary, and appreciate the multiple factors that contribute to the successful treatment of pain.

I would now like to introduce you to PSIG member Katie McBee, PT, DPT, OCS, MS, CEASII. Katie is the Regional Director of WorkStrategies for Select Medical based in Louisville, KY. In addition, she is a member of the Motivational Interviewing Network of Trainers. She has a passion for learning and sharing new information on pain science and best practices for the treatment of pain for physical therapists. Katie spends a portion of her professional time developing new strategies to prevent and manage pain effectively and efficiently in outpatient practice under current payor models. I want to thank Katie for contributing the following article, *Motivate to Rehabilitate: The Use of Motivational Interviewing in Physical Therapy Practice.*

Motivate to Rehabilitate: The Use of Motivational Interviewing in Physical Therapy Practice

Katie McBee, PT, DPT, OCS, MS, CEASII

As clinicians in physical therapy practice, we can find ourselves in challenging situations with patients who demonstrate distressing emotions and maladaptive behaviors in addition to the medical complexity of their injury or illness. Sometimes it seems no matter how much a patient is told what they should do, they are just not compliant with instructions and their passivity becomes a barrier to meeting their health goals. Some patients are extremely angry about their situation and may even be angry about getting referred to physical therapy instead of their desired procedure or prescription. Other patients feel hopeless about their ability to do anything for themselves. These situations and many other patient behavior challenges can come up in the clinic that can be difficult to navi-

gate successfully, especially with a busy schedule and a lack of time for one-on-one communication periods. Building a strong therapeutic alliance with patients may assist with managing challenging emotional and behavioral situations. One skilled and billable tool that can potentially assist with building a therapeutic alliance and overcoming modifiable psychosocial risk factors that present in the clinic is Motivational Interviewing.

Motivational Interviewing (MI) is defined as "A collaborative, goal-oriented style of communication with particular attention to the language of change. It is designed to strengthen personal motivation for and commitment to a specific goal by eliciting and exploring the person's own reasons for change within an atmosphere of acceptance and compassion."[1] Motivational Interviewing was first established in 1983 by William Miller as a counseling technique for addiction rehabilitation. It is now integrated into many clinical as well as non-clinical settings including dentistry, wellness, and leadership training. Although the literature in the physical therapy arena is limited and still building, there are over 1,000 controlled clinical trials for MI and about two-thirds of those trials show a beneficial effect.[2] In some cases, when MI is added to other evidence-based treatments, both can become more effective and the effect size is sustained over a longer period of time.[2] As indicated above in the definition, MI is a technique that promotes autonomy and self-efficacy in the patient by eliciting positive change talk from the patient as to why they should make changes to improve their health. Promoting self-efficacy in patients with chronic pain can positively influence treatment adherence and physical activity.[3,4] Motivational interviewing has also been shown to be more effective in patients that are less motivated, angry, or marginalized.[2] A study by Steven Linton demonstrated that MI, education on the biopsychosocial model, problem solving skills, and communication skills training combined to create a Worker and Workplace Package to treat low back pain that was more effective than usual evidence-based medical care for low back pain in the workplace.[5]

Learning a structured technique for communication to assist in promoting healthy change for complex pain patients with psychosocial risk factors may take a little time and potentially be uncomfortable at first but it could make a difference in some of our more challenging patient populations and has little chance of doing any harm. Adding MI to clinical practice starts with knowing the basics. Then it takes practice and preferably some mentorship by an experienced MI practitioner to be able to practice MI with integrity. To practice MI with integrity there must be an empathetic, client-centered style and MI skills that elicit positive change talk from the client.[2] Even a clinician new to MI can immediately begin adding basic skills and the spirit of MI into clinical interactions to assist with improving the therapeutic alliance.

The two key beginning elements of MI are the MI Spirit and MI Skills. The MI spirit is a way of being with patients that respects their autonomy and shares the driver's seat of the clinical decision-making to ensure a patient-centered approach. The key is to partner with the patient wherever they are and together come up with viable solutions for their care in a collaborative manner. The basis of partnering with a patient instead of telling them what to do as per a more traditional medical interview model is based on the likelihood of behavior change being greater when a patient has intrinsic motivation, hears themselves speak of change, and feels respected by the clinician.[1] By allowing the patient to problem solve and offer solutions, they can take more ownership of their care and develop further self-efficacy. Table 1 summarizes the 4 inter-related elements of the MI spirit.

Table 1. Motivational Interviewing Spirit[1]

Partnership	Building a collaborative relationship with the patient that respects his/her ideas and thoughts for care instead of an authoritarian role.
Evocation	Working to build intrinsic motivation by pulling from the patient's own resources instead of educating him/her on why he/she should do something.
Acceptance	Approaching the patient with respect for one's values and imperfections. Having empathy and promoting autonomy. Working to identify the patient's own strengths and efforts.
Compassion	Unconditionally seeking the patient's best interests, well-being, and growth.

