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ORTHOPAEDIC Physical Therapy Practice

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ORTHOPAEDIC Physical Therapy Practice

In this issue

Regular features

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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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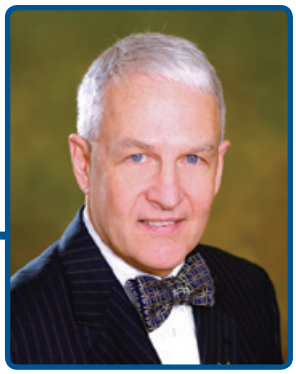
President's Message

Our New Strategic Plan - On To The Next 5 Years And Beyond!

Stephen McDavitt, PT, DPT, MS, FAAOMPT



Our Orthopaedic Section Board of Directors ensures our organization performs productive work for the membership through accountability and performance generally guided by 3 governance principles referred to as fiduciary, strategic, and generative. Fiduciary refers to the Board's stewardship of tangible assets, the overseeing of operations, ensuring appropriate use of resources, and ensuring legal compliance and fiscal accountability. The strategic mode is about setting priorities for the Orthopaedic Section organization, developing and improving various strategies, and then monitoring their performance. In contrast, the principle in generative thinking is a broader, more cognitive process that involves viewing outside the usual framework of overall operations and getting at the core of an organization's reason for existence and purpose. It is about deciding what to do, probing assumptions about the organization, and identifying the underlying values that should be driving strategy and tactics. These principles assist in the development and internal policing of the strategic plan that we traditionally re-examine and fine-tune every 5 years. We are now at our 5-year renewal.

The Orthopaedic Section Board of Directors, staff, and 19 other committee and SIG leaders of the Orthopedic Section held a strategic planning retreat October 16-17, 2014, in La Crosse, Wisconsin. The purpose of the retreat was to develop a results-oriented strategic plan that will guide the Section's activities for the next 3 to 5 years. To enhance our strategic deliberations, a planning survey designed to tease out critical issues was provided to the Section's participating key leadership stakeholders prior to the retreat. We defined "critical issues" as those issues that create an external change, event, problem, or opportunity that significantly impacts the Orthopaedic Section's ability to achieve its mission.

Before starting the strategic plan portion of the meeting, we reviewed the findings from the survey and the progress on the past strategic plan. We then examined and assessed what we all felt was in order for our visionary future. Visionary themes that emerged from those discussions included the needs for advancing best practice and outcome measures, clarifying our roles in being recognized as a content resource, considering our involvement and actions in public policy, providing enhanced mechanisms for member accessibility to our intellectual property, improving our collaborative relationships with outside stakeholders, managing issues pertaining to the term "movement specialist," providing enhanced leadership, augmenting collaboration opportunities and value for members, balancing the dichotomy between serving members and transforming society, enhancing patient care, and creating section growth, to name a few.

The findings from our critical issues analysis from the survey, our visionary themes, and the results from reviewing our past strategic plan were all considered and utilized during the strategic planning discussions. With that information at hand, the leaders of the Orthopaedic Section then reviewed the mission statement, the vision, and long-range goals for the Orthopedic Section. Once the mission and vision were agreed upon, 5 long-term goals were determined with complementary objectives that would be employed to define and describe the efforts the Section would focus on to attain its vision over the next 3 to 5 years.

With pleasure and passion, here are the results of that retreat delineating the mission, long-range vision, goals, and objectives as approved by the Orthopaedic Section Board of Directors.

MISSION

The Orthopaedic Section promotes excellence in orthopaedic physical therapy.

LONG-RANGE VISION

The Orthopaedic Section will be a world leader in advancing orthopaedic physical therapy to optimize movement and health.

GOALS

Standards of Practice

Support the development and distribution of resources that promote the provision of best practices in orthopaedic physical therapy.

- Objective 1: Prior to 2020, disseminate ICF-base Clinical Practice Guidelines (CPG) for 25 common musculoskeletal conditions.
- Objective 2: Deliver educational content through technology applications for clinical practice, professional development and advocacy.
- Objective 3: Develop national orthopaedic outcomes database through modules for shoulder, knee, and low back by 2016. From database, provide mechanisms for measuring and validating value in orthopaedic practice.

Education/Professional Development

Provide exceptional educational content for continuing competence in Orthopaedic Physical Therapy.

- Objective 1: Develop a comprehensive plan using current technologies to access existing and emerging markets for the dissemination of orthopaedic physical therapy content.
- Objective 2: Promote and enhance the educational content and professional development opportunities of the annual Orthopaedic Section meeting, balancing didactic and hands-on learning experiences.
- Objective 3: Analyze the needs of current residency and fellowship programs.

Public Awareness

Increase awareness of orthopaedic physical therapists as experts in movement and functional performance.

- Objective 1: Develop a comprehensive communications plan to improve branding of the Orthopaedic Section and orthopaedic physical therapy in the broader health care environment and general

public.
- Objective 2: Increase public education of physical therapy through ongoing media opportunities.
- Objective 3: Promote the Section mission, vision, and resources by an ongoing presence in print and electronic media.

Research

Provide resources and support for conducting and disseminating research to expand the knowledge base for orthopaedic physical therapy and to improve patient management.

- Objective 1: Implement a sustainable National Clinical Research Network (CRN) to support multicenter orthopaedic physical therapy research through Section funded project grants and external funding within 3 years.
- Objective 2: Implement a process to systematically disseminate findings from the research projects that have been funded by the Section within two years of completion.

Advocacy

Advocate for orthopaedic physical therapist practice and access to care.

- Objective 1: Develop a formal communication process to support relevant scope of practice issues related to orthopaedic physical therapy.
- Objective 2: Develop a strategy for dissemination of payment policy reform information to members.
- Objective 3: Develop strategies to improve access of orthopaedic physical therapy services for the underserved.

Member Engagement

Support the development and allocation of resources to enhance membership retention and recruitment.

- Objective 1: Develop a systematic process for recruiting and utilizing members for Section initiatives.
- Objective 2: Enhance membership involvement in governance.
- Objective 3: Develop ongoing communication process to increase membership.
- Objective 4: Develop strategies to enhance member's recruitment and retention.

Our next step in moving forward with our strategic plan initiative is to define, describe, and prescribe strategies for each objective and its related goal. These strategies will define how the objective and goal will be achieved. Finalized strategies will be considered and placed in relative priority addressing rewards, risks, and required resources based on their components of implementation. Those strategies will be formally completed, organized, and approved by the Board of Directors by our July 2015 meeting and submitted to the Finance Committee for its budget meeting in August. A full report on the finalized strategic plan and strategic initiatives will come back to the membership after that time.

For a more complete view and understanding of the finalized strategic plan, I recommend that all genuinely interested members consider the plan in conjunction with updated financial reports. It will be important to additionally appreciate our liabilities for managing our assets such as our real estate, tenants, and staff as well as other fiscal expectations from other investment organizations such as the Foundation for Physical Therapy and within our accountabilities with the *Journal of Orthopaedic and Sports Physical Therapy*. Members must also appreciate our efforts to keep clinical research networks alive, produce clinical practice research and clinical practice guidelines, and complete other sanctioned outreach activities across the 5 goals defined the strategic plan. Challenging liabilities that must also be valued are within those large initiatives with somewhat indefinite liability exposures such as technical innovations and initiatives for enhancing our website, providing improved access to educational materials, and within our allegiance and alliance with APTA, in developing our clinical modules inside the APTA Physical Therapy Outcomes Registry. Therefore, to clearly understand the dimensions of the Orthopaedic Section strategic plan, it is important to appreciate the Section's assets and multiple financial and manpower demands rooted within the components of strategic planning and implementation. Such consideration and reconciliation will enable a member to appreciate how strategic actions are to be orchestrated by the Board of Directors. The Board must account for not only meeting the projected needs for managing "rainy days" but also ensure the Orthopaedic Section provides nimble responses with relevant results that meets the needs of our members. Otherwise, the Board of Directors would not be fulfilling its obligations for fiduciary, strategic, and generative accountability and performance.

I hope this update on the Board of Directors responsibilities and actions in the development and implementation of the strategic plan is informative. I also hope you will feel free to reflect on this information and share your feedback with the Board as we move forward with our strategic plan. If you are attending our annual meeting in Phoenix, please feel free to pull me aside and speak with me personally to share your thoughts and ideas. I look forward to hearing from you.

Editor's Note

Crazy like A Fox

Christopher Hughes, PT, PhD, OCS

This past fall, I recently stepped into the role as one of the academic coordinators of clinical education (ACCE) at Slippery Rock University. Yes, stepped into it, voluntarily mind you! My first impression as well was, "Am I out of my mind for even contemplating this?"

Being in my 25th year in academia, I am all too familiar with the frustrations and burdens this job can bring. I have heard about the horror stories and seen the frustrations firsthand from students, clinical instructors (CI), clinical coordinators of clinical education (CCCEs), and ACCEs. Experiences can go from highs to lows rather quickly. The stress of placing students, dealing with contracts, and the "twists and turns" of placements can be overwhelming at times not to mention dealing with just plain unfortunate situations. Despite all this strife, in the end there is no option but to make sure everyone finds a site, and that I get it done.

I had a glimpse of the job when I was awarded an APTA grant in the 90s to develop what became a beta software program for matching students to clinical sites. This preliminary work led to APTA's Student/Site Computer-Assisted Matching Program (SSCAMP).[1] Back then it was all about trying to solve the problem of handling so many sites and so many students. The software turned out to be a nice experience and was a real firsthand look at the world of clinical education.

So, after some further soul searching, I decided this challenge was actually a great OPPORTUNITY. I could work with students and clinics on an entirely different level. What better way to feel the pulse of practice than by interacting with sites and CIs across the country. The logistical and organizational challenges were also intriguing. The idea of optimizing the match of a student to a clinical site maximizes the experience for the student and site. At Slippery Rock University, clinical education is about 20% of our total credits and 37 weeks of time in the total curriculum. As ACCEs know, the primary goal is always to share feedback of the internship data BACK to the curriculum in order to best prepare students for affiliation, and ultimately, provide a good start to their careers. I wanted to be on this end for once. After viewing some of the NFL Combine recently, I wondered if curriculums are comparable to the NFL Combine. While in school, we measure and assess students with various tasks and activities, but how well do we in academia really prepare or predict how well they will do in the clinic? I compare getting an A in gross anatomy to running a fast 40-yard dash at the NFL Combine. It has logical relevance, but very little predictive value on how well you will practice as a Physical Therapist. There are just too many variables to account for. Nonetheless, the correlation between academia, clinical internship, career success, and improved patient care is really the big question on my mind right now. Maybe clinical education is about NOT letting school get in the way of a student's education.

I read with interest Rodgehero and colleagues[2] recent findings on fellowships and residencies and clinical outcomes. More education led to better patient outcomes, but only for fellowship and not in support of residency training. Clearly, more work needs to be done, but these types of studies provide a great start to a somewhat misguided premise that more is always better.

I totally understand that my success in clinical education hinges upon collaborative partnerships with students, clinicians, and clinical sites. Since the fall semester, I have faced some pretty interesting realities. For example, clinical sites that will not accept out-of-state students or some sites who offer contracts at a cost are awarded to the highest bidder. I get it, but then again I don't. How quickly bridges have turned into walls! I would like to think sites would really be about taking the best student and not shutting out students based on where they go to school. Just like patients should never pick a clinic based only on location nor should clinical sites be obligated into serving a school based solely on proximity. Today, I know the playing field is not going to be level. Sooner or later we all have to answer the call, step up to the plate for the profession, and do the right thing. After all, where would each one of us be if no one took us for an affiliation! Good clinical instructors put it all on the line. Ultimately the match is the instructor with the student, not the student with the site. Sometimes the only satisfaction the instructor receives from the effort is a sense of pride and satisfaction for the student. Seldom is there an increase in pay, days off, or a promotion. I applaud these types of quality instructors and have already had great feedback from my students after my first round of placements on what an impact and impression they made. As current ACCEs know, this type of feedback is very satisfying and trumps the rigors of the job. This feeling is comparable to how a clinician feels when a patient gets better. You are happy to know you had a positive impact on the outcome. We owe it to our patients and the profession to mentor the next generation and impart a very strong message as to what physical therapy practice is all about. We have a responsibility to pass on the right message. This is especially true in the field of orthopaedics that is so dependent on mentoring–one-to-one training and hands-on skills.

Only time will tell about my decision. Am I crazy like a fox? I hope so. I am willing to give it my best shot because a best shot needs to be taken. My final plea is that all of you who serve as clinical instructors give it your best shot as well. We need each other. After all, aren't we all on the same team?

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Conservative Management of Tarsal Tunnel Syndrome in a Competitive Distance Runner

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ABSTRACT

Background and Purpose: Tarsal tunnel syndrome is an entrapment neuropathy of the posterior tibial nerve. A symptom triad of pain, paresthesia, and numbness is the most common clinical presentation. **Case Description:** This case describes a 23-year-old male collegiate cross-country and track runner who complained of bilateral medial ankle pain and foot numbness with running. **Interventions:** Consisted of trigger point dry needling, augmented soft tissue mobilization, strength, flexibility, and balance exercises. A running video gait analysis detected inconsistencies in the patient's footstrike pattern, running cadence, and hyperpronation at the midstance phases of the running gait cycle. **Outcomes:** The patient demonstrated minimal improvements in bilateral gastrocnemius and soleus flexibility, improvements in bilateral hip abduction strength, and was able to train himself to strike with a midfoot pattern when running. **Clinical Relevance:** This case study describes a successful conservative intervention program of a collegiate runner diagnosed with tarsal tunnel syndrome.

Key Words: cadence, entrapment neuropathy, pronation, trigger point dry needling

BACKGROUND

Peripheral nerves are subject to entrapment at various anatomical locations in the upper and lower extremities. Carpal tunnel syndrome followed by cubital tunnel syndrome are the most common types of peripheral nerve entrapment in the human body.[1,2] Since other peripheral nerve entrapment syndromes are less common, clinicians are less likely to recognize them. Most peripheral nerve entrapment syndromes result in local pain at the compression site, in conjunction with a myriad of other variable symptoms.[1]

Tarsal tunnel syndrome (TTS) is an entrapment neuropathy of the posterior tibial nerve within the fibro-osseous passageway posterior to the medial malleolus.[1] Entrapment most commonly occurs deep to the flexor retinaculum posterior and inferior to the medial malleolus, but may also occur at the proximal and distal aspect of the fibro-osseous tunnel exiting to the plantar aspect of the foot.[3,4] Besides affecting the posterior tibial nerve, entrapment may also involve branches of the nerve including the medial calcaneal nerve to the heel, and medial and lateral plantar nerves to the sole of the foot and toes.[3,5] Anatomical causes of TTS include space occupying lesions, talocalcaneal coalition, accessory muscles, bony fragments, and malalignment of the foot and ankle related to flat foot syndrome.[6] Tarsal tunnel syndrome has a high incidence in an athletic population.[5] Kinoshita et al identified that of all cases between 1986 and 2002 in their clinic 39.1% were athletes.[5] The higher incidence in this population may be associated with the increase in pressure on the tibial nerve in the tunnel as the ankle is repetitively dorsiflexed during sprinting and jumping activities. This premise is supported by the belief that increased pressure occurs on the tibial nerve in the tarsal tunnel as the ankle is dorsiflexed.[7]

Diagnosis of TTS relies on the history, physical examination, electrodiagnostic tests, and imaging. Symptoms may include pain along the pathway of the nerve, medial ankle pain, numbness, burning, tingling, and/or electrical sensations through the foot and heel. Symptoms may also radiate to the toes, and produce pain across the sole of the foot. Symptoms associated with TTS may be described as pain being a dull ache to even a vice-like tense feeling, hot and cold sensations in the foot, and weakness of the muscles of the foot, especially of the toe flexors.[6] Prolonged standing or walking typically exacerbates symptoms whereas rest relieves symptoms.[8] Common diagnostic tests used during the physical examination to differentiate tarsal tunnel from other pathologies, include Tinel's sign and the dorsiflexion-eversion test.

Electrodiagnostic, specifically electromyography (EMG), and nerve conduction velocity (NCV) findings can be employed to assist with the diagnosis of TTS. A pattern of EMG abnormality that would support the diagnosis includes denervation of intrinsic foot muscles isolated to the symptomatic limb of patients with unilateral disease, with sparing abnormalities of the extensor digitorum brevis.[1] Magnetic resonance imaging (MRI) may also be helpful to rule out the presence of any mass, lesion, or tumor.[6]

Traditional conservative intervention for TTS focuses on decreasing pressure, pain, and inflammation.[9] Neutral immobilization of the foot and ankle may relieve symptoms of posterior tibial nerve entrapment in TTS by minimizing pressure on the nerve and maximizing tarsal tunnel compartment volume for the nerve.[9,10] Theoretically, an orthotic device that provides support to the medial longitudinal arch when excessive pronation is present should also provide symptomatic relief. Rehabilitation includes comprehensive stretching, strengthening, soft tissue mobilization, and neural mobilization.[2,11-13] Additional conservative interventions may include extracorporeal shock wave therapy, laser, local anesthetic injections, heel pads and cups, night splints, strapping, foot orthoses, soft-soled shoes, and ultrasound.[14] A short leg cast may be used in the case of acute trauma to keep the ankle from moving while inflammation in the tarsal tunnel region decreases.[6] Nontraditional conservative intervention includes use of trigger point dry needling (TPDN). Trigger point dry needling has been shown to be effective for treating musculoskeletal injuries involving muscular trigger points and or nerve pain.[15,16]

When conservative interventions fail, surgical interventions may be necessary. In a review of literature, Campbell and Landau[1] identified that patients with TTS showed symptomatic improvement in 91% of the cases treated surgically. Similarly, in a retrospective chart review by Mook et al,[17] improvements were reported on the Visual Analog Scale (VAS) from 6.3 to 1.4 when combining a distal tarsal tunnel release with partial plantar fasciotomy. Specific, postoperative outcome measures revealed a decrease in pain as quantified by the VAS and 67% of patients achieved a rating of excellent or good on the American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot

scores. Further, only one of the 15 heels treated surgically reported a poor outcome at the final follow-up visit.[17]

As minimal information related to the successful conservative management of TTS exists, we attempted a unique conservative approach in a runner with TTS to see if we were able to achieve a positive outcome. The approach taken in this case study is different from previous studies as it incorporates running gait analysis and TPDN into the conservative management of TTS along with traditional methods of rehabilitation, including orthotic management and traditional stretching and strengthening exercises.

CASE DESCRIPTION

History

The patient was a 23-year-old male collegiate cross-country and track runner referred to physical therapy by a physiatrist. The patient had been experiencing pain in his left ankle with running for two months duration. At the time of initial evaluation, the patient had not run in two weeks and was biking approximately 10 miles per day without symptoms. The patient was previously running up to 40 miles per week. The EMG results revealed severe TTS on the patient's left ankle and moderate TTS in the patient's right ankle. Current running footwear was the minimal Nike Free Run (Nike, Inc., Beaverton, OR) with custom orthotics and rearfoot medial posting. The custom orthotics were approximately one month old at the time of initial evaluation.

On the first visit, the patient completed the Lower Extremity Functional Scale (LEFS). The LEFS measures a patient's degree of difficulty with various functional activities. The overall score is determined out of 80 points. Greater scores represent less difficulty in functional activities involving the lower extremities. The patient's score on the first visit was a 59/80. The patient indicated difficulty with standing, descending stairs, running fast and making sharp turns, running on uneven ground, and walking one mile. The LEFS was employed because it has been used by previous investigators examining foot and ankle injuries, and it has been shown to demonstrate excellent reliability (.94-.98).[18,19]

Examination

Pain

Pain was assessed using a verbal 0-10 pain scale (0/10 was considered no pain and 10/10 was considered pain that was severe enough to warrant a visit to the emergency room). Upon initial evaluation by the primary author, the patient described his pain as 0/10 at rest and 8/10 with activity. The patient described his pain as sharp and burning in nature. Pain gradually increased in bilateral medial ankles and feet following 8 minutes of running at a 7 minute per mile pace that forced him to discontinue running and seek medical care. The patient reported pain when walking in unsupportive shoes, but denied pain with other functional activities including, stairs and squatting.

Range of Motion

Initial evaluation range of motion measurements were taken using a standard goniometer with the knee extended (Table 1). For plantar flexion, dorsiflexion, inversion, and eversion of the ankle, the measures were taken using standard goniometric landmarks.[20,21] Intraclass correlation coefficients for foot and ankle ROM reliability in patients with orthopaedic conditions have been previously reported by Elveru et al[21] with values ranging from 0.78 for rearfoot eversion to 0.89 for plantar flexion.

Muscle Strength

Manual muscle testing revealed 5/5 strength in the patient's bilateral ankles for all motions. The patient demonstrated slight right hip abduction weakness of 4+/5 in a sidelying position while the tester resisted hip abduction for 10 seconds. The patient also appeared to demonstrate dynamic valgus at the knee with a unilateral squat on the right. Dynamic valgus was operationally defined as a combination of hip adduction and internal rotation.

Palpation

Palpation of the patient's left foot and ankle revealed tenderness posterior to the medial malleolus and in the medial longitudinal arch of his foot. Palpation to the patient's right foot and ankle did not reproduce any tender areas. Thickening was perceived in the tissue of the patient's left posterior lower leg.

Assessment of accessory motions/joint glides of the (talocrural and subtalar joint)

The patient demonstrated decreased mobility in subtalar pronation, as assessed with anterolateral glide of the calcaneus on the talus, and normal mobility in the talocrural joint in his left ankle. Additional mobility testing revealed decreased extension of his first metatarsal phalangeal joint, midtarsal joint mobility (longitudinal and oblique axis), and dorsiflexion of the 1st ray of his left foot.

Posture

Upon visual inspection with the patient quietly standing, decreased medial longitudinal arch height and a calcaneal valgus posture were appreciated on his left. When the patient performed a bilateral squat, visual analysis identified decreased ankle dorsiflexion, foot eversion, and increased hip internal rotation and adduction bilaterally. Unilateral squat testing on the right revealed increased hip adduction, internal rotation, and a contralateral pelvic drop on the unaffected side.

Special Tests

The patient demonstrated a positive Tinel's sign over the posterior tibial nerve posterior to the medial malleolus on his left lower extremity (LLE) and negative Tinel's sign on his right lower extremity (RLE). The Tinel's sign is meant to elicit the patient's symptoms by having the practitioner tap on the posterior tibial nerve where compression is expected. Electrical sensations felt locally or radiating into the foot indicate a positive test.[6]

The patient demonstrated a positive dorsiflexion-eversion stress test on his LLE,

Table 1. Range of Motion at Initial Evaluation

	AROM-Right	PROM-Right	AROM-Left	PROM-Left
Dorsiflexion	10°	15°	12°	18°
Plantar flexion	35°	38°	30°	35°
Rearfoot Inversion	33°	45°	31°	37°
Rearfoot Eversion	10°	13°	9°	15°

Abbreviation: AROM, active range of motion; PROM, passive range of motion

though this was negative on the RLE. The dorsiflexion-eversion test was performed by placing the foot and ankle in maximal dorsiflexion and eversion with the metatarsophalangeal joints in extension and holding for 5 to 10 seconds in an attempt to reproduce symptoms. This test is deemed positive if the patient's symptoms are reproduced.[1,22,23] Alshami et al[24] identified that the dorsiflexion-eversion test was more sensitive when performed in combination with hip flexion and knee extension.

Neurological Exam

Sensation and Proprioception

Sensation was assessed in response to light touch. Specifically, the therapist swiped the patient with the tip of his finger while the patient's eyes were closed. The patient noted whether the sensation was felt and compared the sensation bilaterally. A 4 cm by 1 cm area located 10 cm proximal to the base of the patient's calcaneus on the postero-medial side of the distal leg was appreciated.

Running Video Gait Analysis

A two-dimensional running video gait analysis was performed with Kinesio Capture software (Spark Motion LLC, Baltimore, MD) using the iPad 2 (Apple Inc, Cupertino, CA) with the subject running at 7:00 per mile pace. The iPad 2 was held stationary on an adjustable tray table during video capture while the table was set at a height of 48 inches. Video was recorded for two 5 second and one 10 second durations from anterior, posterior, and lateral views respectively. Video was analyzed on an iPad 2 using the Kinesio Capture software. Running video gait analysis revealed increased left pelvic drop during RLE midstance, bilateral heel striking with the right knee at 0° of knee extension at initial contact, bilateral overstriding (heel striking at initial contact excessively in front of one's center of gravity), and increased stride length on RLE compared to LLE. The patient demonstrated asymmetrical foot inclination angles of 33° on his RLE and 23° LLE (Figures 1 and 2). A posterior view revealed bilateral foot hyper-pronation at midstance and toe off bilaterally though this was greater on his LLE when compared to his right.

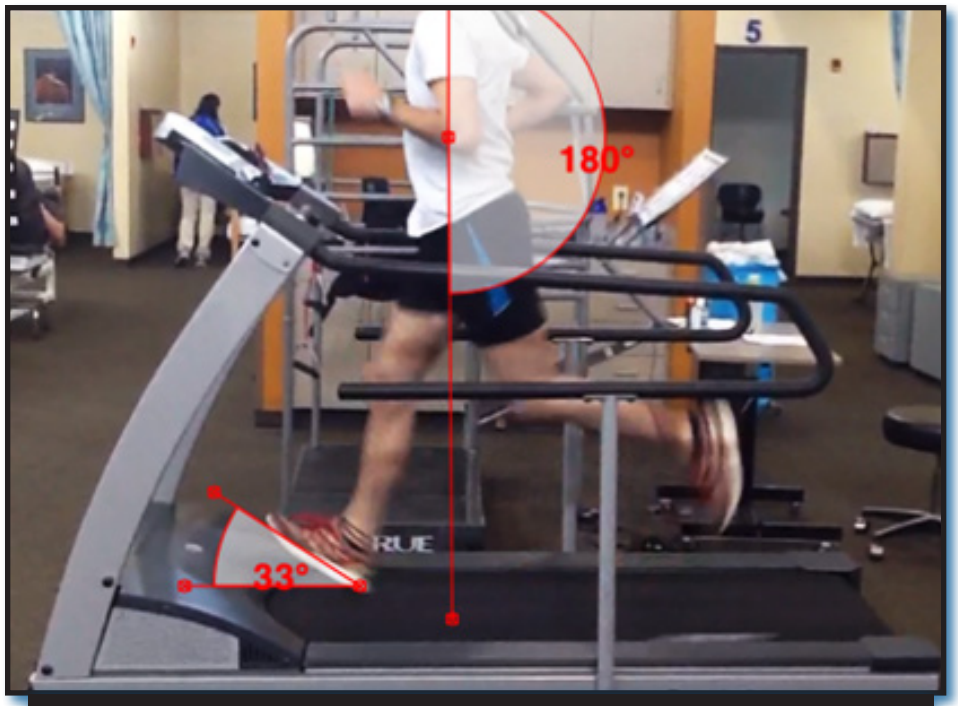

Figure 1. Heel striking right lower extremity at initial evaluation.

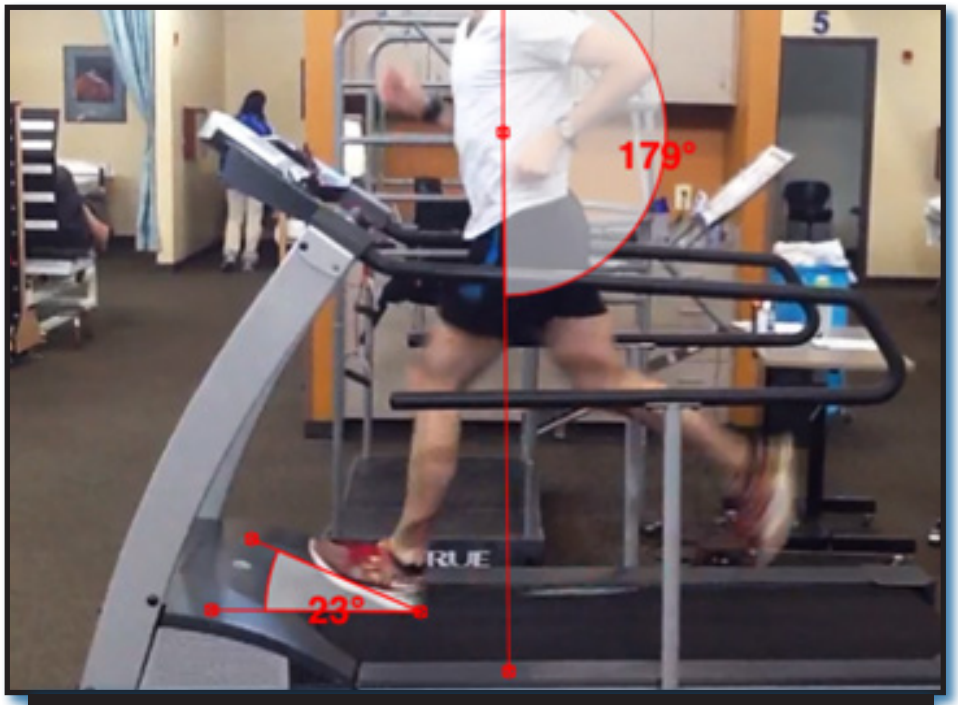

Figure 2. Heel striking left lower extremity at initial evaluation.

DIAGNOSIS

Multiple diagnoses were assigned to this case according to the *Guide to Physical Therapist Practice*[25] Practice Patterns. Specific diagnoses included (1) 4D Impaired Joint Mobility, Motor Function, Muscle Performance, and Range of Motion Associated with Connective Tissue Dysfunction; (2) 4E Impaired Joint Mobility, Motor Function, Muscle Performance, and Range of Motion Associated with Localized Inflammation; and (3) 5F Impaired Peripheral Nerve Integrity and Muscle Performance Associated with Peripheral Nerve Injury.[25]

PROGNOSIS

Given the limited number of cases of TTS in the literature, the prognosis for conservative intervention was unclear. Several reports touted the success of surgical intervention,[27,28] suggesting conservative intervention with a traditional approach is fair at best.

GOALS

The patient wished to return to recreational distance running. Anticipated goals for this patient at initial evaluation included (1) return to recreational distance running a minimum of 3 miles per session, 5 times per week at a pace of 8:30 per mile. (2) run 800 meters at maximal intensity on a track; (3) improve right hip abductor strength to 5/5; and (4) normalize running mechanics as quantified using the iPad 2 and Kinesio-Capture software.

INTERVENTION

The patient was seen for 9 visits. Conservative physical therapy management included modalities, TPDN, augmented soft tissue mobilization (ASTYM), strength, flexibility, and balance exercises.[26-30] Based on the initial evaluation data, the patient was instructed to perform a home exercise program consisting of range of motion and strength exercises for his bilateral feet and ankles. These exercises included active range of motion of his right ankle in all planes of motion, Thera-Band (The Hygenic Corporation, Akron, OH) exercises, gastrocnemius and soleus stretching on a 6" step, single-leg stance balance activities, and TheraBand hip abductor strengthening exercises.

Static and dynamic balance exercises included heel/toe walking, single leg stance on various surfaces, and heel-toe raises on flat surface and 4" and 6" steps. Pain was managed early in the rehabilitation phase with ultrasound, and Kinesiotaping (Kinesio, Albuquerque, NM) to assist the posterior tibialis muscles bilaterally.[31] Kinesiotape was applied at the plantar surface of the patient's medial heel bilaterally and pulled with a 50% stretch, in one strip, toward the origin point of the patient's posterior tibialis muscle, thereby placing the patient's ankle in 30˚ of plantar flexion.

Scar tissue thickness was managed with the ASTYM procedure. The ASTYM procedure was applied to the patient's legs, feet, and ankles with the ASTYM evaluator, localizer, and isolator tools. Cocoa butter was used to minimize irritation that might have otherwise been caused by the ASTYM tools. The ASTYM procedure was applied to decrease fibrotic tissue in the patient's lower extremities, particularly in his left foot, ankle, and lower leg.[32]

Trigger point dry needling was initiated at visit three. This procedure involved placing small ½", 1", and 1.5" acupuncture needles into the patient's lumbar spine bilaterally at levels L2-S1, specific lower extremity acupoints, and symptomatic painful and numb areas in the patient's bilateral feet and ankles. Needles were placed in the low back, hip, and lower extremity nerve acupoints; posterior cutaneous L2, posterior cutaneous L5, superior cluneal, inferior gluteal, iliotibial, lateral popliteal, sural, saphenous, common fibular, tibial, and deep fibular. Additional acupuncture needles were placed in the area of the tarsal tunnel bilaterally (Figures 3 and 4). The patient completed 4 sessions of TPDN before his symptoms resolved.

RUNNING

Running cadence training was initiated on visit 6. Intervention focused on encouraging the patient to adopt a midfoot strike running pattern with an initial cadence of 180 steps per minute at 8:30 per mile pace. Running cadence was practiced on a treadmill with a metronome. Verbal cues were provided to increase or decrease running cadence.

RESULTS

At discharge, the patient scored a 78/80 on the LEFS with limitations in running fast and making sharp turns. The difference score (discharge minus initial evaluation) was 19 points.

The patient described his pain as 0/10 at rest and with running. The patient did not have pain when walking in unsupportive shoes, and he denied pain with other functional activities including stairs and squatting.

The patient demonstrated minimal improvements in AROM of his right and left ankles (Tables 1 and 2), though a significant difference in plantar flexion from initial evaluation to discharge was documented. While it is expected that dorsiflexion would be limited in cases of TTS, this was not the case in this study. It is unclear why plantar flexion was so limited in this patient in comparison to dorsiflexion.

The patient also improved his right hip abduction strength from 4+/5 to 5/5. Palpation of the patient's bilateral feet and ankles did not reproduce any tender areas. The patient demonstrated normal mobility in subtalar pronation and normal mobility in the talocrural joint in bilateral ankles. Additionally, mobility testing revealed normal extension of his first MTP joint, midtarsal joint mobility (longitudinal and oblique axis), and dorsiflexion of the 1st ray of his left foot.

When the patient performed a bilateral squat, visual analysis identified normal ankle dorsiflexion and foot eversion, and improved hip internal rotation and adduction bilaterally. Unilateral squat testing on the right revealed normal hip adduction, internal rotation, and a no contralateral pelvic drop on the unaffected side. The patient demonstrated a negative Tinel's sign over the posterior tibial nerve posterior to the medial malleolus bilaterally. All light touch sensation testing was normal 10 cm proximal to the base of the patient's calcaneus on the postero-medial side of the distal leg.

Figure 3. Trigger point dry needling of the foot and ankle.

Figure 4. Trigger point dry needling of the lower leg.

Table 2. Range of Motion at Discharge

	AROM-Right	PROM-Right	AROM-Left	PROM-Left
Dorsiflexion	13°	17°	12°	18°
Plantar flexion	55°	60°	55°	60°
Rearfoot Inversion	33°	45°	32°	38°
Rearfoot Eversion	10°	15°	9°	14°

Abbreviation: AROM, active range of motion; PROM, passive range of motion

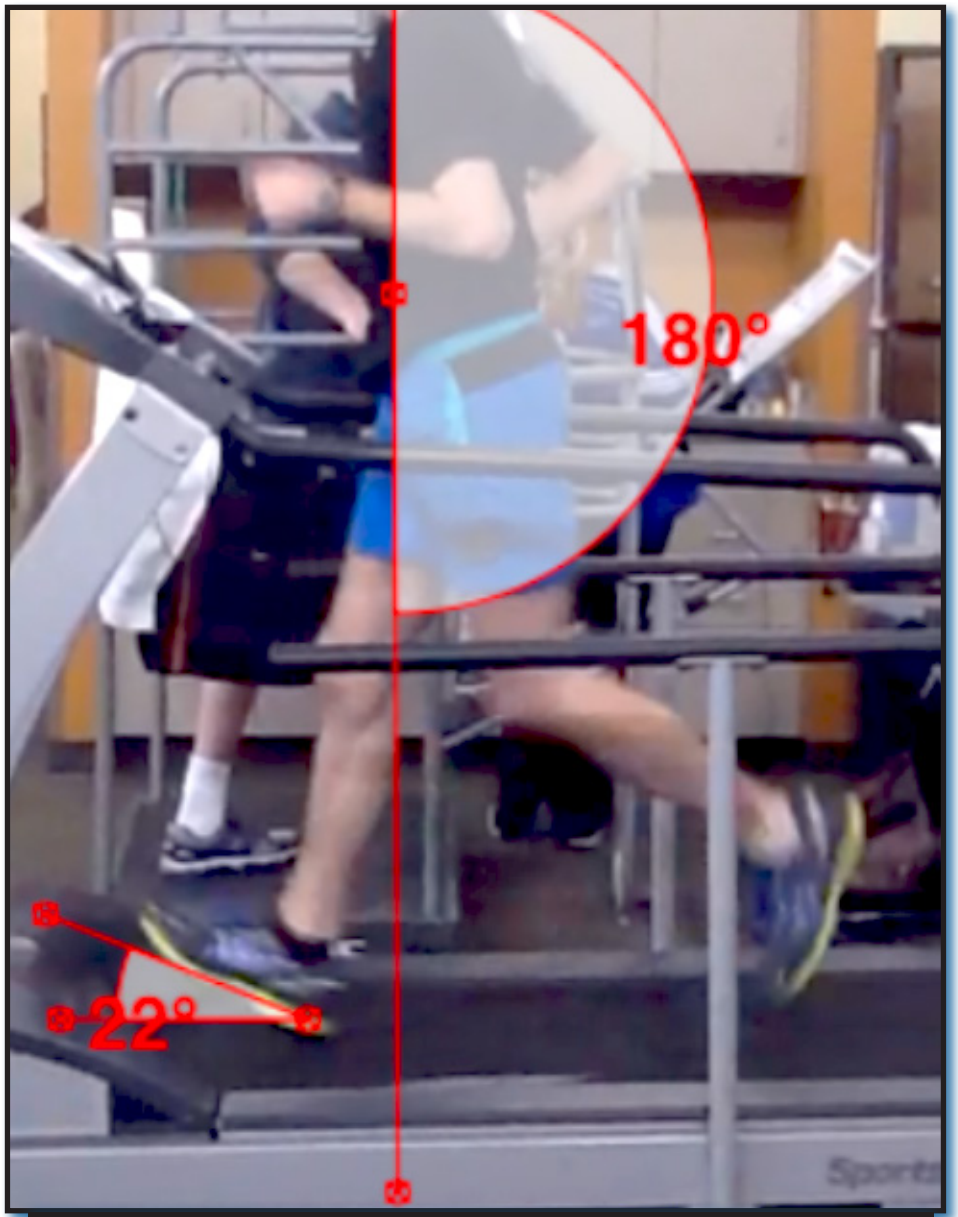

Figure 5. Heel striking right lower extremity at discharge.

Figures 5 and 6 illustrate the patient's footstrike patterns after running cadence training with a metronome at 182 steps per minute (spm). Note the decreased foot inclination angles of 22° on the right and 20°on the left.

DISCUSSION

This case study described a unique and multi-faceted approach to conservatively and successfully manage TTS in a collegiate athlete. Running video gait analysis was an integral part of managing this athlete's symptoms and returning him to competitive running. A midfoot type of footstrike pattern was recommended based on work by previous researchers.[33-37] These works demonstrated less peak impact force at initial contact in runners that land with a forefoot and/or midfoot striking pattern. Further evidence has shown a midfoot strike pattern is associated with a lower incidence of running injuries.[38-40] This is thought to be due to lower vertical ground reaction forces sustained from decreased vertical displacement of the center of mass of the runner and increased step frequency.[33,34,41,42]

A larger foot inclination angle results in greater amounts of knee extension at initial contact and larger peak impact forces.[42,43] Greater knee flexion angles at initial contact allow the patient to better absorb peak impact forces. This is proposed to result in lower peak impact forces on the patient's ankles and less stress on the tarsal tunnel from decreased dorsiflexion at initial contact and landing with more of a midfoot striking pattern. Footwear modification was not necessary as the patient's neutral footwear with his custom orthotics proved to provide

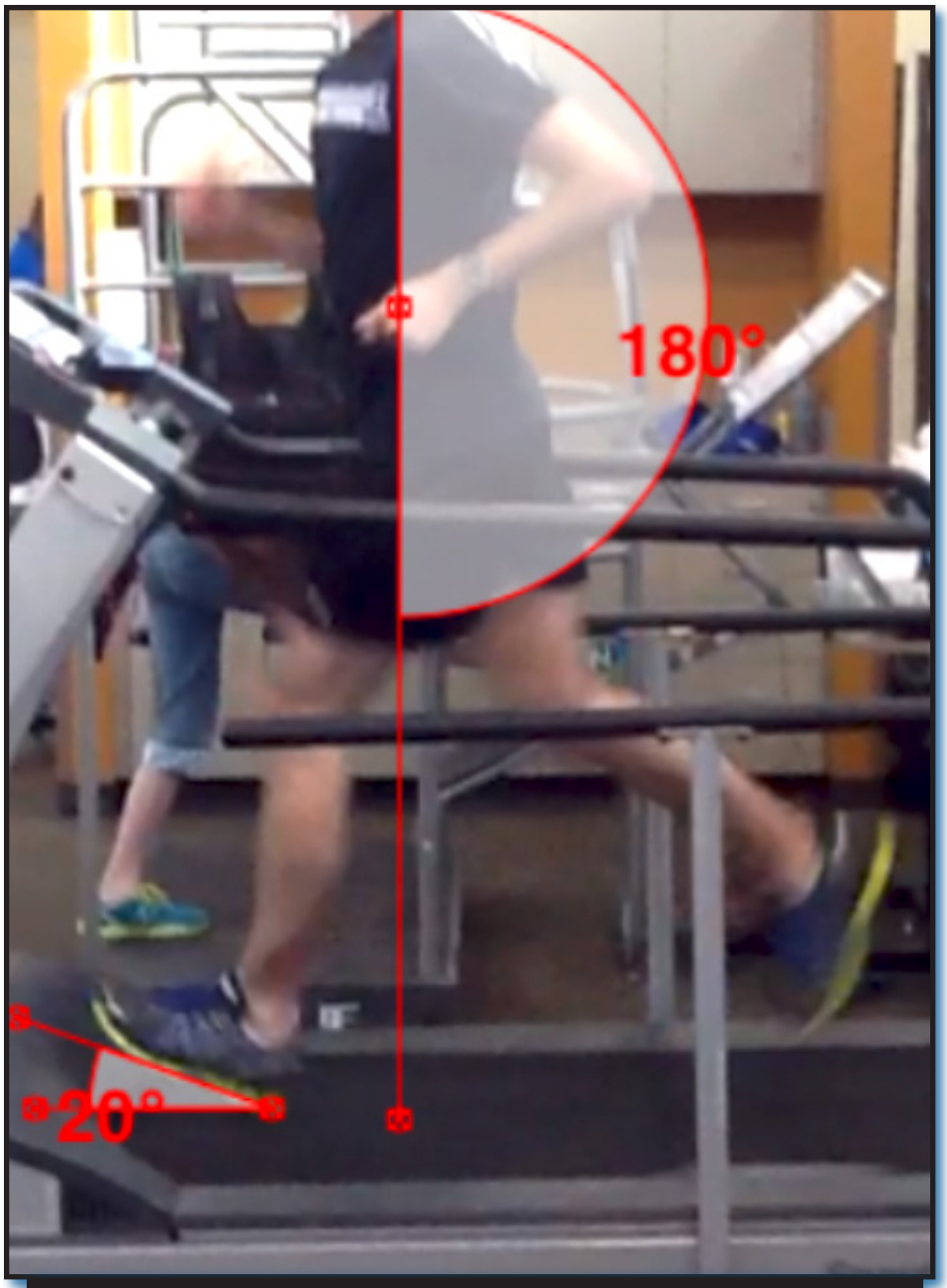

Figure 6. Heel striking left lower extremity at discharge.

ample support to prevent overpronation once his running cadence was increased to 182 spm; therefore potentially leading to lower peak impact forces at initial contact. While video analysis was an essential part of this case, the reader should appreciate the reliability and validity of Kinesio Capture software for iPad 2 has yet to be established.

Trigger point dry needling is a new type of conservative intervention gaining attention in the field of physical therapy. While it is not approved to be performed by physical therapists in all states, it has been shown to be effective for treating musculoskeletal injuries involving muscular trigger points and/or nerve pain.[15,16] Trigger point dry needling is a manual therapy procedure where acupuncture needles are inserted into the skin and muscle in areas of myofascial trigger points. Trigger point dry needling is based on Western medicine. It focuses on areas of fibrosis or myofascial trigger points, and the spinal levels that innervate those areas. It attempts to create a muscle "twitch response" that creates an analgesic effect. Trigger point dry needling was integral in decreasing the patient's numbness and tingling in his lower extremities. While there is no evidence that TPDN has been used to treat TTS, there is evidence that acupuncture has been used to successfully treat this condition.[15,16]

Following the series of ASTYM treatments, less texture was perceived in the subcutaneous tissues. This change may have resulted in decreased stress on the tibial nerve in the tarsal tunnel.

The patient demonstrated slight improvements in active range of motion of his right and left ankles following the treatment sessions. He also improved his right hip abduction strength and footstrike pattern when running. The LEFS demonstrated improved value from 59/80 at initial evaluation to 78/80 at discharge. This score demonstrates the patient's improvement in his ability to perform functional tasks and recreational activities, including competitive running. Given the minimal clinically important difference of the LEFS has been reported to be 9 points, we are confident the difference in score reveals a substantive change.[18]

CONCLUSION

Conservative intervention of TTS with use of a multi-faceted approach proved to be beneficial in resolving symptoms of TTS in a collegiate runner. While it is unclear whether it was one or an interaction of the interventions that was used in this case to resolve the patient's symptoms, the case provides additional literature supporting the use of conservative intervention for patients with TTS. Future work (ie, randomized clinical trials) is necessary with this population to provide stronger evidence further justifying the use of our conservative interventions.

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J. Haxby Abbott is the New Editor-in-Chief for *JOSPT*

On behalf of *JOSPT*'s Board of Directors, I am pleased to let you know that J. Haxby Abbott, PhD, DPT, FNZCP, has accepted the position of Editor-in-Chief for *JOSPT*, succeeding Dr Guy Simoneau. Dr. Abbott will be responsible for material published in *JOSPT* starting with the January 2016 issue. Consequently, he will begin work with *JOSPT* as of July 1, 2015.

Dr Abbott has been an associate editor for *JOSPT* since 2011 and has previous experience as editor for the *New Zealand Journal of Physiotherapy*. He has a strong background in high quality research with diverse design methodologies and has published extensively in a variety of journals. Dr Abbott also brings a vital international perspective to *JOSPT* through his past work experiences and ongoing research collaborations with colleagues from around the globe.

Dr Abbott, who currently resides and works in New Zealand, worked in the United States between 1993 and 1999 in Texas, Iowa, Colorado, and Florida, where he earned his MScPT degree at the University of St. Augustine for Health Sciences. In 2005, he was a visiting research fellow and teaching assistant at the University of Utah. He is a member of APTA and also the Orthopaedic and Sports Physical Therapy Sections.

The Orthopaedic Section welcomes Dr Abbott.