The second key element is the MI skills. These skills are used throughout the interaction to increase the patient's motivation for change. Table 2 summarizes the MI skills. Learning to use all of these skills in the correct ratios with the MI spirit while achieving positive change talk from the patient is how MI is practiced. However, each of the skills can be used as a stand-alone method to assist with better patient interactions. The acronym for the MI skills is OARS.

Table 2. Motivational Interviewing Skills[1]

Open Ended Questions	Ask questions that cannot be answered with one word, a number, or a date. Questions that start with what, how, and tell me more are common open-ended questions. The goal is to decrease reflexive responses and encourage communication.
Affirmations	Affirmations are a statement that points out strengths or values the patient is demonstrating.
Reflections	Repeating back what the patient says in different words. Reflections are a way to ensure the patient is heard and understood.
Summary	A summary is a type of reflections that acknowledges the barriers the patient has stated but reiterates his/her reasons for change and any potential next steps to pull the interaction together and make sure the patient hears his/her own words stated back.

The O from the OARS acronym is for open-ended questions. When practicing MI, about 70% of the questions in the interaction are open-ended questions. An open-ended question is one that keeps the conversation going and makes the patient think about the answer instead of answering reflexively. Open-ended questions begin with words or phrases like "what," "how," and "tell me more." When dealing with a highly emotionally charged interaction, open-ended questions can be a life saver. When a person is emotionally charged, they may be mainly operating from emo-

tional centers of the brain. By asking an open-ended question, the patient has to stop and think about an answer that can bring higher level brain centers back online and calm or at least distract from the negative emotion. Good open-ended questions can also focus the conversation on the positive. For example, "Tell me what you like about exercise" is an example of an open-ended question. This contrasts with "Do you like exercise?"

The A in OARS is for affirmations. Affirmations are a way of identifying and acknowledging the strengths the patient brings to the situation. The focus is on a behavior or value more than an attitude or a decision made. An affirmation is different from a compliment. A compliment would be "nice shoes." A good affirmation would be "you demonstrate a lot of perseverance to keep showing up to treatment despite all of the challenges going on in your life right now." A well timed and quality affirmation can assist with promoting change talk, increase the patient clinician connection, and completely change the mood of the patient if he/she is feeling powerless and down.[5]

The R is for reflections. Reflections are a way to ensure that the patient feels heard and that the clinician can ensure he/she heard the patient correctly. To practice MI, a 3:1 ratio of reflections to questions is recommended. Reflections are a core skill in MI. The goal of the reflection is to state the patient's comment back to him/her in different words and possibly dig a little deeper to take a guess at the underlying feelings or meanings of the statement. I can give a simple example of the skill of reflections in deamplifying a situation. When I get home from work, sometimes I feel overwhelmed with the things still on my to do list and occasionally I will tell my husband this in an emotionally charged manner. Historically his response had been something along the lines of "Why did you spend 2 hours on social media last night if you had so much to do?" You can imagine my reaction. I felt invalidated and shamed. After a few years of MI training, I decided to start teaching my husband how to do reflections. Now when I have one of those days and come to him about my stress, his response is more along the lines of "sounds like you are working hard but you still have a lot on your plate." Reflections have assisted in maintaining a much happier household. Often when people speak of their problems, they are not looking for the obvious solution. They are looking to be heard and validated. Reflections can assist the clinician in helping the patient feel heard and understood. This can be a very powerful patient engagement tool. Reflections can also be very helpful with angry or disgruntled patients. Reflections help the angry individual feel heard but not challenged and can assist with de-escalating a situation and helping a patient get to a calmer state.

Finally, the S in OARS is for Summary. A summary is a type of reflection that basically summarizes the entire interaction to highlight the challenges the patient has faced, the reasons he/she is motivated to make the targeted change and the things that have been agreed upon as next reasonable steps. Summaries are an important way to let the patient hear what was said rephrased again to further increase the motivation for change.

The MI spirit and the MI skills can be easily learned through readily available resources. A great starting place is the Motivational Interviewing Network of Trainers website.[6] Motivational Interviewing is a fairly new practice in physical therapy but used well can assist in improving the therapeutic alliance with complex pain patients and increase their adherence to treatments. Motivational interviewing is also a great tool to assist with mitigating common modifiable psychosocial risk factors like low self-efficacy, depression, and perceived injustice that can be barriers to successful outcomes. When we can get clients past barriers and get them motivated, then we can focus on our traditional rehabilitation skills and drive successful outcomes. What reasons do you have to give motivational interviewing a chance?

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Combined Sections Meeting—Denver

By the time this issue of *Orthopaedic Physical Therapy Practice* appears in your mailbox, CSM in Denver will be rapidly approaching. There is an abundance of educational content related to imaging with multiple educational sessions, platform presentations, and posters.