Axillary Web Syndrome, A Complication of Breast Cancer: What the Orthopaedic Physical Therapist Needs to Know

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ABSTRACT

Background & Purpose: One particular group of people accessing physical therapy services, and whose numbers are steadily increasing, are breast cancer survivors. Axillary web syndrome (AWS) is one complication of breast cancer treatment that can be easily misdiagnosed without an understanding of breast cancer treatment and its effects on the musculoskeletal and lymphatic systems. **Methods:** Literature search in PubMed and CINAHL yielded 25 articles on the topic of AWS. Fourteen articles met the authors' inclusion criteria. **Findings:** Axillary web syndrome was first reported in the literature in 2001 and the incidence rate among breast cancer survivors is 28% to 36%. The most significant impairment is limited shoulder abduction and several articles report positive results with physical therapy intervention. **Clinical Relevance:** With an understanding of breast cancer management and AWS, the orthopaedic physical therapist can properly differentiate AWS from other more commonly encountered conditions such as adhesive capsulitis and thoracic outlet syndrome as well as refer to a specialist if other complications, such as lymphedema, are present.

Key Words: shoulder, lymphedema, lymphatic cording, differential diagnosis

INTRODUCTION

Physical therapy has grown as a profession, with the Doctor of Physical Therapy degree now the standard for entry-level education. The American Physical Therapy Association has adopted *Collaboration and Access/Equity* among its Guiding Principles to Achieve the Vision Statement for the Physical Therapy Profession.[1] Collaboration can include referring to and co-managing patient care with providers, both inter-professionally and intra-professionally, for the optimum care and outcomes for the patient. The principle of access/equity speaks to resolving issues of health inequities and to physical therapy "serving as a point of entry to the health care system."[1]

Consistent with these principles is the growing role of physical therapists as the primary care provider for musculoskeletal and movement disorders. The literature supports this model as one in which quality care is less costly and more expeditious.[2-4] With this, of course, comes a responsibility for physical therapists to thoroughly examine patients/clients and to determine who can best deliver the needed interventions. Most of the time this is the examining physical therapist, but there are times when the patients/clients will be referred to a physician[5] or to another physical therapist with specialized or advanced training.

One such area of specialized services is lymphedema management provided by a certified lymphedema therapist (CLT). It is essential that the orthopaedic physical therapist understands the effects of breast cancer treatments on the musculoskeletal and lymphatic systems in order to determine whether a patient should consult a CLT. The intent of this paper is to provide a review of: (1) breast cancer epidemiology and related treatments, (2) the lymphatic system and lymphedema, and (3) axillary web syndrome (AWS), including differential diagnosis and management of persons with AWS.

BREAST CANCER

Epidemiology

According to the American Cancer Society (ACS), breast cancer is the most common invasive cancer in females accounting for 29% of all new diagnoses.[6] The ACS estimates 232,570 women will be diagnosed with invasive breast cancer while an additional 62,570 women will be diagnosed with noninvasive forms of breast cancer in 2014. In 2014, the ACS estimated there were 2.8 million women in the United States living with a history of breast cancer. Breast cancer in men is rare with an incidence rate of approximately 1% of all new cases.[6]

Following lung carcinoma, breast cancer is the second most frequent cause of cancer mortality in females with an estimated 40,000 deaths in 2014.[7] Fortunately, advancements in both early detection and cancer treatment have resulted in a modest, yet steady, decline in mortality rates between 1990 and 2010.[6,8]

Most breast cancers are initially diagnosed with imaging techniques including mammogram, breast MRI, and/or breast ultrasound followed by biopsy.[9] The staging of breast cancer uses the traditional TNM system. The TNM system is an acronym where **T** refers to tumor size, **N** refers to nodal status, and **M** refers to metastasis. Staging also generally requires tissue biopsies and additional imaging such as computed tomography scanning of the chest, abdomen, and pelvis, as well as bone scanning.[9] Breast cancers are then staged from 0, in situ disease, to IV, distant metastatic disease, according to the final results of the staging work-up.[9]

The pathologic diagnosis of breast cancer includes several different tumor cell types and histological grades ranging from low grade I, or well differentiated cells, to high grade III, or poorly differentiated cells.[9] The most common type of noninvasive breast cancer, or those tumor cells that have not left their initial location of origin, is ductal carcinoma in situ or DCIS, considered Stage 0. Ductal carcinoma in situ accounts for 83% of all noninvasive breast cancer diagnoses.[6] Invasive, or infiltrating, ductal carcinomas (IDC) have the ability to penetrate through ducts and lobules into the normal surrounding breast parenchyma and fatty tissue are characterized as Stage I-IV.[9]

Common non-modifiable risk factors that increase the risk for developing breast cancer include female gender, age, and

race/ethnicity.[6] Specific factors significantly increase the relative risk, or the risk ratio comparing those exposed to a risk factor with those without an exposure, of developing breast cancer. In women, those exposures which increase the relative risk to > 4.0 include age greater than 65, family history of two or more first degree relatives diagnosed with breast cancer at an early age, personal history of breast cancer onset at < 40 years of age, high breast density, a personal diagnosis of atypical ductal hyperplasia or lobular carcinoma in situ, and/or identifiable breast cancer genetic mutations.[9] Modifiable risk factors for breast cancer associated with a 1.1-2.0 increase in relative risk include alcohol consumption, nulliparity, recent and/or long term use of hormone replacement therapy, recent oral contraceptive use, and obesity in post-menopausal women.[6]

Invasive ductal carcinoma in women is typically diagnosed in the geriatric patient population with an average onset being age 65 or older.[6] When younger women are diagnosed with IDC, they often present with more aggressive cancers that can then require more aggressive treatment interventions, and ultimately, have a poorer prognosis.[6]

Breast Cancer Management

Surgery

Breast cancers are managed locally with surgical excision via either breast conserving surgery with a partial mastectomy, also referred to as lumpectomy, quadrantectomy, and/or wide local excision, or by means of simple or total mastectomy. The goal of surgical excision is to remove the cancer and sufficient tissue to demonstrate negative margins, and to assist in staging the breast cancer.[9] Negative, or clean, margins are considered to demonstrate an absence of cancer cells at the inked edge of the excised tissue. Most surgeons also prefer normal breast tissue free of cancer cells for a facility-defined distance from the border of the surgical margin.[9]

Considering breast cancers metastasize by way of either direct extension or through the circulatory or lymphatic systems, invasive breast cancers are staged radiographically and by lymph node sampling.[9] In patients with invasive breast cancer who would otherwise be appropriate candidates for systemic therapy due to reasonably good health, lymph node sampling is generally indicated. In patients with noninvasive breast cancers opting for mastectomy, axillary lymph node sampling is generally recommended.[9] This is accomplished by the sentinel lymph node biopsy (SLNB) technique that uses a radiolabeled colloid and a blue dye to allow the surgeon to properly identify the lymph node(s) responsible for the primary lymphatic drainage from the breast.[9] Once properly identified and excised, a pathologist examines the node(s) for cancer cells, often immediately, as a frozen section.[9] Historically, if a large deposit of cancer in one or more lymph nodes was found to be involved with cancer, the surgeon generally proceeded with a complete axillary lymph node dissection (ALND) where multiple additional nodes were surgically excised leading to a risk of greater postoperative complications.[10] Most recently, however, Giuliano et al[11] during the American College of Surgeons Oncology Group Z0011 trial found no survival benefit in patients with a positive SLNB followed by ALND if systemic therapy was used. Therefore, trends are towards more conservative treatment of the axilla in order to help to reduce arm morbidity.

Reconstruction

Surgical options for cosmesis following removal of breast tissue include several breast reconstruction techniques that may be either immediate or delayed. The most frequently used option includes saline or silicone breast implants, with or without the temporary placement of a tissue expander under the pectoralis major muscle.[9] This option may also be used with acellular dermal matrix or decellularized human tissue, to form a "sling" to allow for early expansion and provide inferior pocket protective support for the breast implant.[9]

Autologous breast reconstruction options include the use of a patient's own tissue, either adipose tissue, muscle tissue, or both.[9] These procedures offer the confidence in and benefits of using the patient's own tissue, but also result in additional surgical wounds, risk of infection, risk of graft/flap necrosis, and scar tissue.[9] Therefore, these procedures require additional consideration for the patient and physical therapist during the rehabilitation process. One option, reconstructive mammoplasty, involves the surgical repositioning of a patient's own ipsilateral breast tissue in order to fill in surgical deficits left behind due to wide local excision or partial mastectomy.[9] Myocutaneous flap procedures, either pedicle or free flaps, use muscles such as the rectus abdominis, the latissimus dorsi, gluteals, or gracilis, often with surrounding adipose tissue, to fashion a reconstructed breast.[9] Microsurgical free flap procedures use harvested skin, adipose tissue, and blood vessels to perform the reconstruction while leaving the muscles intact.[9] Reconstructive procedures can also be done to restore the nipple-areolar complex with harvested skin and/or the use of tattooing.[9]

Radiation Therapy

Since breast cancers that recur are most likely to do so within the immediate region of the original tumor site, radiation therapy techniques are often used for locoregional control to reduce this risk by treating the resected tumor bed and the normal surrounding tissue.[9] Radiation techniques used after surgical excision of breast cancer can include intraoperative brachytherapy with electric sources, brachytherapy used immediately postoperatively with radioactive sources, and/or most frequently, traditional external beam radiation therapy with a linear accelerator at approximately one month postoperatively or, if prescribed, after the completion of chemotherapy.[9] For those patients found to have positive axillary lymph nodes, expanding the radiation therapy treatment field to include the axilla and/or supraclavicular nodes is generally prescribed.[9]

Radiated skin and underlying soft tissues of the upper quadrant can present with fibrotic changes, which reduce flexibility and pliability, as well as altered circulation and texture due to damage to the superficial and deep anatomical structures when compared to nonradiated tissues.[9] In addition to radiation dermatitis in the treatment field, inflammation and irritation of the skin often seen during or immediately after radiation therapy, upper extremity symptoms can also present which may result in pain, paresthesias, and weakness, according to a systematic review by Lee et al.[12] These potential issues, in addition to monitoring for AWS, require close attention in the rehabilitation process with interventions including manual therapy, therapeutic exercise, and detailed home exercise prescription with an emphasis on ongoing range of motion after discharge.[9]

Chemotherapy

Chemotherapeutic, or cytotoxic, agents are used in breast cancer management to act systemically to destroy any residual cancer cells not addressed during surgical excision. Chemotherapy is commonly used postoperatively, or *adjuvantly*, in patients with positive axillary lymph node(s), in those with larger and/or more aggressive tumor types, and in those with genetic assay testing presenting with high recurrence scores.[9] In the

event of a large tumor at the time of diagnosis, chemotherapy may be used *neoadjuvantly*, or preoperatively, in order to attempt to shrink the tumor and make it more amenable to surgical excision.[9] Most regimens in early stages of breast cancer are anthracycline-based, whereas taxanes are generally added in instances of more aggressive tumors and/or node positivity.[9] The use of immunotherapy drugs such as the monoclonal antibody Herceptin (trastuzumab) provides targeted therapy to those patients with an over expression of the human epidermal growth factor 2 (HER2/neu) oncogene.[9]

The most common short-term side effects of chemotherapy include immunosuppression, anemia, mucositis, nausea and vomiting, alopecia, and fatigue.[9] In addition, anthracyclines are associated with potential cardiac toxicity, taxanes can cause chemotherapy induced peripheral neuropathy (CIPN) and Herceptin can cause or exacerbate pre-existing cardiac toxicity from anthracycline-based regimens.[9] These potential long-term side effects of chemotherapy deserve consideration in any breast cancer survivorship care plan.[13]

Endocrine Therapy

In addition to surgery, radiation therapy, and chemotherapy, those breast cancer survivors with breast tumors found to be positive for estrogen receptors (Er+) and/or progesterone receptors (Pr+) are good candidates for endocrine, or hormone, therapy.[9] This systemic technique allows for breast cancer risk reduction and/or tumor control by way of hormone manipulation to either block and/or lower levels of circulating estrogen.[9] The most common hormone therapies used in breast cancer include selective estrogen receptor modulators such as Tamoxifen, Aromatase Inhibitors such as Arimadex, and luteinizing hormone-releasing hormone analogs such as Lupron.[9] Ovarian ablation can also be achieved surgically by oophorectomy to induce menopause in premenopausal breast cancer survivors.[9]

Side effects from certain hormone therapies which are of a concern to rehabilitation include, but are not limited to, menopausal symptoms, myalgias and arthralgias, osteoporosis, blood clots, and an increased risk for cancers of the uterus in postmenopausal women.[9]

LYMPHATIC SYSTEM

Anatomy and Physiology

The lymphatic system, consisting of both superficial and deep layers separated by fascia, includes the components of lymph fluid, lymph vessels, and lymph tissues (Figure 1). Lymph fluid, or interstitial fluid within the lymph system, consists of proteins, water, cellular components, such as salts and white blood cells, fatty acids/fat compounds, and foreign substances.[10] Lymph vessels, including from the initial lymph capillaries to the precollectors and lymph collectors to the terminal lymph trunks, provide the major transportation channels for lymph fluid. Lymph tissues, comprised of reticular fibers either within connective tissue or encapsulated lymphoid cells forming organs, such as lymph nodes, the spleen, and thalamus, perform protective immune functions.[14] Lymph nodes both produce antigen-stimulating lymphocytes and filter harmful material, such as cancer cells, pathogens and debris from lymph fluid.[14] Lymph tissues also function to thicken lymph fluid as blood capillaries within lymph nodes absorb water to reduce the lymph load returning to the venous system.[14]

Several anatomic watersheds divide segments of the body into specific lymph drainage patterns based on directions of lymph flow.[14] These linear watersheds, including the sagittal or *median*, and lower horizontal or *transverse*, separate the body into 4 equal territories including right and left upper and lower quadrants.[14] In addition, the upper horizontal watershed divides the neck and shoulders from the arm and thorax while the inguinal watershed divides the lower extremities from the trunk.[14] In addition to these watersheds, several interterritorial anastomoses exist and may be used to redirect lymph flow preventatively in a particular territory or quadrant by the body's own protective mechanisms, or manually in the event of existing swelling.[14] These anastomoses usually promote lymph flow from anterior to and from posterior, from right

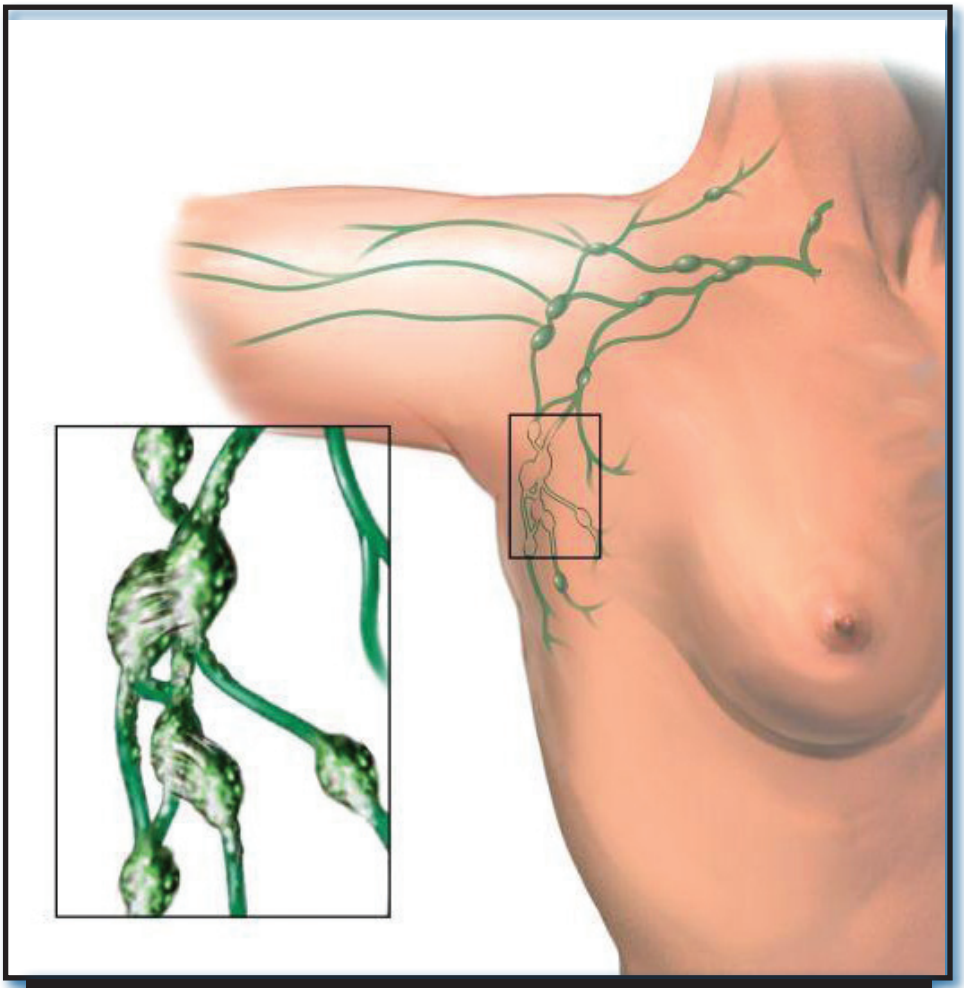

Figure 1. Lymphatic anatomy of the axilla with enhancement of the lymph nodes and lymph vessels. Photo courtesy of Nucleus Medical Media. Lymphedema. Smart Imagebase. April 3 2009 10:20 EDT. Available at: http://ebsco.smartimagebase.com/lymphedema/view-item?ItemID=7567. Accessed February 10, 2014.

to and from left and/or cephalad to caudad ipsilaterally.[14]

Lymphatic System Function

In addition to its immune system function, the lymph system is considered an accessory route for the transportation of lymph fluid from the tissues into the blood stream. In this role, the lymphatic system works with the cardiovascular system to maintain fluid balance throughout the body.[14] This delicate balance occurs when the filtration loads and pressures at the arteriole level are appropriately and equally offset by the reabsorption loads, pressures, and capacities through the lymph system on return to the venules.[14] Disruption in this balance, as a result of an anatomic malformation or a trauma, will result in lymphatic insufficiency that can result in local or generalized edema.[14] Lymphatic insufficiency can be either *dynamic*, where both active and passive edema protective measures fail, or *mechanical*, where transport capacity is reduced due to functional or acquired causes.[14] Mechanical insufficiency, also known as secondary lymphedema, is often due to causes such as surgery, radiation, trauma, and/or infection, and is most frequently experienced by cancer survivors.[10]

Lymphedema

Breast cancer survivors can present acutely with transient edema in the immediate postoperative period in the upper extremity, chest wall, axilla, and/or in residual breast tissue.[10] Closed–suction drains are used to reduce the accumulation of serous fluid in the ipsilateral trunk in the area of the surgical excision, known as seroma, considered a risk factor for the development of upper extremity lymphedema.[10] Patients with persistent or worsening edema should be examined for signs of infection and/or the differential diagnosis of chronic lymphedema requiring referral to a CLT.

Lawenda et al[10] examined the incidence of lymphedema as a consequence of cancer and cancer treatment techniques. Their review of upper extremity lymphedema studies included studies dealing with surgical and radiotherapeutic management of the axilla. Specific findings cited incidence rates as low as 2% by Mazeron et al[15] for individuals treated with lumpectomy and ALND to as high as 44% by Borup Christensen et al[16] for individuals treated with modified radical mastectomy, ALND, and axillary radiation.[15,16] Ahmed at al[17] looked at risk factors and related arm symptoms in 1,287 breast cancer survivors in the Iowa Women's Study. They concluded that tumor stage, number of excised nodes, tumor-positive nodes and adjuvant chemotherapy were cancer characteristics positively associated with lymphedema.[17] In addition, they found the lymphedema to be associated with greater baseline body mass index, greater waist and hip circumference and lower levels of general health. Arm symptoms were positively associated with higher numbers of excised nodes, axillary radiation and lower baseline general health.[17] A multivariable analysis by Norman et al[18] found ALND and chemotherapy in combination resulted in a 4 to 5 fold increase in hazard ratios for lymphedema compared with no treatment while radiation therapy and SLNB did not. In addition, O'Toole et al[19] found an arm volume increase of ≥ 5 % ($p = 0.028$) to be associated with the incidence of AWS in breast cancer survivors.

AXILLARY WEB SYNDROME

Axillary web syndrome is one complication of breast cancer that can be easily misdiagnosed without an understanding of breast cancer treatment and its effects on the musculoskeletal and lymphatic systems. Axillary web syndrome generally appears as taut cords in the axilla and can be a significant cause of pain and restricted mobility. Further description of the diagnostic criteria is included in the subsequent sections of the monograph.

Literature Review

Compared to lymphedema, AWS is a lesser known and less well understood postoperative complication associated with breast cancer. Like lymphedema, however, the incidence reporting varies widely, from 6% to 54% depending on the disease state and reporter.[20-25] The most recent studies of AWS and its relationship as a complication of breast cancer treatments report an incidence between 28% and 36%.[19,26] Axillary web syndrome has also been noted in individuals with melanoma who have had ALND.[21] The etiology and pathogenesis of AWS have not been definitively elucidated; however, several studies point to a hypercoagulation and fibrosis in and around the lymphatic vessels as the cause of the pathological symptoms.[27,28]

The following articles (Tables 1 and 2) were identified in a review of the literature conducted using a search of electronic databases including CINAHL, PubMed, and Cochrane Database of Systematic reviews. "Axillary" was used as the key word in combination with the following search terms: "web," "cording," and "syndrome." There were a total of 25 articles found in the CINAHL database and 28 found in PubMed. Date restrictions for literature published between 2000 up to 2014 were imposed, and only articles in English were considered. Titles and abstracts were reviewed according to merit of design, and only scholarly journal articles were included in this review. Fourteen articles met the authors' inclusion criteria.

Typical Presentation

Patients with AWS typically have significant limitations in shoulder abduction range of motion as the primary reason for seeking treatment.[20] Patients may also complain of pain that radiates down the arm,[31] "tautness" or numbness,[33] and/or paresthesias extending into the hand. It has been proposed that the term *Lymphatic Cording* is more appropriate than AWS because the lymphatic vessels may be affected throughout the entire limb, although symptoms usually begin in the axilla.[25]

Diagnostic criteria for Lymphatic Cording/AWS[20]:

1. Thickened fascial cord(s) running just under the skin, visible or palpable when the upper extremity is in a flexed and abducted end range position.
2. Subjective report from the patient includes the experience of "pulling" through area of cording and beyond.
3. Limited range of motion in area of cording.
4. Reports of discomfort or pain in area of cording.

Examination

While it is more common for the onset of AWS to be within weeks of the axillary node dissection, it is the authors' (McAuley & Litterini) experience that the onset can be up to several months later and the patient herself may not relate this onset to the surgery. In a retrospective review, Severeid et al[22] found that of those with AWS (n = 63), 22% had an onset of symptoms more than 3 months after lymph node biopsy. One individual in particular had an onset of symptoms more than 16 years after biopsy. It is imperative that the physical therapist understand that all persons with a history of lymph node dissection are at risk of developing AWS, regardless of how much time has passed since the initial medical treatment for cancer.