The Imaging SIG Educational Session is titled, *Building an Imaging Alliance for Future Practice: One Voice, One Vision* and is being presented by James Elliott, Aaron Keil, Daniel Watson, Scott Rezac, and two physicians: Frank Crnkovich, MD (Radiologist) and Mark Slabaugh, MD (Orthopaedic Surgeon). This promises to be an outstanding session with a vision toward future practice and collegial relationships and the potential role for physical therapists. This session will be held Thursday, February 13 from 8 a.m. - 10 a.m.

Immediately prior to that presentation will be the Imaging SIG's Member Meeting at 7 a.m., which is tentatively scheduled to be in the same room as the educational session. In addition to our regular business, representatives of Inteleos are expected to be present to discuss a joint strategy toward helping more physical therapists earn the Registered in Musculoskeletal Sonography (RMSK) credential. The Imaging SIG will also have reserved suite time available on the conference site for interested physical therapists to meet with those same Inteleos representatives. This is a great opportunity to ask questions and explore options of how to achieve that credentialed status, particularly how to navigate the pre-requisites for the examination.

Beyond the Imaging SIG's programming, there are at least 8 other sessions over the course of the 3 days at CSM featuring imaging content. If you look on the CSM programming webpage (https://apta.confex.com/apta/csm2020/meetingapp.cgi), a simple search for imaging sessions will provide enough to keep you busy.

CSM Scholarship

Also at CSM, the Imaging SIG will be awarding and recognizing the recipient for the third annual winner of the Imaging SIG Scholarship for an accepted presentation. This will likely be done during the Educational Session on Thursday morning. The received applications are reviewed by the Imaging SIG's Scholarship Workgroup, headed by Lena Volland, and a winner selected. Keep this scholarship in mind for yourself, a colleague, or a mentee in the future. Watch for more information about the scholarship application becoming available again in 2020 for CSM 2021 in Orlando. Information about the scholarship is available on the Imaging SIG's web page on the AOPT website.

State Acts and Regulations on Imaging Referral

During the fall 2019, the Imaging SIG began publishing the results from the APTA study of each state's legal language pertaining to physical therapists referring for imaging. As you may recall, APTA was charged with pursuing practice authority for imaging during the House of Delegates in June 2016. RC 12-16 was passed with a 93% affirmative vote for APTA to begin activities toward pursuing practice authority. Thus, a study was launched toward evaluating the present status of the practice act and any potential interacting other legal language in each jurisdiction in the United States. The first 24 states are currently published on the Imaging SIG's webpage on the AOPT's website. Go to the webpage and look for "State Acts and Regulations on Imaging Referral" on the left side of the page. The remaining 26 states are expected to be published by early 2020. Please note that many of these summaries are not necessarily definitive interpretations on imaging referral. These are actually starting points for discussion and possible strategic planning among the leaders of each APTA component to determine when and how to manage this discussion. Involvement and leadership by the component is critical with these types of undertakings. The Imaging SIG strongly discourages efforts toward securing imaging referral privileges independent of the state chapter's efforts. Such efforts are much more likely to be successful if within the overall priorities of the chapters in each state.

AIUM Webinars

Webinars with AIUM have continued throughout 2019 and we are considering more for 2020. If you have interest in a particular topic for a webinar or you are interested in presenting or collaborating for a webinar, please contact crhazl00@uky.edu. If you missed these webinars, please recall they remain available for your viewing on AIUM's website and on their YouTube channel. These webinars are great opportunities for extremely valuable information at no personal cost.

Strategic Plan Activities

In October 2019, Board, Committee Chair, and SIG leaders of the AOPT met in La Crosse, Wisconsin, to help in formulating a new strategic plan for the Academy. Once through the approval process, all of the SIGs will be re-visiting their strategic plans to assure alignment with the AOPT plan. Subsequent to CSM, we anticipate conducting meetings by web and phone to adjust our current strategic plan.

While at CSM, the Imaging SIG leadership will be seeking additional assistance for the SIG's strategic plan activities. The original plan formulated in 2016 was very ambitious and challenging for a volunteer organization to manage. Please consider volunteering when asked at CSM or by contacting Chuck Hazle at crhazl00@uky.edu.

If you have perused the Imaging SIG's webpage, you have perhaps seen the addition of Research Mentors assembled and published by George Beneck' Research Committee. This is an outstanding advancement for the SIG and has the potential to facilitate professional connections to yield great work. Please take the time to look on the SIG's webpage for these mentors.

Social Media

As previously mentioned, the Imaging SIG no longer maintains its open social media accounts. As with the case of all SIGs, those have now been placed under the umbrella of the AOPT. While the closed Facebook page has remained unchanged, all Imaging SIG Tweets will be present on the AOPT's Twitter feed (@OrthopaedicAPTA), but with the SIG's hashtag identifier: #PTImgSIG.