Table 1. Epidemiology of Axillary Web Syndrome

Author(s) Publication Date	Research Design	Findings
Moskovitz, Anderson, Yeung, Byrd, Lawton, & Moe (2001)[20]	Retrospective Cohort Study	This study was the first to define AWS, described a "typical" presentation of onset at approximately 2 weeks postsurgery and spontaneous resolution approximately 3 months postsurgery.
Leidenius, Leppanen, Krogerus, & von Smitten (2002)[21]	Randomized Control Trial	This study compared the incidence of AWS in patients who underwent Axillary Clearance to those who underwent SLNB. There was a significant decrease in the incidence of AWS in the patients who underwent SLNB.
Reedijk, Boerner, Ghazarian, & McCready (2006)[27]	Case Report	This study describes the case of a 41-year-old female presenting with AWS less than 7 weeks after a lumpectomy and ALND. The presentation of AWS in this case included nodules on the medial aspect of the elbow and upper arm with tightness extending into the patient's ipsilateral thumb. The patient's symptoms resolved spontaneously 15 weeks postsurgery.
Severeid, Simpson, Templeton, York, Hummel-Berry, & Leiserowitz (2007)[22]	Retrospective Cohort Study	The examination of 214 charts of patients who had been diagnosed with breast cancer and referred to physical therapy found an AWS incidence of 29.4%.
Lacomba, del Moral, Zazo, Sanchez, Ferrandez, & Goni (2009)[23]	Prospective Cohort Study	This study found a 48.3% incidence of AWS in a cohort of 116 patients 2 weeks after undergoing ALND. All but two incidences of AWS resolved by a 3-month postoperative examination.
Aydogan, Belii, Baghaki, Karabulut, Tahan, & Uras (2009)[26]	Case Study	AWS appeared approximately 8 weeks after a SLNB and spontaneously resolved 2 weeks after patient reporting. This case is a "typical" presentation of AWS.
Bergmann, Medes, de Almeida Dias, do Amaral e Silva, da Costa Leite Ferreira, & Fabro (2012)[24]	Prospective Cohort Study	This study found a 28.1% incidence of AWS in a cohort of 193 patients 45 days after surgery for a variety of breast cancers. AWS is associated with axillary lumpectomy and numbness in the ipsilateral upper extremity.
O'Toole et al. (2013)[19]	Prospective Cohort Study	This study showed a 36.2% incidence of AWS among 308 patients over the first 24 months post operatively, with 50% of those instances occurring within the first 3 weeks postoperatively.

Abbreviations: AWS, axillary web syndrome; SNLB, sentinel lymph node biopsy; ALND, axillary lymph-node dissection

The intent of the physical therapy examination is to establish whether the diagnostic criteria for AWS are met, and to rule out other potential causes for the patient's symptoms. A thorough history, including all treatments for cancer and/or lymph node biopsy, as well as the onset of the current complaint, should be obtained. The history and/or current presentation may include the report of some swelling or lymphedema into the affected upper extremity. Compared to the patient's complaint of shoulder girdle pain, the swelling may seem minimal, so it may be necessary to specifically inquire. If swelling is not subjectively reported, the patient may convey "heaviness" that is worse at the end of the day. O'Toole et al[19] also recommend specifically asking about possible cording, described to patients as "a thin cord or string in any of the following areas: in your armpit that extends into the inside of your upper arm, across the inside of your elbow, along your forearm and wrist, under your breast extending toward your abdomen, or none of the above," using the Lymphedema Evaluation Following the Treatment for Breast Cancer Questionnaire. According to O'Toole et al,[19] self-reporting using this questionnaire was ≥ 91.5% specific for cording.

The objective examination should include (1) posture assessment; (2) active and passive range of motion and mobility assessment of cervical spine, thorax, and shoulder girdle complex with special attention to the glenohumeral joint; (3) neurological screening of myotomes, dermatomes, deep tendon reflexes; (4) manual muscle testing of the scapular and glenohumeral muscles; (5) tissue movement and glide;[31] and (6) neurodynamic assessment of the median, ulnar, and radial nerves. The details of the full examination are beyond the scope of this paper. Special attention should be made to certain aspects of the examination that contribute to differential diagnosis (Table 3).

Differential Physical Therapy Diagnosis

Shoulder impairments have been reported following breast cancer treatment with restricted ROM in up to 50% of women.[34] Diagnoses typically associated with limitation of shoulder abduction, and more familiar to orthopaedic physical therapists than AWS, are adhesive capsulitis and thoracic outlet syndrome (TOS). Adhesive capsulitis affects the synovial lining and capsuloligamentous complex of the glenohumeral joint, and may be secondary to a

Table 2. Management of Axillary Web Syndrome

Author(s) Publication Date	Research Design	Findings
Kepics (2004)[29]	Expert Opinion	Expert opinion describing intervention options that she has used in the treatment of patients with AWS. Interventions include myofascial release techniques, manual lymph drainage, stretching, and soft tissue mobilizations that elicit a "pop" and an immediate increase in patient ROM.
Wyrick, Waltke, & Ng (2006)[25]	Retrospective Cohort Study	In this review of 180 physical therapy charts, 31 instances of AWS were documented with an average onset time of 36 weeks postoperative procedure. Overall, this study showed a significant shortening of AWS duration from 3 months to 10 weeks when physical therapy is regularly attended.
Craythorne, Benton, & Macfarlane (2009)[30]	Case Report	26-year-old female 2-weeks s/p wide local excision resolved after 2 months physical therapy including shoulder extension stretches, shoulder rotation stretches, and a light exercise program.
Fourie & Robb (2009)[31]	Case Report	47-year-old female 22-days post-mastectomy and axillary dissection. Utilizing soft tissue mobilization techniques, patient returned to pre-morbid ROM in 3 weeks and was symptom free in 16 weeks.
Tilley, Thomas-MacLean, & Kwan (2009)[32]	Case Report	37-year-old 1 week post axillary dissection and sentinel lymph node biopsy. With the application of moist heat, soft tissue mobilization, and stretching exercises the patient regained full ROM, but still had a palpable cord 7 weeks postoperatively.
Lattanzi, Zimmerman & Marshall (2012)[33]	Case Report	44-year-old female 10 days post wide excisional biopsy. Cording extended into the UE and into the ipsilateral breast tissue, making this a unique presentation. Soft tissue mobilization, stretching, and light exercise over the course of 40 days improved patient's Disability of Arm, Shoulder, Hand scores and provided motion within normal limits, but at one year follow up patient still reports occasional feelings of tightness in her thorax and breast during movement.

Abbreviations: ROM, range of motion; AWS, axillary web syndrome; UE, upper extremity

period of immobilization.[35] Adhesive capsulitis has been reported to occur in breast-cancer survivors due to pain and immobility following surgery.[3] It has been proposed that the negative effects of surgery (eg, pain) and radiation therapy (tissue fibrosis) can contribute to adhesive capsulitis in breast cancer survivors.[34] The ROM limitations associated with adhesive capsulitis follow a capsular pattern, and by definition include restriction of external rotation. Conversely, the physical therapist will note that restrictions of movement for persons with AWS are primarily shoulder abduction and flexion and do not follow a capsular pattern.

Thoracic outlet syndrome can be classified as vascular or neurogenic.[36] The majority of TOS is symptomatic neurogenic, meaning symptoms of pain and paresthesias, but not hard evidence of neurologic compromise.[36,37] Neurogenic TOS is typically caused by mechanical compression of the lower trunk (C8-T1) of the brachial plexus at one of 3 sites: (1) between the anterior and middle scalene muscles, (2) in the costoclavicular space, and (3) in the sub-coracoid tunnel.[36] According to Stubblefield and Keole,[34] although nerve entrapment syndromes are likely to occur in breast cancer survivors, there is no direct evidence that they are at greater risk of developing TOS than the general population. However, the scalene muscles and the pectoralis minor muscle are both susceptible to shortening and radiation fibrosis thereby causing a greater likelihood of nerve compression at these sites.[34] It is the author's (McAuley) experience that TOS is the most common incorrect diagnosis given for women with AWS. The symptom presentation is very similar, but the primary differentiating factor is the presence of cording. Additionally, the shoulder ROM restrictions present with AWS have a true tissue end feel while those with TOS are more typically due to muscle guarding or empty end feels.

Both adhesive capsulitis and TOS are more commonly diagnosed in women than men in the general population of persons without a history of cancer.[34] While either of these conditions may be present in the breast cancer survivor presenting to physical therapy, the clinician must recognize that more than one condition may be responsible for the patient's chief complaint. Axillary web syndrome should be strongly considered as contributory when the medical history is supportive. It can be confirmed by the visual inspection of the cording itself, visible crossing the axilla, and even extending distally to the antecubital fossa (Figure 2). In addition, therapists treating breast cancer survivors should be aware of the potential for the presentation of other painful conditions of the involved upper quadrant such as brachial plexopathy, postmastectomy pain syndrome, CIPN, and cellulitis.[34]

A discussion of differential diagnosis of upper extremity pain would not be complete without mention of complex regional pain syndrome (CRPS). There is no literature that demonstrates a greater likelihood of CRPS in breast cancer survivors. Complex regional pain syndrome, despite the controversy and variability regarding diagnostic criteria,[38] is viewed as a condition involving symptoms of diffuse pain as well as signs of vasomotor, sensory, motor impairments, and trophic

Table 3. Differential Diagnosis

Findings	Secondary Adhesive Capsulitis[35]	Thoracic Outlet Syndrome (TOS)[36, 37]	AWS / Lymphatic Cording
Symptom pattern	• May follow period of immobilization • Initially may experience some sharp pain at end ranges of motion • Progressive dull, aching symptoms • Sometimes reported to be worse at night / sleeping affected	• Insidious onset • Primary complaint of paresthesias in C8-T1 dermatome distribution • Secondary complaint of pain affects distal > proximal UE	• History of breast cancer • Primary complaint is of axillary pain; may extend into hand and have paresthesias
Glenohumeral range of motion	• Limitations are pronounced, especially ER, abduction, IR • AROM and PROM equally limited • Firm / capsular end feel • End range pain	• Limitations of overhead UE activity • AROM may be less than PROM for abduction and flexion • Typically these positions provoke symptoms & guarding (vs specific end feel)	• Limitations are pronounced for abduction and flexion • AROM and PROM most often are equally limited • Firm/tissue end feel • End range pain
GH joint mobility	• Joint glides/accessory motions restricted all directions, especially posterior & inferior	• Joint glides/accessory motions not limited (as compared to non involved GH joint)	• Joint glides/accessory motions not limited (as compared to non involved GH joint)
Neurodynamic assessment	• Negative (not associated with symptoms; equal to opposite UE)	• Positive findings with neurodynamic assessment (most commonly ulnar n., but may be median, radial n.)	• May have positive findings with neurodynamic assessment (may be median, ulnar or radial n.)
Swelling/Edema	• None	• Possible if vascular TOS and venous return is compromised; not common	• May have concomitant lymphedema
Cording	• None	• None	• Present in axilla and may extend along medial aspect of upper extremity, antecubital space, and into thumb[29]

Abbreviations: AWS, axillary web syndrome; UE, upper extremity; ER, external rotation; IR, internal rotation; AROM, active range of motion; PROM, passive range of motion; GH, glenohumeral; TOS, thoracic outlet syndrome

changes and edema.[38] One article was identified in which a 28-year-old man with CRPS following a distal radius fracture benefited from manual lymph drainage.[39] This does suggest that persons with AWS in which the lymphatics are compromised, would potentially be at greater risk for CRPS. It is important to note that CRPS is associated with spontaneous and diffuse pain, while persons with AWS experience end range pain associated with the presence of lymphatic "cords."

Axillary Web Syndrome Management

To date, there are no randomized controlled trials regarding the physical therapy interventions for persons with AWS. The available literature includes expert opinion, retrospective studies and case reports[25,29-33] (Table 2). Taken as a whole, however, we can glean meaningful information from the available literature. The most common interventions described can be classified as education, exercise, manual therapy, and manual lymph drainage (MLD).[25,29-33]

Education described in the literature is primarily related to anatomy, posture and diaphragmatic breathing.[29] Exercise encompasses ROM,[25,29] muscle contraction,[29] and progressive resistive exercise.[24] Manual therapy techniques are intended to increase shoulder ROM. It is important to note that joint mobilizations are not necessary as the capsule itself is not restricted. Techniques that target the soft tissue are to be prioritized. Specific techniques described in the literature vary from superficial soft tissue mobilization such as scar massage, cross-friction massage, skin rolling, skin gliding, skin traction, and myofascial release[29,31,33] to direct release techniques along the length of the cord that sometimes yielded audible "pops."[32,33] Physiologic ROM is also important once the superficial tissues are released, as well as to identify areas of restriction. Other methods of improving soft tissue mobility may also be effective, but were not found in the literature; examples include contract-relax techniques and proprioceptive neuromuscular facilitation. All authors emphasize the importance of starting gently and gradually increasing the intensity of all interventions. Two articles describe soreness within 24 to 48 hours after treatment, but the authors deemed this soreness acceptable.[31,33]

It is in the authors' (McAuley & Litterini) experience that neural mobilization of the upper extremity, as described elsewhere,[40] is very effective in treating the limited ROM and pain. The lymphatic system, like the nervous system, is continuous so many of the same principles can apply. Fourie and Robb[31] acknowledge increased shoulder mobility when the elbow is flexed, which is a clear example of the continuity of the lymphatic cords. Kepics[29] describes mobilizing the cords "distal to proximal" in a fashion that is very similar to neural mobilization techniques. Lattanzi et al[33] explicitly state inclusion of "nerve glides" in their case report; they reported the patient was having symptoms of paresthesias shortly after radiation therapy which responded well to the nerve glides.[3] It is likely the glides benefited the AWS as well.

Patients who are experiencing lymphedema, along with the AWS, should be referred to a CLT. A simple method to

Figure 2. A visible cord extending distally from the axilla across the antecubital fossa. Photo courtesy of Nancy Roberge, PT, DPT, MEd.

determine if the degree of swelling warrants referral is to obtain circumferential measurements along the limb. The National Lymphedema Network recommendation according to the Position Paper: Screening and Measurement for Early Detection of Breast Cancer Related Lymphedema, is to measure at 6-points: mid-hand, wrist, elbow, upper arm just below the axilla, and at 10 cm distal to and proximal to the lateral epicondyle on both arms. Criteria for referral is met if the involved limb is >1 cm at any point as compared to the non-involved limb.[41]

Manual lymphatic drainage is a specialized manual technique specifically designed to address the protein-rich lymphatic fluid. Manual lymphatic drainage has been defined as "a very light, superficial massage that facilitates the flow of lymph to drain."[41] Wyrick et al[25] report MLD as part of the intervention provided in their retrospective cohort study and found an average of 52° of improvement in shoulder abduction ROM over the course of 4 weeks. In this study, the average starting abduction ROM was only 84°. Given this initial restriction, 52° of improvement represents a substantial, functional increase.[25] Manual lymphatic drainage as a component of complete decongestive therapy has been shown to reduce edema, reduce pain, and improve function.[42]

Physical Activity and Rehabilitation for the Cancer Survivor

Recommendations for quality improvement in post-cancer treatment survivorship care were first emphasized in the 2005 Institute of Medicine (IOM) Report, *From Cancer Patient to Cancer Survivor: Lost in Transition*, where the importance of a comprehensive interprofessional team approach is considered critical.[43] From there, both the 2012 ACS *Nutrition and Physical Activity Guidelines for Cancer Survivors* and the 2013 National Comprehensive Cancer Network (NCCN) *Guidelines for Survivorship* recommended that rehabilitation and physical activity be the standard of care in cancer survivorship to help mitigate some of the many sequelae of cancer treatment.[44,45] Regarding the prevalence of fatigue in cancer survivorship, the 2014 NCCN Guidelines on Cancer-Related Fatigue also recognize as a standard of care that rehabilitation should begin at the time of diagnosis and physical activity should be encouraged.[46] Therefore, physical activity for overall strength and aerobic conditioning should be considered as part of any rehabilitation model for the cancer survivor.

In order to increase physical activity for cancer survivors, exercise prescription is best done on an individual basis by a skilled clinician for individuals in active cancer treatment and/or for those with advanced disease. In addition, cancer survivors with multiple co-morbidities should receive a formal exercise prescription to maximize patient safety. For those patients who have completed adjuvant cancer treatment and are otherwise considered appropriate for exercise by their physician, the recommended exercise dose by the ACS is for 150 minutes per week of moderate intensity exercise with the addition of strength training twice weekly.[43]

In addition to traditional referrals for the rehab management of breast cancer-treatment related diagnoses, Stout et al[47] and McNeely et al[48] advocate for prospective surveillance models of care to provide early identification of deficits and standardized processes for routine measurements and structured care for breast cancer survivors. Rehabilitation professionals should therefore be considered an integral part of every cancer survivor's initial cancer treatment plan, as well as their long-term survivorship care plan, in order to support and restore functional mobility, activity participation, and quality of life.

CONCLUSION

The expanding roles of physical therapists as the entry-point into the health care system for movement related impairments and as an integral member of the interprofessional team in oncologic rehabilitation necessitates that we be versed with (1) breast cancer epidemiology and related treatments, (2) the lymphatic system and lymphedema, and (3) AWS, including differential diagnosis and management of persons with AWS. This paper addressed each of these areas and serves to increase the knowledge of orthopaedic physical therapists, and in turn, the quality of care our patients deserve from a doctoring profession. For more information about oncological physical therapy, please visit the APTA's Oncology Section at www.oncologypt.org, Women's Health Section at www.womenshealthapta.org, and the Lymphology Association of North America at www.clt-lana.org.

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Golf Injuries:
Prevention & Management

An Independent Study Course Designed for Individual Continuing Education
Independent Study Course 25.2

Course Description

This 3-monograph series will educate the registrant on the kinesiology of the golf swing, injury prevention strategies, and comprehensive rehabilitation program design. The authors have exceptional backgrounds and experiences in treating the golf athlete. Each monograph is designed for the registrant to be able to immediately apply the content to patient care. In addition to the written work, one author has created a library of video clips showing numerous exercises that can be used at various stages of rehabilitation.

Topics and Authors

- **Kinesiology and Biomechanics of the Golf Swing**
  Ada Wells, MPT, PMA®-CPT, TPI-Level 3 Medical
- **Strength & Conditioning for Golf Injuries**
  Brandon Schomberg, DPT, OCS, SCS, CSCS, CGFI-MP3
- **Common Golf Injuries**
  Steven Pavlet, PT, DPT, MS, OCS, ATC

Continuing Education Credit

Fifteen contact hours will be awarded to registrants who successfully complete the final examination. The Orthopaedic Section pursues CEU approval from the following states: Nevada, Ohio, Oklahoma, California, and Texas. Registrants from other states must apply to their individual State Licensure Boards for approval of continuing education credit.

Course content is not intended for use by participants outside the scope of their license or regulation.

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Christopher Hughes, PT, PhD, OCS, CSCS—Editor

Gordon Riddle, PT, DPT, ATC, OCS, SCS, CSCS—Associate Editor

Sharon Klinski—Managing Editor

Learning Objectives

Upon completion of this course, the participant will be able to do the following:

- Cite the incidence and prevalence of common injuries of the golfer.
- Identify the postures, mechanics, and pathomechanics associated with the golf swing.
- Identify common golf injuries according to etiology and body region.
- Develop intervention strategies to minimize golf injuries.
- Identify key elements during each phase of the golf swing motion, including grip, address, backswing, downswing, impact, and follow through.
- Identify the kinematic requirements of the critical body segments during each phase of the golf swing.
- Identify at least 3 examples of different swing styles based on differing body types.
- Identify and differentiate between efficient and faulty swing characteristics.
- Describe how the stretch-shorten cycle and ground reaction forces contribute to maximum club head speed at impact.
- Describe which phases of the golf swing motion increase the torsion, compression, and shear in the lumbar spine.
- Identify stress potentials in the upper and lower extremities during the golf swing.
- Apply knowledge of the golf swing to assist in designing rehabilitation programs and improving performance.
- Apply evidence-based strength and conditioning concepts to assist golf athletes of all skill levels with injury prevention and improved golf performance.
- Appreciate the role of the neuromuscular system in generating an optimal golf swing.
- Explain general timelines, precautions, and contraindications for safely returning to golf.
- Apply clinical screening tools for functional analysis of the golfer and assist in developing injury prevention programs and proper golf warm-up routines.

For Registration and Fees, visit orthopt.org/content/c/25_2_Golf_Injuries
Additional Questions—Call toll free 800/444-3982

2015 Annual Orthopaedic Section Meeting

Phoenix, Arizona | Arizona Grand Resort & Spa

May 14–16, 2015

Maximizing Outcomes: Multidisciplinary Advances in the Continuum of Care of Lower Extremity Dysfunctions

Our 3rd Annual Orthopaedic Section Meeting will be held at the beautiful Arizona Grand Resort & Spa in Phoenix, Arizona, May 14-16, 2015. During this 2-day meeting, we will explore the multidiscipline advances in rehabilitation through the episode of care of various lower extremity dysfunctions, treatment of osteoarthritis from presurgical to postsurgical, and the physical therapist's role in advances in regenerative medicine. Experts in the field will gather together for lecture presentations and small group, hands-on lab sessions. Our goal is to describe the current research in clinical practice. We want to create a meeting where we can interact, learn, and challenge each other as colleagues. We are listening to your suggestions, and will continue to strive to meet your educational needs as an advanced practicing clinician.

Program Information

Thursday, May 14, 2015

Complimentary (Bonus) Session
3:30PM–5:30PM

Lacking Resources to Implement the Didactic Portion of an Orthopaedic Residency Program? The Section's "Curriculum in a Can" Can be the Answer you are Looking For!
Speaker: Aimee Klein, PT, DPT, DSc, OCS

Opening Reception & Keynote Presentation: 6:00PM – 9:00PM

Keynote Presentation
Speaker: James J. Irrgang, PT, PhD, ATC, FAPTA

Friday, May 15, 2015

Daily Schedule: 8:30AM–5:00PM
General Session: 8:30AM–10:30AM

Current Perspectives in Managing Osteoarthritis
Speakers: Fabrisia Ambrosio, PT, PhD*; G. Kelley Fitzgerald, PT, PhD, FAPTA; Johnny Huard, PhD; Jennifer Stevens-Lapsley, PT, MPT, PhD

Concurrent Breakout Sessions:
**Following the general session on Friday, four concurrent breakout sessions will be offered. The registrant will attend three out of four breakout sessions following the morning general session, based on order of preference indicated on the registration form. Note: space is limited, and therefore the attendee's breakout session assignments will be giving on a first-come, first-serve basis.

Breakout Session 1: Psychological Health and Knee Osteoarthritis: Strategies for Screening and Collaborative Action
Speaker: Daniel L. Riddle, PT, PhD, FAPTA

Breakout Session 2: Biomechanical Perspective on Physical Therapy Management of Patients before and after Hip and Knee Replacement
Speaker: Joseph Zeni, PT, PhD

Breakout Session 3: Milestones and Clinical Pearls in Total Knee Arthroplasty Rehabilitation from Early Postoperative through Return to Activity
Speaker: Tara Jo Manal, PT, DPT, OCS, SCS

Breakout Session 4: Considerations for Successful Rehabilitation in Total Joint Arthroplasty: The Case of the Young Active Patient
Speakers: Michael Dayton, MD; Jennifer Stevens-Lapsley, PT, MPT, PhD

Saturday, May 16, 2015

Daily Schedule: 8:30AM–5:00PM
General Session: 8:30AM–10:30AM

Part I: The Team Approach to FAI (Femoroacetabular Impingement): Clinical Presentation, Imaging, and

Management; Part II: The Modern ACL: Myths, Facts and Predictions
Speakers: Stephania Bell, PT, CSCS, OCS; Nancy Bloom, PT, DPT, MSOT; Michael Dugas, MD; Travis Hillen, MD

Concurrent Breakout Sessions:
** Following the general session on Saturday, four concurrent breakout sessions will be offered. The registrant will attend three out of four breakout sessions following the morning general session, based on order of preference indicated on the registration form. Note: space is limited, and therefore the attendee's breakout session assignments will be giving on a first-come, first-serve basis.

Breakout Session 5: Rehabilitation Principles after Second ACL Injury and Reconstruction – Strategies for Maximizing Outcome
Speaker: Stephanie Di Stasi, PT, PhD, OCS*

Breakout Session 6: Rehab Principles and Outcomes Following Rearfoot/Midfoot Trauma with an Emphasis on Hands-On Applications for the Clinician
Stephanie Albin, PT, PhD; Drew Van Boerum, MD

Breakout Session 7: Functional Lower Extremity Eval, Manual Therapy Options and Therapeutic Exercises
Brett Fischer, PT, ATC, CSCS

Breakout Session 8: You Make the Call: FAI (Femoroacetabular Impingement) or Not
Nancy Bloom, PT, DPT, MSOT; Travis Hillen, MD

This meeting will be held at the beautiful Arizona Grand Resort & Spa in Phoenix, Arizona. Visit our web site at https://www.orthopt.org/content/c/2015_annual_orthopaedic_section_meeting for more details, to register, and book your guestroom.

Nestled at the base of America's largest urban park and wilderness preserve, Arizona's only AAA Four Diamond all-suite resort features spacious one and two-bedroom suites. Whether meeting with colleagues or vacationing with friends, gracious service, creative culinary delights, and unique recreational activities await. All in the midst of a tropical escape.

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ORTHOPAEDIC SECTION ○ AMERICAN PHYSICAL THERAPY ASSOCIATION ○ PRACTICE RESEARCH EDUCATION

Reliability of Posterolateral Acromion Process to Examination Table Measurement to Estimate Shoulder Protraction Contracture

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ABSTRACT

Study Design: Retrospective study. **Objectives:** To determine the reliability of measuring the perpendicular distance between the posterolateral acromion process and examination table to estimate passive shoulder protraction in student physical therapists. **Background:** Previous research has identified scapular dyskinesis to be associated with musculoskeletal shoulder pain, and commonly addressed by physical therapists. Tightness of the anterior shoulder muscles may be associated with scapular movement abnormality. Thus, reliable clinical measurements for anterior shoulder muscle length are important for physical therapy care. **Methods:** After a 10-minute review session, two measurements of the distance between the posterior acromion process and examination table were obtained for both the dominant shoulders and nondominant shoulders in 12 nondisabled individuals (6 females, and 6 males age: 25.0 ± 2.4 years) by 12 student physical therapist examiners. A complete set of measurements from 10 subjects were available for analysis. **Results:** Mean (±standard deviation) measurements for the dominant (D) shoulder were 7.6 ± 2.0cm for Trial #1 and 7.4 ± 2.0 cm for Trial #2, and 7.5 ± 2.1cm for Trial #1 and 7.4 ± 2.3cm for Trial #2 for the nondominant (ND) shoulder. Tightness was determined in 85% and 86% for D and ND shoulders, respectively. The measurement demonstrated good intra-rater reliability (D: intraclass correlation, formula 2,1; $ICC_{2,1}$ .751, 95% confidence interval; CI: .628-.861; ND: .764, 95% CI: .645-.869) and moderate to good inter-rater reliability (D: $ICC_{2,1}$ = .651, 95% CI: .445-.876; ND: $ICC_{2,1}$ = .733, 95% CI: .548-.911) considered as a continuous variable, and good percent agreement both within raters (94%) and between raters (90%) as a binomial variable. The coefficient of variation was acceptable (D: 25.8, ND: 28.4%). Standard error of measure was 0.99 cm for D shoulders and 1.01 cm for ND shoulders. Minimum detectable change outside the 95% confidence interval was 2.74 cm for D shoulders and 2.80 cm for ND shoulders. **Conclusion:** Measurement of the perpendicular distance between the posterolateral acromion process and examination table is a reliable method to estimate passive shoulder protraction in novice clinicians.

Key Words: measurement reliability, shoulder, physical examination

INTRODUCTION

Pain related to shoulder pathology is a common form of disablement, affecting up to one-third of individuals during the life course.[1] The etiology of shoulder pain is multi-factorial and often clouded. Development of shoulder pathology has been associated with scapular dyskinesis. During shoulder girdle elevation, patients with scapular dyskinesis exhibit limited scapular external rotation and posterior tilt. As a result of these faulty kinematics, a decrease in subacromial volume is evident, with a greater likelihood of the soft tissues in the subacromial space becoming compressed.[2-7] Maladaptive shortening of the anterior shoulder musculature, including the pectoralis minor (PMi),[5,8,9] pectoralis major,[10] biceps brachii, and coracobrachialis[10,11] has been implicated as one cause of scapular dyskinesis. Excessive anterior movement of the humerus and clavicle imparted by contracture of the anterior musculature may draw the posterior capsule of the glenohumeral joint taut and force the scapula to anteriorly tilt and internally rotate as a compensatory movement during elevation.[12]

Previous studies have documented the properties of specific muscle length measurements that may be accountable for excessive passive shoulder protraction. Borstad and Ludewig[9] briefly reported on a measurement that was proposed as a specific PMi measurement, in which a clinician measures the distance between the 4th sternocostal junction and coracoid process. The data set consisted of pilot measurements of 6 nondisabled subjects. Validity and reliability data was not documented in this pilot study. However, data from a subsequent larger study of 11 cadaver specimens suggested this clinical measurement of PMi length demonstrated excellent concurrent validity with respect to direct cadaveric measurements.[1] Inter-rater reliability, intra-rater reliability, and sensitivity of change of this measurement has yet to be elucidated. This brings into question the readiness for this measurement to be implemented clinically. The specific palpation of the 4th intercostal space may be unreliable and considered personally invasive by some patients. In addition, a specific measurement for PMi length only addresses one potential cause of excessive shoulder protraction. A global screening assessment also may be clinically useful to identify the need for more specific muscle length assessment.

Kendall and colleagues[11] proposed to use the distance between the treatment table and posterior-lateral edge of the acromion with the patient positioned in supine as a clinical estimation of pectoralis minor tightness. It is also possible that contracture of other muscles could result in shoulder protraction, such as the pectoralis major, biceps brachii, coracobrachialis, and latissimus dorsi.[12] The serratus anterior, as the primary protractor of the shoulder, also could cause excessive shoulder protraction if tight. Thus, the test proposed by Kendall and colleagues[11] may best be considered a screening examination tool that could indicate the need for more specific muscle length assessment in the presence of a positive result. Lewis and Valentine[14] studied the posterior acromion to table distance in 45 asymptomatic subjects and 45 subjects with various shoulder pathologies, based on 3 measurements from

a single tester. No subject met the criteria for normal muscle length established by Kendall and colleagues, and the posterior acromion to table distance ranged between 5.9-6.3cm.[11] The range of measurements documented by Lewis and Valentine[14] (5.96-6.57 cm) also does not support the presence of individuals who were considered to have normal muscle length by Kendall and colleagues' criteria,[11] even among asymptomatic individuals measured in this study. Taken together, these studies suggest that continuous measurement of posterior acromion to table distance may be more clinically relevant than a categorical assessment of "tight" versus "not tight" based on acromion process position with respect to the table.

For clinicians to be able to treat various forms of scapular dyskinesis and prevent progression to more serious shoulder pathology, they must be able to identify and quantify patterns of muscular restrictions if they are to develop an accurate clinical hypothesis. Given the relative inexperience of novice clinicians, although evidence for construct validity is present, only one study provides evidence of adequate intrarater reliability among relatively experienced and specifically trained clinicians.[14] Inter- and intratester reliability among novice clinicians remains unknown. In addition, sensitivity to change also remains unclear for this measure. The purpose of this study was to determine the interrater reliability, intrarater reliability, and sensitivity to change of the posterior shoulder-to-table measurement for passive shoulder protraction among student physical therapists.

METHOD

This study involved a retrospective review of student physical therapist records that documented a laboratory exercise. The exercise was performed by 21 first year Doctor of Physical Therapy students. The Institutional Review Board at University of the Pacific (Stockton, CA, USA) approved this study.

Subjects

Participants were currently enrolled in the University of the Pacific's Doctor of Physical Therapy program and had successfully completed coursework leading up to the point of the study. Participants with known cervical or upper quarter pathology were excluded from the activity to ensure student safety. Twenty-two subjects were recruited to participate in this study, of which 10 were assigned to be subjects and 12 were assigned to be evaluators. There were 120 total observations available for analysis. Subjects included 4 females and 6 males aged 25.0 ± 2.4 years. Subjects self-designated 9 right shoulders and one left shoulder as the dominant shoulder.

Procedure

Subjects were instructed to lay supine on the treatment table in a comfortable position[11] (Figure 1). First year DPT students (n=12) served as testers. Testers were provided with a 10-minute review session to familiarize themselves with study measurements. Levels of measurement included categorical measurement (an estimation of whether the anterior shoulder musculature was "tight" versus "not tight." Tight would be identified by failure of the posterior lateral edge of the acromion to make contact with the table, in accordance with the operational definition provided by Kendall and colleagues,[11] as well as a continuous measurement using the cloth tape measure to the nearest 0.1 cm (Figure 1). The tape measure was placed at the distal-most extent of the posterior aspect of the acromion process at the zero point, and the perpendicular distance between this anatomical landmark and the treatment table was measured. Testers had previous experience with measurement in the context of a previous course. Testers were allowed to practice the measurement twice, but were given no feedback from instructors about the technique. At the conclusion of the training session, testers performed measurements on each subject. Testers were randomly assigned to the first subject, and then sequentially measured each subsequent subject in series. Testers were provided one minute with each subject to complete each measurement, which included each shoulder. The process continued until testers measured each subject twice.

Statistical Analysis

Descriptive statistics were calculated, including means, standard deviations, 95% confidence intervals (95% CI), and frequencies. Interrater reliability and intrarater reliability were estimated for continuous measurements using the intraclass correlation coefficient ($ICC_{2,1}$). The $ICC_{2,1}$ values were interpreted using the criteria advocated by Portney and Watkins.[15] This model was selected because single measurements from randomly assigned multiple raters were used in the study procedure. Interrater and intrarater agreement for nominal datum were assessed using Cohen's Kappa (κ). Minimum detectable change outside the 95% confidence interval (MDC_{95}) was used to assess sensitivity to change as described by Kovacs and colleagues.[16] The MDC_{95} was calculated using the equation standard error of measure (SEM) x 1.96 x $\sqrt{2}$, where SEM is given as the pooled measurement standard deviation multiplied by the square root of 1 minus the measurement reliability. Coefficient of variation was calculated as the grand standard deviation divided by the grand mean for each shoulder. The PASW 18.0 for Mac (Chicago,

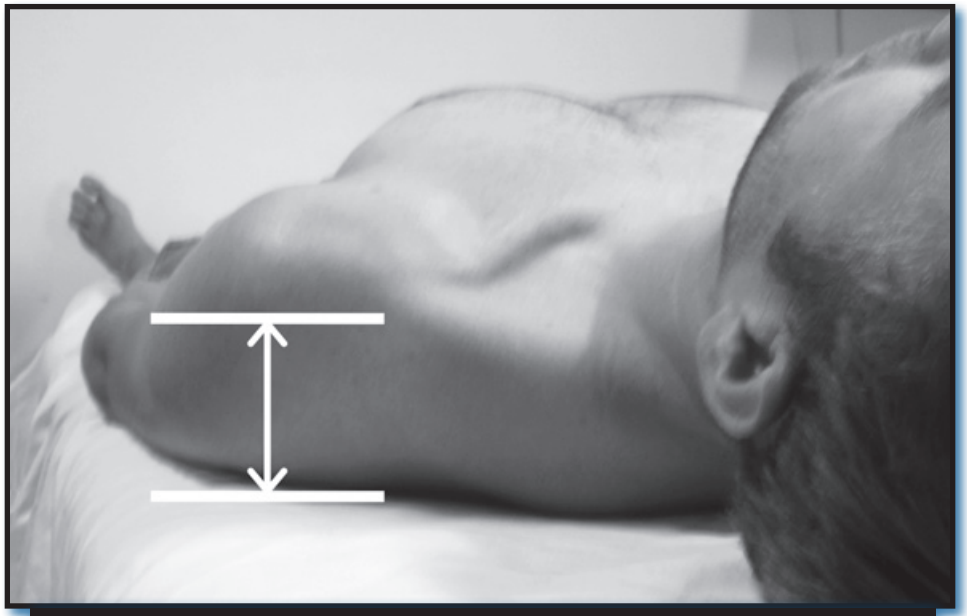

Figure 1. Posterior acromion to table distance under study. Measurements were made using the distance between the lateral-most expanse of the acromion process and the treatment table.

IL, USA) was used for all data analyses. For all analyses, differences were considered statistically significant at $p < 0.05$.

RESULTS

Descriptive Statistics

Mean measurements for the dominant and nondominant shoulders were 7.6 ± 2.0 cm and 7.5 ± 2.1 cm, respectively, for trial #1. Mean measurements were 7.4 ± 2.0 cm and 7.4 ± 2.3 cm for the dominant and nondominant shoulders, respectively, for trial #2. Tightness was identified for 85% to 86% of all shoulders, with the remaining shoulders classified as "not tight."

Relative Reliability

Intrarater reliability for the posterior acromion to table measurement was .751 (95% CI: .628-.861) for the dominant shoulder and .764 (95% CI: .645-.869) for nondominant shoulders. Interrater reliability for the posterior acromion to table measurement was .651 (95% CI: .445-.876) for the dominant shoulder and .733 (95% CI: .548-.911) for the non-dominant shoulder. Percent agreement within raters was 94% and agreement between raters was 90% for the categorical interpretation of the measurement.

Absolute Reliability

The coefficient of variation for dominant shoulders was 25.8% for dominant shoulders and 28.4% for nondominant shoulders. The SEM was 0.99 cm for dominant shoulders and 1.01 cm for nondominant shoulders. The MDC_{95} was 2.74 cm for dominant shoulders and 2.80 cm for nondominant shoulders.

DISCUSSION

This study was conducted to determine the reliability of a common passive shoulder protraction measurement. Because passive shoulder protraction does not appear to discriminate between individuals with and without shoulder pathologies, nondisabled individuals were selected for study. The categorical interpretation of the passive shoulder protraction measurement under study demonstrated very high interrater and intrarater agreement. By contrast, the continuous measurement of passive shoulder protraction demonstrated greater variability and lower interrater and intrarater reliability. The results of this study may be considered a lower limit of reliability, considering the clinical inexperience of the observers that was appropriate for their stage of didactic training, brief training in the measure that observers received, and the relatively high number of observers involved in this study. Previous studies of passive shoulder protraction measurements have demonstrated favorable construct validity with regard to cadaveric measurements and computerized 3-dimensional measurements of scapular position.[9,13] The mean and range for continuous measurements reported in this study are in line with ranges from a previous report.[14]

Although this study contributes meaningfully to our understanding of muscle length testing of the shoulder girdle, particularly for student physical therapists, several research questions as yet remain unaddressed. This study was not designed to assess reliability among practicing clinicians. It is possible that a cohort with greater clinical experience, specifically involving the integration of passive shoulder protraction measurements into practice, could demonstrate higher reliability estimates than observed in this study. The prevalence of normal findings was very low in this study's convenience sample, and normal findings were not independently verified. This study should be repeated in populations that are purposefully recruited to represent the broad range of shoulder protraction measurements. The clinical relevance of passive shoulder protraction measurements are an emerging area of interest.[9] However, this study was not designed to assess the clinical relevance of the measure. Despite these limitations, this study's findings may be used for sample size calculations that can ensure appropriately powered studies to address these remaining research questions. Future studies based on the present report hold promise to continue to improve clinical decision-making and outcomes associated with nonsurgical intervention for shoulder pathology.

CONCLUSION

The posterior acromion to table measurement demonstrates excellent interrater and intrarater agreement when interpreted as a categorical measure, as well as good interrater and intrarater agreement when interpreted as a continuous measure. These data combine with prior findings to support clinical and research application for this passive shoulder protraction measurement.

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Thoracic Outlet Syndrome: A Differential Diagnosis Case Report

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ABSTRACT

Background and Purpose: Thoracic outlet syndrome is a symptom complex caused by the compression of nerves and/or vessels in the neck and shoulder. The purpose of this case report is to discuss differential screening and the impact of physical therapy care of a patient with a diagnosis of thoracic outlet syndrome who presents to therapy with shoulder and arm pain. **Methods and Findings:** A review of the literature was conducted to find the latest treatment and diagnostic imaging studies used for thoracic outlet syndrome. **Clinical Relevance:** A comprehensive and focused evaluation, as well as a thorough knowledge of the brachial plexus anatomy, is needed to help clinicians sort through the maze of symptoms associated with thoracic outlet syndrome. **Conclusion:** Patient recovery from a thoracic outlet syndrome dysfunction requires a physical therapist to perform a comprehensive evaluation and understand how diagnostic imaging can help identify specific pathology and direct the course of rehabilitation.

Key Words: thoracic outlet, axillary, brachial plexus

INTRODUCTION

Thoracic outlet syndrome (TOS) is a symptom complex caused by the compression of nerves and/or vessels in the neck and shoulder. The compression may be due to a cervical rib, an abnormal first thoracic rib, abnormal position or insertion of the scalene muscles, a malunited clavicle fracture, fibrous bands (ie, congenital or acquired due to injury or surgery),[1] subclavian artery aneurysm, tumor, an entrapment of the brachial nerves and vessels between the pectoralis minor muscle and ribs, and finally, muscle imbalance and faulty postural alignment.[2] An article by Collins[3] further indicates that TOS crimps the great vessels in the neck and shoulder ("like a water hose"), which diminishes "nutrient arterial, venous, and lymphatic circulation to the five senses (hearing, sight, smell, taste, touch) that triggers patient's complaints."[4]

Illig et al[5] defines TOS as having at least 3 separate conditions. The first is known as **neurogenic TOS**, which may account for about 95% of the cases. In neurogenic TOS, the brachial plexus is compressed at the scalene triangle and may present as either local or extremity pain. This condition is often exacerbated by lifting the arms overhead. The second condition is known as **venous TOS** and may account for about 4% of the cases. Venous TOS is when the subclavian vein is compressed by the structures making up the costoclavicular junction. Finally, the third condition is known as **arterial TOS** and is considered the rarest form of TOS. In arterial TOS, arterial injury occurs due to abnormal bony or ligamentous structures at the thoracic outlet region.

Signs and symptoms of TOS may include pain and paresthesia in the neck, shoulder, arm, or hand, or weakness and atrophy of the intrinsic muscles of the hand.[2] Thoracic outlet syndrome usually develops between the ages of 35 and 55 and is more common in women.[6] The symptoms of TOS must be differentiated from other diagnoses such as brachial plexus injury, shoulder bursitis or impingement, cervical osteoarthritis, cervical disk lesions, carpal tunnel syndrome, Raynaud's syndrome, subclavian artery aneurysm, angina or lung cancer (ie, Pancoast's tumor). All of these pathologies can yield similar symptoms such as pain and paresthesia that may begin in the neck or shoulder and extend to the medial aspect of the arm and hand and sometimes to the anterior chest.[6-8]

A comprehensive and focused evaluation, as well as a thorough knowledge of the path of the brachial plexus originating from the lower neck (ie, C4 to T1) to the axilla can help clinicians sort through the maze of symptoms associated with TOS.[8] The purpose of this case report is to discuss differential screening and the impact of physical therapy (PT) care of a patient with a diagnosis of TOS who presents to therapy with shoulder and arm pain, which may be associated with neuromuscular dysfunction or systemic disease.

OVERVIEW OF DIAGNOSTIC IMAGING FOR THORACIC OUTLET SYNDROME

Radiographs may be used to show anatomic variations, which may lead to symptoms of TOS. A study by Chang et al[9] measured the sternal head width and vertebral head width of the first rib as well as the sternal head width, the acromion head width, and the length of the clavicle through posteroanterior chest and anteroposterior cervical spine radiographs to investigate the relationship between TOS and the first rib. The study looked at 32 patients undergoing surgical decompression for TOS and 30 normal subjects as a control group. Researchers used an independent t-test with an alpha value of 0.05 to compare measurements between the affected side and the unaffected side of the unilateral TOS patients. An independent t-test was also used to compare measurements between TOS patients and the normal control group. The affected side and unaffected sides were not statistically different in terms of mean clavicle lengths and widths of both ends. The results showed that individuals with wider vertebral end width of the first rib (ie, greater than 15 mm) or wider sternal end width of the first rib (ie, greater than 20 mm) may potentially lead to TOS due to either anatomical variations or a fractured clavicle. Thus, abnormal widening of the first rib, either at the sternal or vertebral end, may lead to TOS. Limitations of this study include a small sample size and a retrospective experimental design.

Magnetic resonance imaging (MRI) is considered the primary examination tool for evaluating the brachial plexus.[10] Even though vascular TOS accounts for less than 10% of the cases, this condition can lead to debilitating ischemia or congestion in the arterial or venous system.[11] A study by Lim et al[12] looked at 31 patients referred for vascular TOS evaluation using a single-injection blood pool agent (BPA) with gadofosveset trisodium as the contrast medium versus a dual-injection extracellular contrast agent (ECA) with gadopentetate dimeglumine. The study was conducted with magnetic resonance angiography (MRA) and magnetic resonance venography (MRV)

using contrast-enhanced 3D T1 weighted imaging and provocative arm positioning to assess the arteries and veins. The results indicate that both a single-injection BPA and a dual injection ECA enable the identification of fixed and functional arterial and venous pathologies. According to the authors, limitations of the study include lack of subject randomization and the use of a retrospective experimental design.

Contrast-enhanced 3-D MRA can be used to image a patient's arm during abduction and at rest to determine associated vascular compression to determine a correlation of the findings with clinical symptoms. A study by Ersoy et al[13] evaluated 78 consecutive patients to establish the efficiency and reproducibility of a contrast-enhanced 3D MRA protocol for the frequency and distribution of vascular compression and vascular complications in the thoracic outlet. The findings revealed a venous component in 85% and an arterial component in 82% of the subjects evaluated. The findings also showed that 3-D MRA is an ideal imaging modality for postsurgical follow-up for identifying restenosis or residual vascular compression. Finally, the 3-D MRA is considered a complementary test for the diagnosis of TOS based on the protocol described in this study. Ersoy and colleagues[13] cited a limitation of the study was that only 9 patients received digital subtraction angiography (DSA), which is considered the standard of care in the evaluation of the vascular anatomy. Ersoy and colleagues[13] also indicated that the T2-weighted imaging included in their protocol did not have adequate spatial resolution to identify anomalous ligaments or fibrous bands that may lead to neurovascular compression.

Visualization of bony anomalies and fibrous bands through magnetic resonance neurography (MRN) can aid in the diagnosis of TOS and help identify specific anatomy that may be helpful for surgical considerations and rehabilitation programs. A study by Baumer et al[1] investigated the efficacy of MRN in being able to visualize fibrous bands that may be compressing the brachial plexus. The authors found that 7 out of 30 patients had fibrous bands (n = 5) and pseudarthrosis or synostosis of the ribs (n = 2). Even though a limitation of the study includes a small sample size, an MRN may help identify the specific causes of TOS. The authors also indicated that a high positive predictive value provides the clinician a specific reason for considering surgery.

Diagnostic ultrasound is an emerging technique and may become a valuable tool for assessing brachial plexus compression. An article by Fried and Nazarian[14] showed that diagnostic neuromuscular ultrasound may assist clinicians in determining brachial plexus compression during dynamic elevated arm stress testing. The correlation of the onset of symptoms and compression may assist the clinician in determining the presence of TOS. Lapegue et al[15] also confirmed that ultrasound (US) may be used to visualize the roots, trunks, and cords of the supraclavicular fossa in a dynamic manner. Therefore, US may be an effective tool for the physical therapist to visualize the brachial plexus in a variety of dynamic movements in a clinical setting. Limitations of US include clinician experience in interpreting the results and communicating the results to other clinicians who may be unfamiliar with ultrasound imaging.

PATIENT PRESENTATION

The patient was a 51-year-old Caucasian female who has worked as an administrative assistant for the past 25 years. She went to see her family physician for pain in both shoulders along with left arm fatigue and also tingling to the medial aspect of her left arm. She was referred back to the orthopaedic surgeon who had performed a shoulder rotator cuff repair a year ago when the patient injured her right shoulder after falling off her mountain bike. After undergoing radiographs to the cervical spine, both shoulders, and an MRI study to the left shoulder, the patient was referred by the orthopaedic surgeon to PT with a medical diagnosis of bilateral TOS (ICD 9 code 353.0) and bilateral shoulder pain (ICD 9 code 719.41).