Imaging Privileges Webinar Recording Available

In early October 2019, Connie Kittleson and Evan Nelson described the process that Wisconsin went through to obtain specific legislative changes to allow physical therapists to have imaging referral privileges in that jurisdiction. The recording of this webinar is available on the Imaging SIG's webpage under "Webinars." This is a great opportunity to learn from those who have been through the process.

Combined Sections Meeting Upcoming Events:

- 2/12/20 8:00 a.m.-5:00 p.m.
  ORF-SIG Sponsored Preconference Programming: *Clinical Excellence in Residency and Fellowship Education*
- 2/12/20 7:00-8:30 p.m.
  AOPT Special Interest Group Meet and Greet
- 2/13/20 8:00-9:30 p.m.
  Orthopaedic Res/Fellowship Career Reception
- 2/15/20 7-7:45 a.m.
  ORF-SIG Business Meeting

PRESIDENTS MESSAGE

ORF-SIG Members,

As 2019 has come to an end, I think it is safe to say we have taken some big steps forward. In 2018, we set out to put a strategic plan in place for the ORF-SIG. In 2019, we started making this plan a reality. Parts that started out as goals have now become simple operations. With every developing organization, operations keep the motors running and things moving forward. With the motors running at full force, I look forward for that momentum to build speed into 2020!

Let's take a look back at the Strategic plan in 2019!

GOAL 1: The process of residency and fellowship accreditation will be positively impacted through relationship building and advocacy.

1. OBJECTIVE 1.1: Formalize the ORF-SIG's liaison role between ABPTRFE and members/directors of residency and fellowship programs to promote communication and excellence in practice.
   - Progress: Has now become operational in nature as the ORF-SIG communicates regularly with:
     - Program Directors via Osteoblasts and direct emailing lists, a closed Facebook group, Quarterly President's message via *Orthopaedic Physical Therapy Practice (OPTP)* and quarterly WebEx meetings
     - ABPTRFE via quarterly Residency and Fellowship Leadership meetings
     - AOPT leadership via Quarterly updates
2. OBJECTIVE 1.2 Establish relationships with other stakeholders related to residency and fellowship education.
   - Progress: Established communication with:
     - The American Council of Academic Physical Therapy to address concerns regarding terminal internships and resident interviews
     - Residency and Fellowship leadership in the other Academies/Sections to work on shared initiatives
     - The Academy of Education Residency and Fellowship Special Interest Group developing a liaison and working relationship with our research committees
     - The American Academy of Orthopaedic Manual Physical Therapists (AAOMPT) creating a liaison for communication and processes shared between our members
     - RF-PTCAS via Ryan Bannister

GOAL 2: Excellence in orthopaedic residency and fellowship education will be promoted.

1. OBJECTIVE 2.1: Provide and encourage the use of mentoring resources for all orthopaedic residency and fellowship programs to establish common practice strategies.
   - Progress: Established a Practice Committee to focus on mentorship resources. Currently finalizing a survey that will be sent to residency and fellowship directors to evaluate current mentorship methods. Results will be disseminated at upcoming business meeting.
2. OBJECTIVE 2.2: Provide resources to enable programs to perform regular curriculum monitoring and evaluation.
   - Progress: Established a Curriculum Subcommittee who identified areas of development to meet the new Description of Residency Practice for the current AOPT Residency Curriculum Package. With their support the AOPT BOD moved to add two Independent Study Courses to the residency base curriculum package including:
     - Outcomes in Orthopaedic Physical Therapy Practice
     - Screening for Orthopaedics
3. OBJECTIVE 2.3: Identify developmental changes in residency and fellowship education that are impacting programs and their participants.
   - Progress:
     - Applicant Shortage/Surplus: Several programs identified a concern regarding having available positions following their application cycle while other programs noted having excessive applicants. The ORF-SIG developed a Subcommittee to understand this discrepancy evaluating the ABPTRFE Aggregate data as well as to evaluate the need for a common offer date. Less than 50% of programs noted interest in a common offer date due to rolling admissions, variable interview, and start dates, etc.
     - Applicant Sharing: The ORF-SIG set out to identify how applicants could be notified of pending application deadlines and open positions. The ORF-SIG met with Ryan Bannister and RF-PTCAS to help programs notify applicants of open positions. Programs can reopen their application cycle that will list their availability. Programs will need to notify RF-PTCAS if they do this so their system can be updated.
     - Program Director/Coordinator Administrative Time: Programs and members of the ORF-SIG were looking for information to provide to their administrations to support the need for additional time to manage their residency or fellowship programs. The ORF-SIG developed a Program Director Administration Subcommittee to survey current program directors evaluating how their time is allocated and managed. Results of this survey were published in the 2019 Volume 31, number 4 issue of *OPTP*.
     - ABPTRFE Policies and Procedures Impact Analysis: Several programs reported concern regarding

the new Substantive Changes Policies leading the ORF-SIG to survey programs. Forty-two percent of programs reported they were unsure if they would maintain their accreditation if the policy remained. This information was shared with the ABPTRFE leading to a "provisio" suspending policy 13.4.2 and initiating a key stakeholders meeting at APTA headquarters. The ABPTRFE has since further suspended this policy until a new policy can be drafted and approved following a public comment period.