Patient presented to PT with right shoulder pain of 3 to 7 out of 10 and 6 to 8 out of 10 on the left shoulder using a visual numeric pain scale. Patient also reported occasional left chest and breast pain and some left hand weakness. Pain in both shoulders was triggered after 15 minutes of computer work (with the mouse on the left side) and when driving; however, the patient was not sure about a trigger for her intermittent left arm tingling. Past medical history included hypertension, asthma, and osteoarthritis of both knees. Patient did not smoke or consume alcohol. Patient stated she lived with her husband and two children and was independent with her activities of daily living. Exercise history for this patient included stationary bicycling at home and mountain biking with her family 3 to 4 times a week. Her right shoulder and left shoulder and arm pain prevented prolonged sitting at work during computer-related tasks.

The patient's medications included acetaminophen (Tylenol) for knee pain as needed, atenolol (Tenormin) for management of hypertension, and albuterol (Ventolin HFA) for controlling her asthma. Pertinent medication side effects to consider for this case include joint pain from atenolol and chest pain from albuterol use.[16] A case report by Patel et al[17] indicates that individuals with asthma and chronic obstructive pulmonary disease exacerbations may develop Takotsubo cardiomyopathy (ie, the medication may become a stressor) possibly due to overuse of beta-2 agonists such as albuterol. Thus, prompting the therapist to pay particular attention to the cardiopulmonary screening.

A review of symptoms identifies the following clusters of signs and symptoms during the initial subjective screening: musculoskeletal/neurologic–joint pain, paresthesia, and radicular pain; rheumatologic–muscle pain and weakness; cardiovascular–chest pain; pulmonary–shortness of breath; endocrine–joint or muscle pain. Red flags identified in the subjective screening included fall from a bicycle, insidious onset of left shoulder and arm pain, pain that was poorly localized in the left shoulder, and left-sided chest pain. Risk factors included hypertension, asthma, age over 50, female gender, and sedentary occupation involving prolonged sitting. No constitutional symptoms were identified for this patient.

EVALUATION AND TESTING

The Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire score was identified as 41.7 out of 100, with a score of zero being considered no disability and 100 as the most severe disability.[18] A physical examination and systems review was initiated with observation at the waiting room. The patient showed difficulty pushing off the left armrest of the chair and then rubbing both knees upon standing. After standing, the patient hung her large purse on her left shoulder and also demonstrated difficulty doffing her light jacket in the exam room. Gait revealed decreased arm swing on the left and posture revealed internally rotated shoulders, forward head, and moderate scapular winging bilaterally.

Observation during the exam revealed a surgical scar on the right shoulder but no bruising, cuts, hemorrhage, or swelling in the upper body. Patient was observed to use a chest breathing strategy with mild use of

the scalene muscles. No atrophy of the arm or hands muscles was noted. Seated blood pressure on the right was 120/75 mmHg and 125/80 mmHg on the left. Pulse was measured at 67 beats per minute, respiration at 18 breaths per minute, oxygen saturation at 97%, and oral temperature at 98.4° F. No jugular venous distension was noted.

Auscultation of the carotid arteries did not reveal any bruits, and jugular venous pulse pressure was measured to be normal at 8 cm. Auscultation of the heart did not appear to reveal abnormal sounds while auscultation of the lungs revealed a mild wheezing sound in the upper right and left lobes. Palpation of the chest revealed symmetrical, but reduced, chest expansion. Percussion of the chest, back, and abdomen did not illicit pain or a dullness sound.

Accessory nerve (cranial nerve XI) tested normal for the trapezius and sternocleidomastoid. Upper extremity pulses and vibration sense were intact, with the deep tendon reflexes 2+/4 and manual muscle testing 5/5. Left arm tingling was localized to the ulnar nerve distribution with light touch sensation testing. Shoulder active range of motion (AROM) was measured at 150° on the right and 140° on the left secondary to pain limits. Cervical AROM was painfree and within normal limits. Patient did not demonstrate difficulty with a finger to nose coordination test. Flexibility testing revealed tightness of the pectoralis minor and latissimus dorsi. Grip strength was measured at 35 pounds on the right and 30 on the left using a dynamometer, which is considered low since she is left-hand dominant.[19]

Palpation of the cervical region revealed no enlarged lymph nodes; however, myofascial restrictions were noted at the right shoulder near the surgical incision and trigger points along the left anterior scalene, levator scapula, and pectoral muscles, which may contribute to TOS symptoms.[20] Vertebral artery (cervical quadrant test) test was negative. Provocation tests of the upper extremity, which included the Adson Maneuver, Roos Test, and the Cyriax Release Test, were positive in the left upper extremity.[21]

Radiographs of the bilateral shoulder revealed osteoarthritis and mild cervical disc degeneration from C5 to C7 in the cervical spine. Magnetic resonance imaging of the left shoulder revealed a partially torn supraspinatus with impingement in the subacromial space. Laboratory tests were unremarkable for a complete blood count and urine analysis. A recent mammogram was negative.

ASSESSMENT AND PLAN OF CARE

The patient's symptoms appeared consistent with myofascial restrictions, postural faults, and work-related tasks and possibly due to recreational activities, such as leaning on her outdoor bicycle handlebar. Problems identified in the evaluation indicated the need for PT intervention. Specific treatments addressed impaired shoulder range of motion with overhead reach and shoulder function with donning or doffing a jacket. Poor posture due to flexibility and strength imbalances, and pain and tingling in the left upper extremity was also targeted. No contraindications for PT interventions were identified.

Patient goals were to reduce pain with daily activities and computer use at work. Physical therapy goals were to decrease pain, restore shoulder range of motion, improve posture, teach patient proper ergonomic strategies, and provide a home exercise program. The plan for the PT diagnosis (ie, shoulder soft tissue and postural dysfunction, overuse, upper body muscle imbalances) and medical diagnosis (ie, shoulder pain and TOS) was to see the patient one to two times a week for 12 weeks using patient education, modalities, manual therapy, and therapeutic exercises.

ONGOING EVALUATION AND TREATMENT

Ongoing assessment consisted of evaluating pain, blood pressure, heart rate, AROM, myofascial restrictions, flexibility, grip strength, and sitting tolerance. The short-term goal was to use modalities and manual therapy for pain reduction, but the primary treatment focus was on patient education and a home exercise program with emphasis on the following factors[2]:

1. **Ergonomic principles.** Adjust work chair and computer for optimal function and avoid sitting for greater than 30 minutes. Minimize repetitive motion (typing, writing, texting), and take frequent breaks.
2. **Habits.** Avoid hanging a purse on the shoulder.
3. **Assistive clothing.** Consider wearing a "posture bra."[2]
4. **Activities.** Avoid leaning on bicycle handle bars for prolonged periods.
5. **Therapeutic exercises.** Correct muscle imbalances by stretching the pectoralis minor and latissimus dorsi muscles and strengthen the serratus anterior, lower trapezius, and rhomboid muscles. Learn to breathe diaphragmatically to minimize activation of scalene muscles.

OUTCOMES AND DISCUSSION

The patient was seen for a total of 10 visits over 12 weeks. Pain in the bilateral upper extremity was reduced by 75% and the DASH score improved from 41.7 to 10.0 out of 100.

The mechanism of left shoulder pain and chest pain in this case study appears to be consistent with myofascial restrictions, postural faults, and work-related tasks and possibly due to recreational activities, but does not appear to be related to systemic causes. Goodman and Snyder[23] state that "chest/breast pain can occur (and may be the only symptom of TOS) as a result of cervical spine disorders, an underlying etiology in TOS. This is because spinal nerves originating as high as C3-4 can extend down as low as the nipple line."(p699) However, the radiating symptoms in the upper extremity in this case study warranted a thorough evaluation to rule out systemic causes.

The patient's past medical history, recreational history, systems review, functional observation in the waiting area, sensory testing, provocation tests of the upper extremity (ie, Adson Maneuver, Roos Test, and the Cyriax Release Test), myofascial restrictions, and a review of the imaging studies in PT helped to determine the physician diagnosis of TOS.

CONCLUSION

In conclusion, diagnosing and treating a patient with TOS requires a thorough evaluation to rule out systemic factors and to identify a specific neuromuscular dysfunction. Also, proper identification of anatomical structures through imaging studies may help direct the course of the rehabilitation for a patient with TOS. However, the clinician must correlate imaging results with the physical examination involving provocative maneuvers[24] and use quality of life surveys, such as the QuickDASH, to optimize clinical outcomes.[25]

(References continued on page 116)

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(Continued from page 114)

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Book Reviews

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Book Review Editor

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

Transcutaneous Electrical Nerve Stimulation (TENS): Research to Support Clinical Practice, Oxford University Press, Inc., 2014, $59.95
ISBN: 9780199673278, 261 pages, Soft Cover

Author: Johnson, Mark I.

Description: This book describes the research to support the clinical practice of transcutaneous electrical nerve stimulation (TENS). **Purpose:** The purpose is to synthesize research findings and to inform clinicians about safe and appropriate techniques when using TENS. In the era of evidence-based practice, this book is needed for summarizing the current research in the clinical use of TENS. The author does an excellent job of balancing the evidence and clinical parameters for the various applications of TENS. **Audience:** The target audience is students and clinicians who will use TENS in practice. The author has investigated the factors that influence the analgesic effects and clinical efficacy of TENS since 1987. He covers a wide array of clinical topics and includes most specialty areas, such as acute postoperative pain, labor pain, dysmenorrhea, chronic and acute musculoskeletal pain, non-inflammatory and inflammatory rheumatic diseases, neuropathic pain and cancer. He also presents other uses for TENS as well (autonomic nervous system, tissue regeneration, incontinence, etc.) and applications for children and the elderly. **Features:** The book does an excellent job of reviewing the current research evidence and quality of literature for TENS. A highlight is the description of the mechanism of action of TENS. The author is able to explain the complex mechanisms of pain reduction in a way that clinicians can convey to their patients. Other highlights are the charts on the appropriate electrode sites for electrical stimulation, including dermatomes, myotomes, trigger points, and acupuncture points. Chapters address contraindications and precautions when evaluating the appropriateness of TENS for a new patient. A nice clinical feature is the discussion of the practicality of using TENS for specific conditions and situations. The author elaborates on changing different parameters if the initial short-term goals of TENS are not met. One area that could be more robust is the use of illustrations for the various parameters for electrical stimulation. **Assessment:** This is an excellent book for clinicians that also can serve as a companion book for students taking electrophysiology. I would highly recommend it for clinicians and students.

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Connective Tissue Massage: Bindegewebsmassage According to Dicke, Thieme Medical Publishers, Inc., 2014, $79.99
ISBN: 9783131714312, 189 pages, Soft Cover

Authors: Schiffter, Roland, MD; Harms, Elke

Description: This is the first English translation of the 15th edition of a German textbook published in 2009 on connective tissue massage (CTM) concepts and techniques used to treat patients with various ailments. **Purpose:** The book is designed to teach students of physical therapy and massage therapy, as well as physicians, the theories and techniques of connective tissue massage. **Audience:** The author notes that this book is not for physical therapists seeking to augment their established massage treatment techniques with new, simple ones, because each CTM treatment must start with a basic sequence of strokes before progressing to the more specific techniques used to treat a particular condition, and therefore is not effective if used individually. As such, one cannot perform an individual CTM massage sequence and expect to have an effective treatment. **Features:** The book provides in-depth explanations of how Elisabeth Dicke developed the technique as well as a general overview of the anatomy and physiology of the nervous system and connective tissue. The book explains the neuroanatomical and neurophysiological effects of connective tissue massage that contributes to its therapeutic effects. In addition to describing how to perform the massage strokes and the basic stroke sequence used for all treatments, the book includes instructions on how to perform a CTM evaluation using palpation throughout the connective tissue zones to direct a treatment plan. Chapters describe CTM treatment for an array of orthopedic, neurological, internal medicine, and gynecological and obstetric disorders. Each chapter defines a medical diagnosis and notes medical contraindications and precautions for CTM treatment. Additionally, the book describes what a CTM practitioner will find when examining a patient with specific conditions in terms of tension within the connective tissue zones. It also provides a CTM treatment plan for each described medical condition, explaining specific strokes and sequences as well as the duration and frequency appropriate to treat the average patient. **Assessment:** This is an instructive book for medical professionals interested in learning this treatment. Adding online video would greatly enhance the presentation, by enabling readers to get a more thorough understanding of how to perform the specific massage strokes, as well as how to perform the individual treatment sequences. Overall, the book is quite comprehensive and provides detailed CTM treatment plans for many medical ailments.

Jennifer Hoffman, PT, DPT, OCS
MedStar NRH

Guide to Evidence-Based Physical Therapy Practice, Jones & Bartlett Learning, 2015, $96.95
ISBN: 9781284034165, 434 pages, Soft Cover

Author: Jewell, Dianne V., PT, DPT, PhD, FAACVPR

Description: This is an extensive update of a book on the fundamental research methods vital to the evidence appraisal process as applied to the patient/client management model in physical therapy practice. It is the only book that integrates fundamental research methods into clinical practice. The previous edition was published in 2010. **Purpose:** The author's stated goal is to teach the knowledge and skills necessary to evaluate evidence and apply these to physical therapist practice. With the current emphasis on evidence-based

practice throughout healthcare, a book of this scope is relevant and important for novice and experienced clinicians. The author has filled a critical void in the market with this book, and with the extensive revisions and updates to this edition, it continues to remain current and relevant. **Audience:** Its format makes this book equally beneficial for students and experienced clinicians. It follows a logical progression, starting with a definition of the principles of evidence-based practice, followed by a description of features that enhance or diminish the qualities of a research study. Readers are then educated on how to determine whether evidence is useful to them and guided through the process of applying evidence to their own practice patterns. Experienced clinicians who may be less conversant with evidence-based practice can easily learn the material. The author has spent her 25-year career as a clinician, educator, and administrator. More recently she founded a company helping rehabilitation practices to demonstrate their value to consumers, referral sources, and payers by leveraging their patient and practice data. She also is a program director for a university-based health policy certificate program. **Features:** The 19 chapters are grouped into four separate sections on principles of evidence-based physical therapist practice; elements of evidence; appraising evidence; and evidence in practice. Each chapter begins with clearly stated learning objectives, essential terminology, and with 6-10 concluding questions strongly correlated to the learning objectives. Tables and figures in a two-color format highlight important concepts. Chapters 9 and 10 exemplify the author's ability to simplify confusing and complex concepts, giving readers an appreciation of statistical significance balanced against clinical relevance. The book also includes an access code to an accompanying website with additional learning/review resources including flashcards, an interactive glossary, practice quizzes, web links, and screenshots of electronic databases from chapters 3 and 19. All are excellent supplements to the book. **Assessment:** This excellent book has particular relevance to the evolving profession of physical therapy and is a timely update of the previous edition. It is an excellent adjunct to other established books, such as "Evidence-Based Medicine: How to Practice and Teach It," 4th edition, Straus et al. (Elsevier, 2011), "Critical Evaluation of Research in Physical Rehabilitation: Towards Evidence-Based Practice," Helewa and Walker (Saunders, 2000), and "Foundations of Clinical Research: Applications to Practice," Portney and Watkins (Prentice Hall, 2008).

Charles R. Wolfe, III, PT, DPT, DAC
U.S. HealthWorks Medical Group, Inc.

Running Mechanics and Gait Analysis, Human Kinetics, Inc., 2014, $45
ISBN: 9781450424394, 139 pages, Soft Cover

Authors: Ferber, Reed; Macdonald, Shari

Description: This book on the evaluation and treatment of running-related injuries is organized to assess foot, knee, and hip mechanics and includes a discussion of footwear selection, case studies, and technical aspects of gait analysis. **Purpose:** The purpose is to describe the biomechanics of running and how strength, flexibility, and anatomical alignment relate to abnormalities in gait and running. The book presents both biomechanical and clinical research and includes multiple references. The presentation is clear and simple, providing readers with an understanding of normal running mechanics and how they can be altered. **Audience:** The intended audience includes physical therapists and athletic trainers, but personal trainers, coaches, and runners would find the book helpful in improving running mechanics and preventing injuries. Both authors are from the Running Injury Clinic in Calgary, Alberta, Canada. **Features:** The book outlines the incidence of running injuries, defines overuse injuries and etiology, discusses common injuries, and reviews the clinical and biomechanical risk factors involved. Summaries of the assessment of foot, knee, and hip mechanics include biomechanics, strength, anatomical alignment, and flexibility issues or dysfunctions. Discussions of footwear selection and the technical aspects of video gait analysis are also presented. Other features include terminology for gait biomechanics, a glossary, references, and an index. Users have access to online videos that present both normal and abnormal gait and running mechanics in 45-second clips. **Assessment:** Very few books provide information specifically on running mechanics and gait analysis. This one has an excellent overview of each joint related to the mechanics of gait, and the online video clips help users visualize abnormal as well as normal patterns of gait. This book provides information that will have an immediate impact on patient care.

Sylvia Ann Mehl, BS, MS
University of Southern California

2015 Election Results

The Nominating Committee slated the following candidates for the 2015 election:

Director:
Keelan Enseki
Beth Jones
Aimee Klein

Treasurer:
Jason Tonley
Kimberly Wellborn

Nominating Committee Member:
Judy Woehrle

Election Results:
Total number of ballots cast: 916
Total number of valid ballots: 916
Total number of invalid ballots: 0

Director: Aimee Klein
Treasurer: Kimberly Wellborn
Nominating Committee Member: Judy Woehrle

2015 CSM Award Winners

The Orthopaedic Section Awards Ceremony was at CSM February 6, 2015, at the JW Marriott Hotel in Indianapolis, IN. Congratulations to all of this year's award winners.

OUTSTANDING PTA STUDENT AWARD

The purpose of this award is to identify a student physical therapist assistant with exceptional scholastic ability and potential for contribution to orthopaedic physical therapy. The eligible student shall excel in academic performance in both the pre-requisite and didactic phases of their educational program, and be involved in professional organizations and activities that provide the potential growth and contributions to the profession and orthopaedic physical therapy.

Kristy Hyden of Prestonsburg, Kentucky, is currently a second-year PTA student at Somerset Community College (SCC). She holds a Bachelor of Arts Degree in Exercise Science from the University of Kentucky (UK). While at UK, she was a member of Phi Beta Kappa Honor Society and the Calvary College Ministry, a group with whom she raised funds for UK's Pediatric Hematology and Oncology Clinics by coordinating dance marathons, fall festivals, and other various fundraisers.

At SCC, she is a member of Phi Theta Kappa Honorary, the Physical Therapy Student Organization, and the Student Government Association and she is the historian for her class. In 2013, she was selected to serve on the Forward in the Fifth Student Congress. In 2014, she received the highest honor presented within our program, having been selected the recipient of the James H. Anderson Award. This award is especially meaningful as it is peer-selected and based on the expectation that the recipient will make a significant and lasting impact on the physical therapy profession. She was also recognized as one of three PTA students in Kentucky to be named to the Kentucky Physical Therapy Association's (KPTA) All-Academic Team.

Kristy is active in a number of charitable and community service activities including assisting with free health screenings at the Kentucky Special Olympics, teaching and mentoring teen students in Camp Jump Start, and raising funds for the Jordan Light Foundation, a group whose mission is to provide awareness, support, and funding for families with a financial medical crisis, since 2010.

Upon graduation, she plans to work as a physical therapist assistant in eastern Kentucky. She is the daughter of Larry and Patricia Hyden of Prestonsburg.

OUTSTANDING PT STUDENT AWARD

The purpose of this award is to identify a student physical therapist with exceptional scholastic ability and potential for contribution to orthopaedic physical therapy. The eligible student shall excel in academic performance in both the professional and pre-requisite phases of their educational program, as well as be involved in professional organizations and activities that provide for potential growth and contributions to the profession and orthopaedic physical therapy.

The 2015 Orthopaedic Section Outstanding Physical Therapy Student Award is presented to Christa Wille, a third year Doctor of Physical Therapy student at the University of Wisconsin-Madison. Christa attended the University of Wisconsin-Madison for her undergraduate education, graduating summa cum laude with a major in biomedical engineering. She has continued this level of academic excellence during her time in the DPT program, and is recognized by her peers as an accomplished, yet unassuming, leader.

While early in her professional career, Christa has developed interest and skills involving physical therapy-related research. She has co-authored five peer-reviewed publications including one as lead author. She has presented her research findings at various meetings of professional associations and societies, including the American Physical Therapy Association, American College of Sports Medicine, and the World Congress on Biomechanics, earning awards for several of these presentations.

This strong work ethic is not limited to academic interests as Christa maintains a well-balanced lifestyle that includes serving on and leading a number of committees during her graduate studies. As a student member of the APTA's Orthopaedic, Sports, and Research Sections, she assisted with the development of a running-related home study course, facilitated research projects for several orthopaedic physical therapy residents, and serves the Wisconsin chapter of the APTA as the Student Liaison for the University of Wisconsin-Madison. She participated in a global health service learning trip to Belize, where she worked on improving the accessibility of the local clinic, educating kids on disabilities, and creating culturally appropriate handouts for home exercise programs. Christa's leadership extends to recreational activities as well, where she organizes and leads a weekly bike ride and run as the Triathlete Ambassador for a regional bike store. And on top of it all, she completed the 2014 Wisconsin Ironman, an appropriate descriptor for who Christa is.

Upon graduation, Christa is committed to completing a clinical residency and eventually achieving clinical specialization. Thereafter, she plans to pursue a PhD in clinical investigation with a research emphasis on orthopaedic injuries, and eventually, a career as a clinician-scientist. Her ability to lead with humility and compassion, combined with her dedication and drive to become an expert in the area of orthopaedic physical therapy, makes Christa an incredible advocate for the profession.

RICHARD W. BOWLING – RICHARD E. ERHARD ORTHOPAEDIC CLINICAL PRACTICE AWARD

This award is given to acknowledge an individual who has made an outstanding and lasting contribution to the clinical practice of orthopaedic physical therapy as exemplified by the professional careers of Richard W. Bowling and Richard E. Erhard. Individuals selected for this award must have been engaged in extensive orthopaedic physical therapy clinical practice for at least 15 years and have positively and substantially affected the shape, scope, and quality of orthopaedic physical therapy practice.

RobRoy Martin, PhD, PT, CSCS, earned his Bachelor of Science degree in Physical Therapy at S.U.N.Y. Health Science Center in Syracuse in 1991. He was awarded a doctoral degree from the School of Health and Rehabilitation Sciences at the University of Pittsburgh in June 2003.

Currently, Dr. Martin is a Professor in the Department of Physical Therapy at Duquesne University in Pittsburgh, Pennsylvania. He also practices part-time as a staff physical therapist at the Centers for Rehab Services/University of Pittsburgh Medical Center's Center for Sports Medicine. Dr. Martin's areas of interest and scholarly contributions include outcome research related to the lower extremity, specifically the hip, ankle, and foot. He has over 70 publications and 90 presentations related to his research. For many years, he has demonstrated a consistent dedication to the mentorship of clinicians and students in the area of orthopaedic physical therapy. Through his numerous publications and professional presentations, as well as years of teaching and mentoring both entry-level and PhD students, he has had a significant impact on the practice of orthopaedic physical therapy both nationally and internationally.

JAMES A GOULD EXCELLENCE IN TEACHING ORTHOPAEDIC PHYSICAL THERAPY AWARD

This award is given to recognize and support excellence in instructing orthopaedic physical therapy principles and techniques through the acknowledgement of an individual with exemplary teaching skills. The instructor nominated for this award must devote the majority of his/her professional career to student education, serving as a mentor and role model with evidence of strong student rapport. The instructor's techniques must be intellectually challenging and promote necessary knowledge and skills.