- o ABPTRFE Policies and Procedures Review: Given the challenges of the new ABPTRFE policies and procedures supporting the new Quality standards the ORF-SIG was tasked with reviewing the unintended consequences these could have on programs and solutions to these concerns. The ORF-SIG Communications committee provided a review of the document that was submitted alongside other supporting documentation from AOPT leadership regarding the new Primary Health Conditions and processes ABPTRFE was taking in implementing new policies. The complete letter can be found on the ORF-SIG Facebook page.

4. OBJECTIVE 2.4: Facilitate the conduct of research in residency and fellowship education.
   - Progress:
     - o Operations: Annually submit 2-3 educational sessions to be provided at CSM. Sponsoring: "Beyond the Basics: Design and Implementation of Best Practice in Residency and Fellowship Clinical Education" in 2020 in Denver, CO.
     - o Collaboration: A Research Committee was formed where communication has been established between the AOPT Research Committee and the Academy of Education Residency and Fellowship Research Committee.
     - o Projects:
       - Provided a letter of support to Matt Briggs and Raine Osborne for funding of a research study, "Defining Excellence in Residency Education: The Next Step in Demonstrating Value."
       - Developing a Resident Poster Award at CSM to highlight their work and move into full publication within *OPTP*. Two winners will receive $250 for publication.

GOAL 3: Members of the ORF-SIG will be engaged and connected.

1. OBJECTIVE 3.1: Recruit relevant stakeholders to become members of the ORF-SIG.
   - Progress:
     - o Operations:
       - Membership Committee: Established committee to assist in member communication and recruitment.
       - Member Tracking: AOPT staff now able to collect ORF-SIG related demographic information for new members.
     - o Members: Membership Committee developed a survey for current members to understand who makes up our members.
     - o Recruitment: ORF-SIG sent our Vice President to National Student Conclave to meet and discuss residency and fellowship education with attendees.
2. OBJECTIVE 3.2: ORF-SIG membership will be reached and engaged across all program and membership categories.
   - Progress:
     - o Website Visibility: Membership Committee worked with AOPT staff to update and enhance user navigation of the website. The website was broken into a flow process to assist in navigating the user quickly to the information one needs and enhance communication. The focus remained in two different populations- individuals that host residency/fellowship education and individuals attending or seeking residency/fellowship education.
     - o Marketing: Membership committee has been working with AOPT staff to be active on social media to keep members informed and engaged.
     - o Engaged: At the request of programs to better communicate with potential residents the ORF-SIG has brought back the Residency and Fellowship Career Reception to CSM in 2020.

The ORF-SIG continues to be very active in creating a Community of Excellence in Physical Therapy Residency and Fellowship Education. Please be sure to get involved with one of our Committees or Subcommittees!

Committees	Subcommittees
Research: Kathleen Geist & Mary Kate McDonnell • kgeist@emory.edu • mcdonnellm@wustl.edu	Applicant Sharing: Steve Kareha • Stephen.Kareha@sluhn.org
Communications: Kirk Bentzen • kirk.bentzen@ah.org	Curriculum: Molly Malloy • mollyscanlanmalloy@gmail.com
Membership: Bob Schroedter • bob@movethrurehab.com	ACAPT: Carrie Schwoerer • CSchwoerer@uwhealth.org
Practice/Reimbursement: Darren Calley • dcalley@mayo.edu	Mentor Development: Kris Porter • kporter@thejacksonclinics.com
	PD Admin Survey: Kathleen Geist • kgeist@emory.edu

Thank you to all our members for their hard work. We look forward to great things in 2020!

Matt Haberl,
President, ORF-SIG

Letter From the President

Jenna Encheff, PT, PhD, CMPT, CERP

In October, I was able to attend the Strategic Planning Meeting for the Academy of Orthopedic Physical Therapy in La Crosse, Wisconsin. This meeting was a gathering of the AOPT Officers, Directors, Committee Chairs, SIG Presidents, and AOPT staff to review and discuss the Mission, Vision, and Goals of the AOPT, and revise and add, if needed, to best serve our members, clients, and community. One of the main points of discussion and themes this year was inclusion. As the largest Section/Academy of the APTA, it is imperative that our members and the physical therapy community at large know that we strive for diversity in all aspects of our Mission, Vision, and Goals. As a new-ish officer of the Animal Rehabilitation Special Interest Group, I must say that I felt immediately welcomed by this group of passionate professionals. My input regarding the AOPT Strategic Plan as it may apply to animal rehabilitation was taken into consideration thoughtfully and respectfully, and I absolutely felt as if I had a voice for the over 400 members of the ARSIG. As those of us who treat animals continue to strive for inclusion and support in each of our respective states and practice acts, please know that the AOPT does support our mission and inclusiveness. The below patient case highlights the importance of animal rehabilitation.

A Vestibular Case Study

Kaitlyn Arnsdorf, PT, DPT

Signalment
Name: Sassy
Age: 14 years
Breed: Golden Retriever
Sex: Female, spayed (after having 3 litters)
Working/sporting history? Competed in agility, obedience, and field trials until age 11.
Clinical presentation (brief history of the problem): Sassy presented with insidious onset of spontaneous nystagmus and a head tilt to the right on March 10, 2019 (10 days prior to initial evaluation by physical therapy on March 20, 2019). Sassy was seen by her regular veterinarian 2 days after onset and was prescribed Dramamine to manage vestibular symptoms. Sassy's vet referred her to rehabilitation to help manage her head tilt, nystagmus, and difficulty walking without consistent loss of balance (LOB).

March 20, 2019 – Evaluation

Subjective: Observation: alert and responsive with significant head tilt to the right, spontaneous nystagmus has resolved without use of Dramamine (indicating it is now appropriate to begin vestibular rehabilitation).[1]

Objective:

Gait assessment: No lameness noted but decreased cervical dissociation due to significant muscular guarding in right shoulder and neck, and head tilt present throughout gait cycle. Significant unsteadiness noted during transition from stance to swing phase with decreased stance time on the right vs. left.

Modified Clinical Test of Sensory Interaction in Balance (MCTSIB): eyes open hard surface: no LOB.

Eyes open on compliant surface: mild LOB and increased postural sway requiring contact guard assist (CGA) from physical therapy.

Eyes closed on firm surface: mild LOB and increased postural sway requiring CGA from physical therapy.

Eyes closed on compliant surface: patient unable to balance without maximum assist from physical therapy.

Active Range of Motion (ROM): Decreased cervical rotation ROM bilaterally, with left showing greater restriction than right and decreased cervical extension.

Passive ROM: Decreased right shoulder flexion and extension (flexion > extension).

Neurological testing (all appropriate neurological testing, results, and meaning of the outcomes): Diminished upregulation of vestibular system, as seen by MCTSIB testing; deep pain and light touch sensation intact.

Treatment: Manual therapy consisted of dorso-ventral mobilizations to cervical spine and passive ROM of bilateral shoulders.

Assessment: Due to the patient's inability to perform diagonal leg lifts without LOB, the exercise was regressed to single leg lifts. Once she became comfortable and showed increased stabilization with single leg lifts, then diagonal leg lifts were reinstated.

Owner given diagonal leg lifts, cervical and bilateral shoulder ROM as home exercise program (HEP).

Problems: Decreased balance, decreased cervical and right shoulder ROM.

Goals: Increase stability on stable surfaces→progress to unstable surfaces, increase cervical and shoulder ROM.

Plan: Plan to focus on improving upregulation of vestibular system in upcoming sessions as well as focusing on reducing hypomobility of the cervical spine. Owner given diagonal leg lifts and cervical and bilateral shoulder ROM as HEP.

March 27, 2019 (visit 2)

Subjective: Owner states she noticed improvement in Sassy's neck after her first physical therapy session.

Objective:

Manual intervention: Passive ROM to bilateral shoulders, instrument-assisted soft tissue mobilization (IASTM) to cervical paraspinals, active ROM cervical rotation, dorso-ventral mobilizations to cervical spine.

HEP: Owner given balancing on disc with front feet for 30 seconds working up to 1 minute, cervical and bilateral shoulder ROM.

Gait: No longer displays head tilt, head continues to be lowered.

Assessment: Was able to progress balance training to unstable surface as owner was diligent about doing narrow base of support training in the form of diagonal leg lifts, with only occasional LOB. Sassy showed some reluctance with exercise and had increased postural sway but improved with each set.

Remaining problems and goals: Hypomobile lower cervical spine and right shoulder, decreased balance.

Plan: Continue therapy once a week.

April 7th, 2019 (visit 3)

Subjective: Owner states she notices Sassy slowing down when having to make turns or coming in from the yard; in the dark she is unsteady.

Objective:

Manual intervention: Passive ROM and stretching to bilateral shoulders, IASTM to cervical paraspinals, active ROM cervical rotation, dorso-ventral mobilizations to cervical spine.

HEP: Owner given balancing on disc with front feet for 1 minute, cervical and bilateral shoulder ROM.

Gait: No head lowering this session; decelerates more than normal with turns and deviates from trajectory.