Mary Hickey is a most deserving recipient of this year's James A. Gould Excellence in Teaching Orthopaedic Physical Therapy Award. Mary has influenced countless students and faculty members since 1996 when she began teaching at Northeastern University in Boston. There is no doubt that Mary has the breadth of knowledge and clinical experience required to be an instructor. She maintains a rigorous clinical practice, reads current literature, and applies current evidence and best practice in all of her teaching. Mary also incorporates new technology and instructional methodology in order to enhance teaching and learning, as well as improve student outcomes. However, what makes her a standout in her profession is her unique ability to actively engage students in large classroom and lab settings, challenge students to use higher level thinking skills, and foster reflective practice all while maintaining a sense of humor. She pushes her students to think critically; often this is accomplished by answering their questions with another question of her own that is crafted to get students to synthesize and apply their own knowledge. Mary's ability to help students develop their clinical reasoning abilities in a fun, interesting, and non-threatening manner is truly remarkable, and speaks to what an extraordinarily gifted educator she is.

Mary is one of the most highly regarded professors in the Department of Physical Therapy, Movement and Rehabilitation Sciences at Northeastern. She has been voted by her students to be the keynote speaker at numerous graduation and pinning ceremonies, demonstrating the respect and admiration the students have for her. Mary's teaching and course evaluations are consistently excellent. Student comments are overwhelmingly positive, and full of praise for her dedication, manner, and knowledge. Many of these sentiments are summed up by the following statement by a former student on a course evaluation, "Dr. Hickey is one of the best instructors I have ever had, she treats you as a professional and leaves the responsibility up to the student. She gives candid answers about real world applications, and shows great enthusiasm for whatever she does." Mary is also praised by her students for her nurturing and caring manner, and acts as a mentor and confidant to many of her students. She has an open door policy, and will never turn away a student in need. On behalf of all of her current and former students and colleagues, we are very pleased and honored to present the 2015 James A. Gould Excellence in Teaching Orthopaedic Physical Therapy Award to Mary Hickey.

ROSE EXCELLENCE IN RESEARCH AWARD

The purpose of this award is to recognize and reward a physical therapist who has made a significant contribution to the literature dealing with the science, theory, or practice of orthopaedic physical therapy. The submitted article must be a report of research but may deal with basic science, applied science, or clinical research.

Dr. Dan Rhon is currently the Director of Physical Therapy at the Center for the Intrepid (CFI) for the Department of Defense (DoD). The 3-fold mission of the CFI is to (1) provide rehabilitation for OIF/OEF casualties who have sustained amputation, burns, or functional limb loss; (2) to provide education to DoD and Department of Veteran's Affairs professionals on cutting edge rehabilitation modalities; and (3) to promote research in the fields of orthopaedics, prosthetics, and physical/occupational rehabilitation. He holds a position as Adjunct Professor in the Baylor University's entry-level doctorate in physical therapy program and their doctor of science fellowship program in orthopaedic manual physical therapy. He is also a faculty member of the Military Musculoskeletal Residency program. In addition to teaching activities, he is an active researcher leading several funded lines of research that include musculoskeletal injury prediction and prevention approaches

in the military and improving the current pathways in place for managing patients with musculoskeletal pathology from point of entry to final care.

Dan received his Masters degree in Physical Therapy from U.S. Army-Baylor University in 2003. His first assignment was at William Beaumont Army Medical Center, in Fort Bliss, TX, where he completed a transitional DPT from Temple University. He also deployed from here to Iraq for a year in support of the 4th Infantry Division (Mechanized) as the physical therapist for the 4th Brigade Combat Team. Following this, he returned to the U.S. Army-Baylor program for a Doctor of Science in Orthopaedics and a fellowship program in orthopaedic manual physical therapy. He then went on to Madigan Army Medical Center at Fort Lewis where he took the role of Research Director for the Department of Physical Medicine and Rehabilitation, which was the perfect blend of clinic time and research. He was awarded the Army Medical Specialist Corps Award of Excellence in Physical Therapy (awarded to only one physical therapist each year, for the biggest impact on Army PT) in 2004, and he was awarded the Army New Horizons Research Award (awarded to one emerging clinician-researcher each year) in 2011. Dan is an active member of the American Physical Therapy Association and the American Academy of Orthopaedic Manual Physical Therapists.

PARIS DISTINGUISHED SERVICE AWARD

The Paris Distinguished Service Award is the highest honor awarded by the Orthopaedic Section and is given to acknowledge and honor an Orthopaedic Section member whose contributions to the Section are of exceptional and enduring value. The recipient of this award is provided an opportunity to share his or her achievements and ideas with the membership through a lecture presented at APTA Combined Sections Meeting.

The Orthopaedic Section's Paris Distinguished Service Award for 2015 is being presented to James J. Irrgang, PT, PhD, FAPTA, ATC. Jay has demonstrated exceptional prominent leadership in advancing the interests and objectives of the Orthopaedic Section for over 15 years. Six of those years, he served as its President.

Across his years of service, Dr. Irrgang obtained professional recognition and respect for the Section's achievements on many levels. He has been recognized by 6

awards for research both within and outside the physical therapy profession, including the Orthopaedic Section's Rose Award for excellence in orthopaedic physical therapy research. In 2009, he was recognized as a Catherine Worthingham Fellow of APTA. As an additional sample of his recognition of service and leadership, Dr. Irrgang has served as Chair of the American Orthopaedic Society for Sports Medicine's Outcome Measures Consensus Task Force, President of American Society of Shoulder and Elbow Therapists, and is a past Director of the *Journal of Orthopaedic and Sports Physical Therapy* Board of Directors.

Jay has accomplished many major prominent visionary achievements, especially in the arenas of research and practice. Much to Jay's credit are the initial development and implementation of the Clinical Practice Guidelines, the Clinical Research Network, and the National Orthopaedic Physical Therapy Outcomes Database (NOPTOD). These 3 initiatives have all had a major impact on orthopaedic physical therapy practice and the profession of physical therapy nationally and internationally.

There are many ways Dr. Irrgang has advanced public awareness and leadership in orthopaedic physical therapist practice. One of Jay's nominators reported admiration for his relationship within the national and international community of orthopaedic surgeons. At their institution, Dr. Irrgang is the number 1 "go to" physical therapist for the orthopaedic surgery department. Other nominators genuinely confirm that Dr. Irrgang has been highly recognized as a leader and contributor to the scholarly body of knowledge for orthopaedic practice for both physical therapists and physicians. Jay has been an invited speaker to more than 212 national and international meetings and conferences, published over 167 articles in peer-reviewed journals, and has contributed as an author in 38 health care related books. This vast recognition and credibility among the orthopaedic community has improved the Orthopaedic Section's relationship with both internal and external stakeholders across practice, education, and research.

Dr. Irrgang has also served as an accomplished role model and has provided incentive for other clinicians to reach their highest potential. Jay has provided opportunities for career and professional development to likely hundreds of people over his career and particularly within the Orthopaedic Section. Jay has always welcomed the addition of young therapists on committees and in leadership roles. He has provided research, teaching, continuing education, and leadership experiences for countless members of the Orthopaedic Section and has assisted them with their growth to expert status and leadership in the physical therapy profession.

Dr. Irrgang has been a strong visionary leader who has guided the Orthopaedic Section to achieve futuristic goals in advancing the Section as "the" source for the orthopaedic physical therapist. Dr. Irrgang has served and continues to serve as a role model advocating for practitioners of orthopaedic physical therapy by fostering quality in practice and promoting professional growth. Those of us that have worked with Jay are motivated by his generous knowledge, service, and leadership both within and outside the Orthopaedic Section. In recognition of Jay's enduring history of honor, sacrifice, outstanding service, and exceptional contributions to not only the Orthopaedic Section, but the entire profession of Physical Therapy, it is most fitting that Jay Irrgang receives this prestigious Section Award.

OUTSTANDING RESEARCH POSTER AWARD

Dana Judd, PT, for her poster, Multi-Component Rehabilitation Following Total Hip Arthroplasty: A Randomized Controlled Trial

OCCUPATIONAL HEALTH

SPECIAL INTEREST GROUP

President's Message

Lorena Pettet Payne, PT, MPA, OCS

Members of the Occupational Health Special Interest Group had a busy Combined Sections Meeting in Indianapolis. Here is the summary. The group will emphasize expanding educational opportunities during various meetings this year. Also, keep watching for the popular podcasts and literature reviews in your inbox. The OHSIG Board is searching for liaisons in each chapter to help keep members up to date regarding work compensation payment and policy changes in each state. The Board is also interested in getting the word out to members regarding related organizations, conferences, and trade shows. If you are involved in a group and feel it would benefit your colleagues or provide opportunities for speaking, let us know. The outline of specialty services including work hardening, work conditioning, functional capacity evaluation, etc is due for review and revision. You can access these on the OHSIG web page, under guidelines. Work groups will be convened for each topic area. If you want to be involved or have information related to any of these initiatives, contact any Board member. Detail can found on the OHSIG page under special interest groups on the Orthopaedic Section web site. Additionally, please feel free to contact Lorena P. Payne at lpettet@aol.com.

Physical Therapy Care for Modified Work Duty vs Off Duty Workers Who Have Back Injuries

Jean Weaver, PT, MBA
Associate Chair, Traditional DPT Program & Assistant Professor, The University of Findlay
Ronald Lasley, DPT
Christopher Seybert, DPT
Vineet Kaul, DPT
Douglas Mitchell, DPT

INTRODUCTION

Sprain and strain injuries (most often involving the back) have constituted 40% of work-related injuries and illnesses in the United States from 2005-2010 and were the leading cause of days away from work.[1-4] Workers' compensation has annually paid $11 billion in the United States to treat back injuries and employers have lost $7.4 billion annually in productive time.[5] Evidence has revealed once a worker was injured and off work, the longer they stayed off work, the less likely they returned to work (RTW).[6]

Physical therapy (PT) has played a crucial role in helping patients regain their preinjury functional level in an effort to get them back to work. What has not been known, however, was how PT aided in a person's RTW when it was coupled with an employer's RTW program. The purpose of this study was to compare the full duty RTW outcomes of workers placed in modified work duty versus those off work. Both groups of workers received PT following a back sprain or strain. The full duty RTW outcomes included the number of days off work, days of modified duty, days from injury to full duty RTW, the number of PT visits, and reported low back pain disability with full duty RTW using the Oswestry Disability Index.[7] We hypothesized workers placed on modified work duty while receiving PT intervention would have faster full duty RTW with fewer PT treatments and less perceived disability than those individuals who were off work during their PT intervention.

METHODOLOGY

The subjects recruited for the study were consenting workers with low back sprains and strains referred to PT at an occupational health outpatient clinic in Kentucky from 7/1/12 thru 12/31/12. Exclusion criteria included any past history of surgery or pre-existing condition to the specific area of treatment and any radicular symptoms stemming from the cervical or lumbar regions. The University of Findlay Internal Review Board approved the study.

There were two groups of subjects. Group one included subjects placed on modified work duty as determined by their physician while participating in PT. Group two included subjects who received PT while placed off of work by their physician.

Subjects in either group did not return to full duty work until cleared by their physician. The treating PT had subjects complete the Oswestry Low Back Disability Questionnaire[7] at the time of their initial evaluation and recorded all demographic information in the subject's clinic medical record. The physical therapist also recorded the date of the subject's injury, the date the individual was placed off work or on modified duty, the date PT was initiated and concluded, and the date the individual returned to full duty work. Researchers performed subject medical record audits and phone calls post PT discharge to capture full duty RTW outcomes and Oswestry scores.[7] All data descriptives and differences were analyzed with SPSS Statistical Software using t-tests for scaled variables and nonparametric tests for nominal or ordinal variables. The level of significance was established at .05, power was .80, and confidence interval was 95%.

RESULTS

There were 42 subjects who met the inclusion criteria with 23 subjects placed in group one by physician assignment and 16 subjects placed in group two. Three subjects were excluded from the study due to not returning to PT. There was no difference in mean age between groups ($t(37) = -.200$, $p = .842$). The mean age of group one was 36.7 years (s.d. = 12.5) and group two was 37.5 years (s.d. = 12.1). There was also no difference in evaluation Oswestry disability percentages between groups (Group 1 = 35.13%, Group 2 = 35.22%, $p = .954$). Following discharge and full duty RTW, group 2 had a 17% improvement in reported disability compared to only 12% in group one. There was no significant difference between groups in any RTW outcome measure except days off work ($t(37) = -5.68$, $p = .000$) and modified work duty ($t37) = -5$, $p = .000$). Refer to Figure 1.

DISCUSSION

This study supported previous studies where workers with low back sprains and strains had a faster full duty RTW when working in modified work duty while recovering versus being off work.[6] In contrast, this study revealed the worker who performs modified work duty may have greater reported or perceived low back pain disability than workers who are able to be off work during recovery. Our hypothesis was partially supported. Limitations to this study included self-report on the disability questionnaire, a small convenience sample, and no randomization of the groups.

CONCLUSION

Physical therapists will need further clarification of best practice in RTW strategies to minimize long-term low back pain disability so those workers are able to continue being productive.

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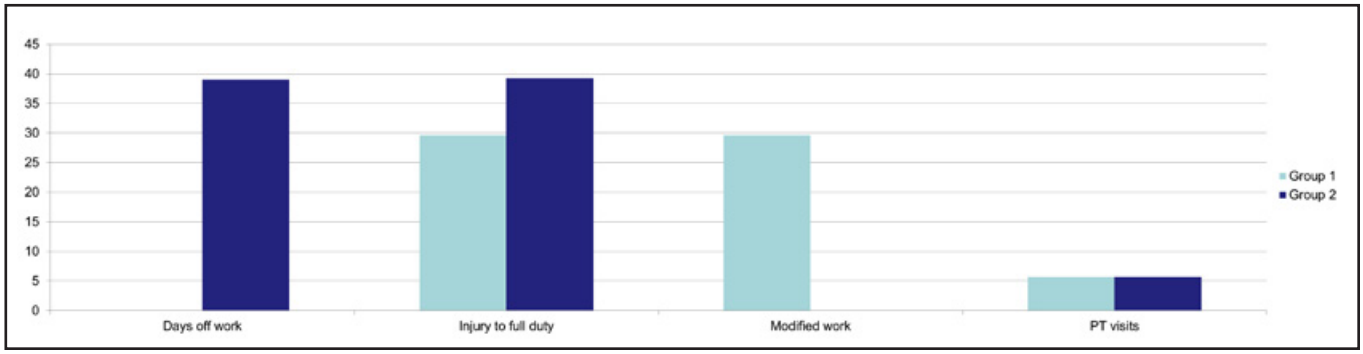

Figure 1. Time until full duty return to work in days.

PERFORMING ARTS

SPECIAL INTEREST GROUP

President's Letter

Annette Karim, PT, DPT, OCS, FAAOMPT

2014-2015 has been a great year for review and planning. The Performing Arts SIG has several new projects, thanks to the creative collaboration of our members and leaders. Every 3 years the Orthopaedic Section leadership gathers for a strategic planning meeting, to review the mission, vision, and goals of the Section. I was glad to be a part of this group of hard-working, passionate leaders and delighted to see how the well the PASIG participates as an integral part of the Section. I would like to share the Orthopaedic Section mission and vision, and how our SIG is disseminating the goals though our projects, then report on our Business Meeting, and introduce our student writer.

Orthopaedic Section Mission Statement:

The Orthopaedic Section promotes excellence in orthopaedic physical therapy.

Orthopaedic Section Vision Statement:

The Orthopaedic Section will be a world leader in advancing orthopaedic physical therapy to optimize movement and health.

Performing Arts SIG Mission Statement:

The mission of the Performing Arts Special Interest Group (PASIG) is to be the leading resource for physical therapy as it relates to the performing arts. The special interest group serves its members and represents the interests of orthopaedic physical therapy by fostering high quality patient care and promoting professional growth through:

1. advancement of education and clinical practice,
2. facilitation of quality research,
3. professional development of its members, and
4. encouragement of an interaction between physical therapy and performing arts communities.

Performing Arts SIG Vision Statement:

The Performing Arts Special Interest Group (PASIG) is a leading authority in performing arts physical therapy. The PASIG leads through professional development and dissemination of current information/trends, current practice, research initiatives, and outreach programs with performing artists and performing arts groups.

The Orthopaedic Section APTA, Inc 2015-2019 Strategic Plan has goals with several objectives in the areas of *Standards of Practice, Education/Professional Development, Public Awareness, Research, Advocacy, and Member Engagement*. A detailed description will be posted soon on the Orthopaedic Section's website. The PASIG is working toward meeting the objectives under these goals: *Standards of Practice.* We have a Practice Chair who is investigating current evidence to support best practices in performing arts physical therapy, and will promote the use of the ICF-based Clinical Practice Guidelines. We are learning from the Section how to provide web-based educational material. *Education/Professional Development:* We are updating our Independent Study Courses (ISCs). We are revalidating our 2004 Description of Specialized Clinical Practice to a Description of Advanced Specialized Practice, working with the American Board of Physical Therapy Residency and Fellowship Education, to promote the development of performing arts fellowships. We provide educational programming at CSM. We plan on providing preconference and conference programming at CSM 2016, and are considering PASIG courses at the 2016 Annual Orthopaedic Section Meeting. *Public Awareness:* We have a new flyer, a Facebook page, a Twitter handle, and are developing new media sites. We plan on having a booth at IADMS and PAMA. *Research:* We have supported student research presentations with offering an annual scholarship at CSM. We have been approved by the Section to offer a $15,000 research grant. We requested this, but have the grant on hold until we increase our encumbered funds through preconference courses and ISCs. We have a monthly citation blast that any member can contribute to, which includes the most current evidence on performing arts topics. *Advocacy:* Performing artists are often an underserved community, with limited access to performing arts orthopaedic physical therapy services. This is an area our SIG needs to address. *Member Engagement:* We have appointed, elected, and recruited our SIG members for governance and to work on Section and SIG initiatives. Our website has a membership profile update, affiliation sites, and bulletin board. We have a quarterly newsletter in *Orthopaedic Physical Therapy Practice*. We have an annual business meeting at CSM to further develop communication and member involvement.

Business Meeting Report:

1. Our leadership contact information is listed as follows:

Annette Karim, President 2014-2017
neoluvsonlyme@aol.com
Mark Sleeper, Vice President/Education Chair 2013-2016
markslee@buffalo.edu
Elizabeth Chesarek, Nominating Committee Chair..2013-2016
echesarek@gmail.com
Janice Ying, Nominating Committee.....2014-2017
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Brooke Winder, Research Chair.....2014-2016
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Sbw28@drexel.edu
Dawn Muci, Public Relations Chair 2014-2016
Dawnd76@hotmail.com
Mariah Nierman, Fellowship Task Force Chair.....2014-2016
Mariah.Nierman@osumc.edu
Reginald Cociffi-Pointdujour, Practice Chair.....2014-2016
Regi7@live.com
Anna Saunders, Secretary/Student Scholarship Chair...2015-2017

annarosemary@gmail.com
Andrea N. Lasner, Nominating Committee.....2015-2018
alasner1@jhmi.edu

2. *Recognition:* We recognized and thanked Tom McPoil, our outgoing Orthopaedic Section liaison, Rosalinda Canizares, our outgoing Nominating Committee Chair, and Amy Humphrey, our Student Scholarship Chair, for their service to the PASIG. Thank you!!
3. *Our Funds:* $15,867 are encumbered, rolling one year to the next. $2,500 annual PASIG stipend from the Orthopaedic Section is non-rolling.
4. *Research:* We need help with citation blasts. Contact Brooke Winder.
5. *Call for Authors:* Interested in writing for the PASIG newsletter of the *Orthopaedic Physical Therapy Practice magazine*. Contact Annette Karim.
6. *Education:* We will be submitting proposals for PASIG preconference and conference programming. We invite you to submit and earmark for the PASIG, as well as contact Mark Sleeper, for upcoming CSM and Annual Meeting conferences.
7. *Public Relations:* We have a closed Facebook page. Our Twitter is PT4Performers. Contact Dawn Muci.
8. *Nominating Committee:* We will have several elected and appointed positions available in 2016: Membership Committee, Dance Screening Chair, Research Chair, social media, Fellowship Task Force Chair. The process is: submit your interest and CV. It is a 2-year term for an appointed committee and a 3- year term for an elected committee. Contact Elizabeth Chesarek or any of our Nominating Committee members if you are interested in serving in leadership or on any of the committees.
9. *Dancer Screening:* We would like to provide our members with a pre-professional dancer screen, and promote validity and reliability research of the screen. Contact Sarah Wenger. We recognize and promote the Dance USA screen for professional dancers, encouraging members who work with professional dance companies to contact the Dance USA Taskforce for more information.
10. *Membership:* Please go to the PASIG website. Search for yourself as a member. Update your information and profile, interests, as well as if you have residencies available or if you are looking for a fellowship or residency.
11. *Residencies and Fellowships:* Clinical residency Clinical Specialization should be done prior to entering a Performing Arts Fellowship. If you are interested in establishing a pilot site for a Performing Arts Fellowship, such as a Dance Medicine Fellowship or Music Medicine Fellowship, or helping with the DASP, contact Mariah Nierman, our Fellowship Task Force Chair. Mariah is also the Practice Analysis Coordinator for our DASP revalidation.
12. *Student Scholarship:* This year we had 6 entries, and the scholarship recipient was C. McBride, A. Gill for the article, "Musculoskeletal Injuries in Professional Modern Dancers: A 12-year Prospective Cohort Study." Congratulations!
13. *Musicians Group:* Contact Anna Sunders or Janice Ying.
14. *Mentoring:* The Orthopaedic Section has a mentorship program. As members of the PASIG, this means you! If you are interested in being a mentor or receiving mentorship, contact Nata Salvatori at nata.salvatori@gmail.com
15. *Independent Study Courses:* Prior ISCs developed by the PASIG will be updated. Interested in helping? Contact Shaw Bronner: shaw.bronner@gmail.com or Julie O'Connell: joconnell@athletico.com

There is a growing interest among PASIG members, students, clinicians, and academicians all-for clinical sites that focus on performing artists, for affiliations, mentorship, residencies, and fellowships. The following commentary, written by Kathryn D. Jankford, SPT, provides an insider view of the process many of us have experienced on our journey towards performing arts specialization.

Insider View from a Dance Medicine Student Physical Therapist: My Path to the Perfect Internship

Kathryn D. Jankord, SPT
Slippery Rock University, Class of 2015

I chose to pursue physical therapy in high school after a chasse en tournant landing ended in a badly sprained ankle. I went to a well-known orthopaedic clinic in town to start the process of regaining enough motion and strength to wear my pointe shoes again. At the clinic, I was happy to find a ballet barre installed in the back wall. There I did seemingly endless exercises my physical therapist called heel raises, but I knew them to be relevés. My therapist was a bit confused as to why I insisted on doing my heel raises with a turned-out foot, but I explained, "It's what we do in ballet." From then on, I brought my pointe shoes into each therapy session. My therapist was open to my suggestions about how my therapy could incorporate my dance training. I did my heel raises in all 5 ballet positions and practiced landing a few sautés, but we did not think to add more. Movements like weight transitions, turns, and the biomechanics of landing never became part of our sessions. I knew there had to be more to rehabilitating a dancer and I was determined to find out how I could become the type of therapist to do just that.