Assessment: Decreased hypomobility noted in cervical spine in this session indicating increased muscle length and decreased guarding of cervical paraspinals as well as improved joint play confirmed with increased tolerance and mobility noted during dorso-ventral mobilizations. Progressed duration of unstable surface training with front legs and Sassy had no LOB in this session requiring assistance from the physical therapist. She is also demonstrating improved upregulation of the vestibular system due to her improved gait pattern and ability to balance for brief durations on an unstable surface without LOB and with diminished craniocaudal sway.

Remaining problems and goals: Progress balance exercises to all 4 limbs on unstable surface.

Plan: Continue therapy until patient can tolerate being on a compliant surface without visual feedback (ie, blindfolded) and have no LOB.

April 15th, 2019 (visit 4)

Subjective: Owner states Sassy played fetch for the first time since her onset of vestibular system without loss of balance and was almost running at her normal speed.

Objective:

Manual intervention: Stretching shoulders, IASTM to dorsal, cervical musculature.

HEP: Balancing on disc with all 4 feet for 30 seconds working up to 1 minute, cervical active ROM, bilateral shoulder stretching.

Gait: gait pattern unremarkable, turns have normalized in terms of speed and trajectory deviation.

Assessment: Sassy showed increased balance this session and was able to stand with all 4 feet on discs with only one instance of LOB requiring assistance from physical therapy. Plan to increase duration and then progress to reduced visual feedback in order to force full reliance on vestibular system to improve balance when Sassy is in dark or dimly lit settings. Sassy is also maintaining improvement in cervical and shoulder ROM between sessions.

Remaining problems and goals: Add in blindfold next session.

Plan: Transition to an independent HEP next session due to owner traveling with her dogs for competition and being textbook compliant with exercises.

April 22, 2019 (visit 5)

Subjective: Owner states Sassy is doing great; she does not notice any deficits anymore.

Objective:

Therapeutic exercise: Balancing on discs with all 4 feet and blindfolded for 30 second intervals.

Manual intervention: Stretching to bilateral shoulders, cervical soft tissue mobilization, and active ROM.

HEP: Diagonal leg lifts on foam or disc surface, balance on foam with blindfold until reaching 1 minute without LOB.

Gait: Unremarkable gait pattern.

Assessment: Sassy has shown dramatic improvement compared to her initial evaluation and is no longer exhibiting a head tilt, or restricted cervical or shoulder ROM. She now exhibits a normalized gait pattern with both trotting and walking, as well as during directional changes and in dimly lit environments. Her balance has returned to normal and she shows proper upregulation of her vestibular system during compromised visual and somatosensory situations, such as when she is blindfolded and on a compliant surface. She did show some noted mild LOB when blindfolded on foam toward end of duration, however.

Remaining problems and goals: None.

Plan: Since all goals have been met and the owner is independent with a HEP, she will be discharged from the structured rehabilitation program.

Discussion:

Veterinarian feedback: Sassy's veterinarian seemed extremely pleased with Sassy's progress and was very surprised she was able to recover as quickly as she did, especially without medication. She asked if she could refer more vestibular patients to physical therapy in the future.

- **How do you feel physical therapy made a difference in this particular case?**
  I think physical therapy made a tremendous impact in this case, and was what allowed Sassy to make a quick and full recover. I think without therapy she would have been reliant on medicines much longer to keep her condition stable and developed orthopedic issues with her neck and shoulders secondary to compensating for lack of balance and upregulation of vestibular system.
- **What is your speculation of the case if the patient did not receive physical therapy?**
  If this patient did not receive physical rehabilitation, I do not think she would have returned to her prior level of function given her age and level of impairment.
- **What could have been altered in the physical therapy care of this case?**
  I feel good about the outcome of this case and would not

really change anything at this time. I might have added a weighted vest in the very acute stages to see if that helped, but I was hesitant to try that given her level of head tilt and restricted shoulder ROM.

- **Were there any barriers to the outcome of the case?** The patient went on an 8-week trip to compete with her other dogs, which is why therapy was transferred to a HEP sooner than it may have been, but the great majority of the goals had been met by that time.

REFERENCE

Han BI, Song HS, Kim JS. Vestibular rehabilitation therapy: review of indications, mechanisms, and key exercises. *J Clin Neurol*. 2011;7(4):184–196. doi:10.3988/jcn.2011.7.4.184.

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Head, Spine, and Shoulder Disorders:
Integration over Isolation

Hilton Minneapolis/St. Paul Airport
Mall of America

AOM 2020

APRIL 3-4, 2020

Orthopaedic physical therapists are often presented the challenging task of treating complicated and often coexisting injuries of the head, cervicothoracic spine, and shoulder complex. The Academy of Orthopaedic Physical Therapy's 2020 Annual Orthopaedic Meeting will explore integrated evaluation and treatment principles for these regions highlighting the orthopaedic and vestibular factors affecting patients with concussion injuries, the interconnection of the head neck complex, and the relationship between the neck and shoulder in rehabilitation. A diverse team of experts will integrate best available evidence in hot topic areas and enhance participant learning with exciting laboratory breakouts focused on skill acquisition.

We invite physical therapists, *Residents, Fellows, PhD Students, and DPT students to join us for this exciting meeting!

*SEE RESIDENT, FELLOW, AND STUDENT ATTENDANCE REQUIREMENTS ON WWW.ORTHOPT.ORG.

Friday and Saturday will begin with a general session, followed by breakout sessions, and an interactive session and panel discussion to end each day. This year, attendees will have the opportunity to attend all breakout sessions!

Friday, April 3, 2020

General Session: ***Concussion: Cervico-Vestibulo-Ocular Integration over Brain Isolation***

Description: In this session we will review the complex interaction between the central nervous system, vestibulo-ocular system and cervical musculoskeletal system in generating signs and symptoms after concussion, with special emphasis on the latter two systems. We will describe the differential diagnostic thought process and integrated management of common vestibulo-ocular and cervico-thoracic impairments that occur after a concussive event. Case examples will be used to illustrate key concepts and caveats for treatment.

Speakers: Airelle Giordano, PT, DPT; Rob Landel, PT, DPT, FAPTA

Friday Breakout Sessions

Considerations for Managing Vestibulo-ocular Impairments

Breakout Description: In this session we will review key tests and measures for identifying and differentiating vestibular and oculomotor impairments that contribute to symptoms post-concussion. Using case vignettes participants will be asked to identify appropriate measures, to summarize their findings and explain how the findings can be used to guide clinical practice. Participants will be given the opportunity to perform/administer the tests/measures and key manual interventions.

Speaker: Airelle Giordano, PT, DPT

Considerations for Managing Post-concussion Cervicothoracic Impairments

Description: In this session we will review key tests and measures for identifying and differentiating cervical and cervicothoracic musculoskeletal impairments that contribute to post-concussive event symptoms. Using case vignettes participants will be asked to identify appropriate measures, to summarize their findings and explain how the findings can be used to guide clinical practice. Participants will be given the opportunity to perform/administer the tests/measures and key manual interventions.

Speaker: Rob Landel, PT, DPT, FAPTA

Saturday, April 4, 2020

General Session: ***Trouble with Reaching? Differential Diagnosis and Management of the Relevant Physical Impairments***

Description: In this general session we will review integrated upper quarter kinesia and dyskinesia (movement deviations) as related to development or outcome of common clinical tissue pathologies such as rotator cuff pathology, nerve injuries, and pain syndromes. The session will incorporate current evidence regarding relationships between impairments, movement deviations, and tissue pathologies. In particular, the most common peripheral nerve injury and/or nerve entrapments of the neck and shoulder region, and common historical presentation and clinical findings of those different injuries/entrapments will be presented. Emphasis will be on incorporating diagnostic findings and clinical reasoning strategies to rule in or out the most relevant movement system/physical impairments that can be used to direct optimal interventions.

Speakers: Joseph Godges, DPT, MA, OCS; Paula Ludewig, PhD, PT, FAPTA; LTC James T. Mills, III, PT, MS, ECS

Saturday Breakout Sessions

Trouble with Reaching? Movement Analysis and Re-education Strategies

Description: In this session we will overview and perform movement screening with an emphasis on scapular dyskinesias in each of the frontal (upward/downward rotation), sagittal (tilting) and transverse (internal rotation) planes. Participants will be given the opportunity to perform an upper quarter movement screening and use case vignettes to identify appropriate follow-up tests and consider diagnostically driven physical therapy interventions. Appropriate stretching, strengthening and movement coordination interventions will be discussed, including use of electromyographic biofeedback.

Speaker: Paula Ludewig, PhD, PT, FAPTA

Trouble with Reaching? Manual Examination and Intervention Strategies: Addressing Relevant Pain and Mobility Impairments

Description: In this session, participants will be invited to participate in hands-on practice with co-participants with feedback from the instructor and lab assistants – so come in lab clothes and be ready to expose your neck, upper back, shoulders, and arms. There will be demonstrations and practice with ongoing clinical reasoning "pearls" using live case examples. The labs practice sessions will cover examination, manual interventions, and reassessment of 1) cervical, thoracic spine, and rib segmental mobility, 2) upper limb nerve mobility and symptomatic entrapment sites, and 3) glenohumeral joint and soft tissue restrictions.

Speaker: Joseph Godges, DPT, MA, OCS

Learn More

The 2020 Annual Orthopaedic Meeting will be held at the Hilton Minneapolis-St. Paul Airport, Mall of America Hotel. This beautiful property is conveniently located near the Minneapolis-St. Paul International Airport, and within walking distance to fantastic shopping, restaurants, and nightlife, to include the world-famous Mall of America.

Please visit the AOPT's website for full details on this conference, reserve your guestroom, and register: www.orthopt.org. Additional questions? Contact the AOPT office at tfred@orthopt.org or 800-444-3982 x 2030.

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