After choosing Ohio University for my undergraduate studies, I began the task of nailing down a major…or two. I wanted, *needed*, dance to be a major part of my education. I had just graduated from a pre-professional dance company, Northeast Ohio Dance Ensemble, a program that instilled in me the value of an intelligent, articulate dancer. Our health was of the utmost importance to company directors, Brenda and Christopher Stygar. I gained a respect for injury prevention and developed an understanding of the importance of proper technique. I wanted to continue to learn and grow in my technique and understanding of dance, especially modern dance. I had auditioned for and been accepted into the OU School of Dance, where I decided to pursue the full dance major, knowing I would take classes in subjects like anatomy and dance kinesiology. Now I needed to decide what would complement my dance education and meet the entrance requirements for graduate schools. Not knowing enough about sports to feel confident in pursuing an athletic training degree, I decided an exercise physiology major would best prepare me for my dream job as an orthopaedic physical therapist.

The next major step I took towards my career goals was in my pursuit of volunteer hours for graduate school applications. I wanted to make sure my hours related to my dance interests. Before I knew about the Performance Arts SIG or the International Association of Dance Medicine and Science, I had to do some creative research to find clinics that specialized in treating professional dancers. I started by scouring major dance companies web sites for any acknowledgement of physical therapy services. What better place to start than NYC? I reviewed the web sites for the School of American Ballet and NYC Ballet looking through staff listings. My research helped me to find Westside Dance Physical Therapy in Manhattan, NY. I continued my search in the same way and while reviewing the Cincinnati Ballet's web site I came across Wellington Orthopaedic & Sports Medicine. Both clinics provided therapy to major dance companies and graciously accepted my requests to complete volunteer hours with them. I was overjoyed to begin my pursuit of performing arts physical therapy.

While at these clinics, I saw the kind of therapy I wanted to practice. The exercises prescribed to performing artists addressed specific dance movements. Dancers did their therapy at a ballet barre on a sprung floor. At Wellington Orthopaedic, I observed young dancers go through pointe shoe screenings. At Westside Dance PT, I had the opportunity to observe an evaluation of a dancer who had been acutely injured during that evening's rehearsal. The therapist used the evaluation to determine if the dancer was able to perform the following night. I had the chance to shadow physical therapists who were working with dancers post-op hip and foot surgeries, to achieve their prior level of function, in order to be able to return to their respective dance companies. While volunteering, I was introduced to the International Association of Dance Medicine and Science (IADMS) by Marika Molnar. I immediately joined, happy to find a community of professionals who shared my interest.

After completing my volunteer hours and submitting a few grad school applications, I chose Slippery Rock University in Pennsylvania as my graduate physical therapy school. I made my dance interests known to my professors and clinical coordinators within the first semester. My most important meeting happened with one of the clinical coordinators in that first semester. During that meeting, I expressed my passion for dance medicine and my desire to complete my orthopaedic rotation in a clinic that treated dancers. My request was met with enthusiasm, not only by the clinical coordinator, but also the entire staff at the school. I was encouraged to research different clinics and find practitioners I could potentially work with during my forthcoming internships. I was introduced to and strong encouraged to join the APTA the very first day of classes so that I could take advantage of all the different resources. I signed up and over the next few months I learned about the Orthopaedic Section and its Performing Arts SIG. The directories of the SIG and IADMS made my search for possible internship sites easy and convenient.

Slippery Rock University requires its physical therapy students to complete 4 clinical affiliations prior to graduation. I thought that some of those affiliations would not relate very well to my interests. When I thought about acute care and neuromuscular rehab, I struggled to make the connection to dance medicine. That was until I arrived at my internships. My first clinical brought me to South Bend, IN, where I worked with a FAAOMPT therapist. While I did not treat any dancers on that two-week affiliation, I learned a great deal about manual therapy. I had seen the therapists at Westside Dance PT and Wellington Orthopaedics use manual therapy in their treatments, and I knew it would be an important component for effective dance rehabilitation. My next rotation was in my hometown at the very same clinic that I had gone to for therapy following my ankle sprain. Because the clinic had special camera equipment to aide in the diagnosis of vertigo and therapists who were certified as neurological specialists, I took the opportunity to focus on neuromuscular rehabilitation. It became clear that proper management of concussions and benign paroxysmal positional vertigo would be important for performing artists who incorporated aerial and acrobatic stunts in their performances. My third clinical rotation was in a skilled nursing facility (SNF) and I thought for sure connections to dance medicine would be few and far between. I was wrong again. I worked with Lisa Spencer, PT, a clinician who had worked as a manual therapist for over 20 years. I was very pleased to find that along with our responsibilities to the SNF patients, Lisa also provided outpatient services to patients with chronic pain. Under her instruction for an entire semester, my manual therapy skills improved immensely. She taught me what injured tissue felt like and how one injury can negatively impact the human body's delicate biomechanical balance. After all of these amazing affiliations, I knew I was ready to find the one clinical I had been searching for and dreaming of since my first injury took me away from center stage.

I found that dream internship for my final affiliation with Neurosport Physical Therapy in Atlanta, GA. During this affiliation, I have the privilege of working under the supervision of Laura Baeumel, DPT, ATC. Laura has toured with *Bring It On The Musical* and *Westside Story* as a therapist working for Neurotour, a sister company of Neurosport. She is helping me hone my manual therapy skills and is providing me with opportunities to go backstage with Neurotour at shows like Wicked to witness first-hand the therapy provided to dancers moments before they walk on stage. While at the Neurosport clinic, we have evaluated and treated dancers from touring Broadway shows and local ballet companies. I am so fortunate to have found an internship that is exactly my ideal learning experience.

Becoming a member of organizations like APTA and IADMS helped me find the information I needed to completely validate my career goals. I joined the Orthopaedic Section of the APTA and the Performing Arts SIG. I believe the PASIG membership is the best resource in the APTA for professionals working with dancers. I found an established network of professionals who worked with dancers every day, just like I had imagined in high school. Quality research was available regarding how to rehabilitate dancers. There were training courses and conferences all with a dance medicine focus, and I was able to obtain continuing education units. My dream career as a physical therapist that works with performing artists is possible. As I look towards my graduation in May, I am eager to find that career I have dreamed of and worked for all these many years. I want to be one of those instructors future students contact when they are looking for performing arts focused internships. The dance medicine community continues to inspire me, and I look forward to returning the favor.

CSM 2015 In Review: A Look to the Future

Clarke Brown, PT, DPT, OCS, ATC
FASIG President

Almost 12,000 physical therapists and physical therapy students descended upon Indianapolis, Indiana, last February. I would be willing to bet that every single one of them left in some sort of a level of fatigue. Between poster presentations, outstanding programming, preconference courses, caucus meetings, alumni gatherings, a busy exhibit hall, and presentations from all of the 18 special interest sections of the APTA, there was not a dull moment. For the foot and ankle special interest group (FASIG), CSM is a time to gather together our membership (about 700 strong), to meet with the Orthopaedic Section Board, and meet with the other special interest groups. Since the FASIG is responsible for providing programming, we are also proud to annually present nationally known speakers who are also often members of the FASIG.

Programming at CSM

This past year, FASIG provided an overview of the recently published heel pain clinical practice guidelines in a presentation including RobRoy Martin, JW Matheson, Christine McDonough, and Todd Davenport. This presentation brought the foot to life in practical and clinical ways, particularly through the comparison of the original heel pain clinical practice guidelines from 2008 to the more recent version in 2014. In certain categories of foot and ankle research, our knowledge base is increasing rapidly and our confidence in using certain interventions, in favor of others, continues to improve. We urge all physical therapists to review and use the heel pain clinical practice guidelines.

Annual Business Meeting

Each CSM allows the FASIG the opportunity to conduct a Business Meeting. We really do not discuss business at all; rather, this meeting is a gathering of all available FASIG members and FASIG leadership. Our current officers include myself as President, Todd Davenport as Vice President and Program Chair, Chris Neville as our Research Chair, and our three-person Nominating Committee includes Judy Gelber, Steve Pettineo, and Ruth Chimenti.

As most of you may know, our primary FASIG directive over the past few years has been the development and creation of "foot and ankle curriculum guidelines for entry-level physical therapists." This impressive document is a curriculum-based treatise on the evaluation and treatment of foot and ankle conditions. The purpose of such a guideline is simply a curricular aid to physical therapy orthopaedic instructors. The FASIG membership has long felt that it would be helpful to provide orthopaedic instructors a product that establishes a referenced and minimal level of content related to foot and ankle instruction. The Orthopaedic Section supports the evidence-based approach by the FASIG to provide information to entry-level programs, to aid in the development of skilled foot and ankle clinicians and researchers. To date, the document is reaching the final stages of preparation and will be disseminated to all entry-level physical therapy programs nationally. This document, as well as the entire project, was funded and completed by the FASIG membership.

The Business Meeting was highlighted by bringing forth of a motion to provide a $15,000 grant toward foot and ankle research. This grant should be available to interested Orthopaedic Section researchers. Funds used for this grant were generated by income from CSM preconference programming and ISC sales.

A Look Ahead

The annual Business Meeting also included healthy discussion from the floor about the roles and directives for the FASIG in the years to come. These topics included:

- Patient Handouts (prepared, printed, professional)
- Certification in Foot/Ankle Therapy
- Fellowship/Residency Opportunities
- Advanced Practice Standards
- Intra-member Communication via Social Media

In an effort to brand and market the FASIG, and, thereby, bring interested foot and ankle physical therapists to the SIG and Section, the FASIG membership also overwhelmingly agreed to work more closely with the other SIGs within the Orthopaedic Section to:

- generate marketing strategies/materials,
- optimize CSM programming variety and timeliness, and
- improve the service and practicality of SIG webpages.

If you are reading this…

Orthopaedic Physical Therapy Practice, and this FASIG newsletter in particular, is an outstanding place to present your Clinical Pearl, your research idea, or viewpoint/strategy regarding the treatment of foot and ankle conditions. Do you have some preliminary research that could be presented here for a greater perspective? Do you know of a particularly interesting or innovative research article that could be discussed in this column? Please do not hesitate to contact me by email at brownstonept@gmail.com if you have any questions or ideas related to foot and ankle research or clinical strategy.

IMAGING

SPECIAL INTEREST GROUP

BUSINESS MEETING CSM 2015

Minutes

ISIG Leadership

Douglas M. White, DPT, OCS - President
Deydre Teyhen, PT, PhD, OCS – VP
Nominating Committee
James "Jim" Elliot, PhD, PT
Richard Souza, PT, PhD, ATC, CSCS Incoming Chair
Marcie Harris-Hayes, PT, DPT, MSCI, OCS
Research Committee
George Beneck, PhD, PT, OCS, KEMG Chair
Publications
Editor vacant
Gerard Brennan, PT, PhD - Orthopaedic Section Board Liaison

Nominating Committee Report

Success in recruiting for open positions of Vice President and Nominating Committee
- Incoming Vice President James "Jim" Elliot, PhD, PT
- Incoming Nominating Committee Member, Nancy Talbott, PhD, MS, PT

Positions open for 2015 election
- President
- Nominating Committee one to be elected

Outgoing Leadership
- Deydre Teyhen, PT, PhD, OCS, Vice President
- James "Jim" Elliot, PhD, PT, Nominating Committee Chair
- John C. Gray, DPT, FAAOMPT, Publications Editor

Imaging SIG 2014 Activities

ISIG Education Activities
- Programing for CSM
- "Imaging and Low Back Pain: What's Useful, What's Not?" presented by George J Beneck, PhD, PT, OCS, KEMG

American Institute of Ultrasound in Medicine (AIUM)
- ISIG participated in development of AIUM Practice Guideline for the Performance of Selected Ultrasound-Guided Procedures available at www.AIUM.org
- Will also be published in the *Journal of Ultrasound in Medicine*
- Implications for PT practice particularly for dry needling.

Research Committee
- George J Beneck, PhD, PT, OCS, KEMG, Chair
- Daryl Lawson, PT, MPT, DSc
- Murray E. Maitland, PhD, PT
- Robert C. Manske, PT, DPT, SCS, MEd, ATC, CSCS
- Chuck Thigpen, PhD, PT, ATC
- Teonette Velasco, PT, DPT, OCS

Survey of Imaging Curriculum in PT Education Programs
- Boissonnault WG, White DM, Carney S, Malin B, Smith W. *Diagnostic and Procedural Imaging Curricula in Physical Therapist Professional Degree Programs. J Orthop Sports Phys Ther*. 2014;44(8):579-B12.

Publications
- John C. Gray, DPT, FAAOMPT, Editor
- *Orthopaedic Physical Therapy Practice*
  - Published Imaging Pearl in each issue of *OPTP*
- Soliciting Submissions for Imaging Pearl
- Soliciting Editor for ISIG

New Business

2015 Activities

Research Committee
- Develop research committee agenda

Imaging Education Manual Steering Committee
- Douglas White, DPT, OCS, RMSK, Chair
- Bill Boisonnault, PT, DHSc, DPT, FAAOMPT, FAPTA
- Bob Boyles, PT, DSc
- Chuck Hazel, PT, PhD
- Aimee Klein, PT, DPT, DSc, OCS
- Becky Rodda, PT, DPT, OCS
- Rich Souza, PT, PhD
- Deydre Teyhen, PT, PhD, OCS

Open Forum on Draft of Imaging Education Manual
- Feedback from select reviewers has been positive
- Final revisions will occur this winter and anticipated publication in Spring 2015.

Diagnosis of a Posterior Cruciate Ligament Disruption after a Motorcycle Accident

Capt Aaron M. Butler, DPT[1]
Lt Col Brian A. Young, PT, DSc, OCS, FAAOMPT[2]
Dr James D. Dauber, PT, DPT, DSc, OCS, SCS[3]

[1]*Wilford Hall Ambulatory Surgical Center, Lackland AFB, TX*
[2]*US Army-Baylor University Doctoral Program in Physical Therapy, Ft Sam Houston, TX*
[3]*School of Physical Therapy, Marshall University*

The views expressed in this manuscript are those of the author(s) and do not reflect the official policy or position of the Department of the Air Force, Department of the Defense, or the US Government.

The patient was a 26-year-old male who was referred to a physical therapist (PT) by a primary care physician's assistant for a chief complaint of left foot pain. The patient was involved in a motorcycle accident approximately 6 days prior to being seen by the PT. During the accident, he was thrown from his motorcycle, striking his left knee, hip, and wrist on the pavement. Plain radiographs were taken of each of these regions prior to the initial physical therapy evaluation, and were all negative for fractures.

Although the patient was referred for left foot pain, he also complained of left knee and hip pain at the initial evaluation (Figure 1). The patient presented wearing an ACE bandage over left knee that he applied himself to cover a non-healed abrasion over the patella, and was able to ambulate to clinic unassisted with antalgic gait. Physical exam displayed moderate effusion to the left knee and limited range of motion (ROM). Left knee active and passive extension were full, but flexion was limited to 45° actively, and 50° passively. Stability testing of the left knee was negative with the exception of a positive sag sign and posterior drawer test. Both of these tests are indicative of a posterior cruciate ligament (PCL) rupture.[1] The patient was also tender to palpation over left anterior superior iliac spine with normal motion and full strength of hip. There were no grossly abnormal findings with examination of the left foot. All other special tests to hip and foot were deferred as attention priority was focused to the patient's knee.

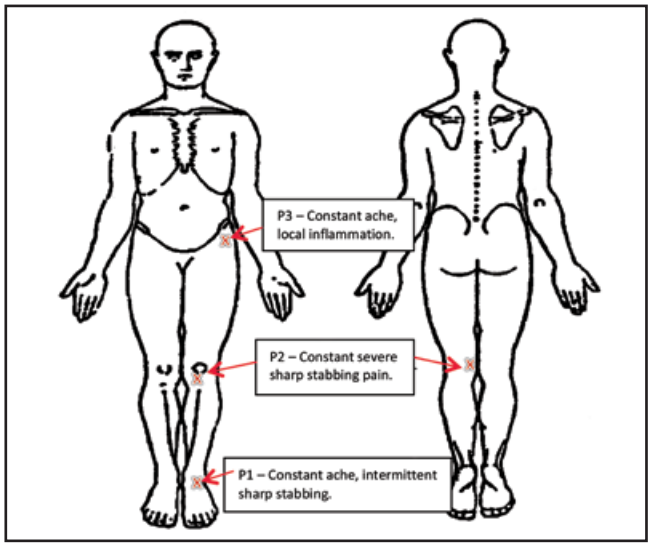


Figure 1. Body chart.

Based on clinical examination and patient safety, the patient was fitted for and educated in painfree partial weight bearing ambulation with crutches, and was given self-assisted passive ROM exercises as a home exercise program to restore ROM to left knee. Due to the clinical suspicion of a PCL derangement, the therapist ordered a non-contrast MRI of the left knee per the American College of Radiology Guidelines, Variant 3.[2] To ensure clear communication to the radiologist, the MRI request from the PT stated, "26 year-old male involved in motorcycle accident 6 days prior. Struck anterior L knee on pavement. Seen same day in ER. X-ray report negative. Exam consistent with PCL rupture (positive post drawer and sag). Please do MRI to confirm. Thanks." The knee MRI, taken 8 days later, revealed left PCL disruption. The PT subsequently referred the patient to Orthopedic Surgery for consultation (Figures 2 and 3).

Further physical therapy was deferred pending examination by an orthopaedic surgeon. In consultation with the orthopaedic surgeon, the patient decided to not undergo reconstructive surgery of the PCL. The patient was referred back to physical therapy, which was accomplished at a different facility.

Physical therapists commonly evaluate patients after trauma, and need to clear areas above and below the region of complaint or referral for full assessment. The use of a body chart, medical screening, and detailed history assist in this process. In this patient, if attention was focused completely on the primary complaint of left foot pain, delayed identification of the PCL rupture may have caused further complications with continued use of the extremity and lack of activity restrictions. The ability of the PT to order guideline-based advanced diagnostic imaging, concurrently initiate treatment based on the clinical hypothesis, and subsequently complete the referral to the orthopaedic surgeon saved valuable time, provider visits and costs in the definitive management of this patient.

REFERENCES

1. Rubinstein RA, Shelbourne KD, McCarroll JR, VanMeter CD, Rettig AC. The accuracy of the clinical examination in the setting of posterior cruciate ligament injuries. *Am J Sports Med*. 1994;22(4):550–557.
2. American College of Radiology, ACR Appropriateness Guidelines for Acute Trauma to the Knee https://acsearch.acr.org/docs/69419/Narrative/. Accessed October 28, 2014.

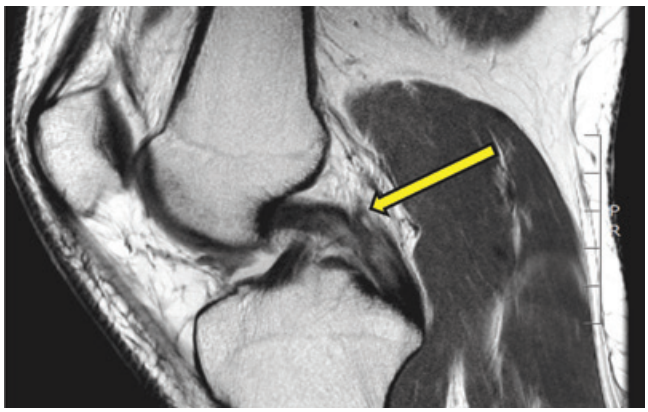


Figure 2. Sagittal T1-weighted fat-saturated magnetic resonance image of the left knee demonstrating a posterior cruciate ligament tear. (Arrow) Irregular outline to mid-superior border.

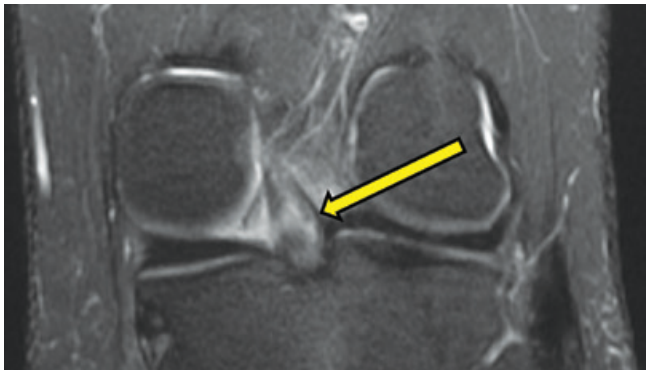


Figure 3. Coronal T2-weighted magnetic resonance image of the left knee demonstrating inflammatory process (increased edema) to posterior cruciate ligament. (Arrow)

ANIMAL REHABILITATION

SPECIAL INTEREST GROUP

President's Message

Kirk Peck, PT, PhD, CSCS, CCRT

CSM Indianapolis:

It gives me great pleasure to announce that animal rehabilitation as a niche practice in physical therapy hit a new mark at CSM this year. Lisa Bedenbaugh, PT, CCRP, presented to a packed house on the topic of, *"Designing an Effective Therapeutic Exercise Program for Canine Clients."* An additional 25 minutes was spent in Q&A following the presentation that generated a multitude of excellent inquiries regarding the practice of animal rehab. Topics of discussion included legalities of practice, liability coverage, access to clients, and the relationship between physical therapists and veterinarians.

During CSM, the SIG held its annual Business Meeting prior to the two-hour programming. Unfortunately, the majority of those who attended Lisa's programming stood outside the conference room as they were apparently unaware that the Business Meeting is open to all CSM participants interested in SIG activities. I hope to get this issue clarified in the description used for SIG Business Meetings for CSM 2016. It is vitally important that SIG members and those interested in participating in the SIG be present during the Business Meeting in order to generate valuable discussion and move the SIG forward on many initiatives.

Legitimizing the Practice of Animal Rehabilitation:

Have you ever asked yourself how the practice of human physical therapy became more formally recognized by society, higher education, and governmental agencies? Rest assured it did not occur overnight. In reality, it took several years following the service of Reconstruction Aides during World War I for the profession of physical therapy to finally emerge as a viable health care entity on American soil.

The professional organization, known initially as the "*American Women's Physical Therapeutic Association,*" was initially formed in 1921. Many years of political struggles and restructuring of the association ensued due in part to many dedicated individuals who truly believed that physical therapists offered something unique by way of rehabilitation. Today, physical therapy has evolved to a doctoring profession that shares varying levels of direct access to patient care in all 50 states. Pretty remarkable when you consider that the first educational programs to prepare "Re-Aides" were only 3 months in duration. So what does this have to do with animal rehabilitation? The answer is simple—a lot.

Legitimizing the practice of animal rehab by licensed physical therapists can hopefully be accomplished in fewer years than it took for human care, but nonetheless, there is much work to be done. During CSM, the ARSIG officers communicated with representatives from APTA Government Affairs and Orthopaedic Section Board members about the current status of animal rehab in PT practice. The outcome of those conversations led to a robust action plan that will involve ALL SIG members in addition to as many non-SIG members who also treat animals as part of practice. Below is an outline of action steps that need to occur over the next several months:

1. **Conduct a comprehensive "Practice Analysis" of Animal Rehab** – will entail the development of a member survey to collect data on animal practice, in addition to a review of other documents related to PT practice on animals.
2. **Create a "White Paper" on Animal Rehab** – will help educate professional, public, and political entities about the history, safety, liability, educational training, practice description, legislative authority, and relationship of PTs with the veterinary profession.
3. **Develop "Model Legislative Language"** – will establish recommended language for APTA Chapter Components and state regulatory entities to use in drafting language for the practice of physical therapy on animals.

The process of justifying and validating practice will require a great deal of time and effort among volunteers, but most importantly, a collective input from all SIG members. In preparation for this lofty endeavor, a task force will be developed by the SIG officers to specifically focus on achieving the items just noted.

Legislative Front:

In this edition of *OPTP,* I am going to focus on one very important concern regarding PTs who practice on animals. On more than one occasion, I have received a direct inquiry from a PT (almost always a non-ARSIG member) asking about liability insurance for animal practice. The PT, unfortunately, often resides in a state where either no explicit legal language exists for PTs to practice on animals or even worse, the PT Practice Act specifically uses the word "humans" in relation to whom PTs are allowed to deliver care. There are two problems with this scenario.

First, the PT in question is technically practicing "at risk" when treating animals. If their practice was called into question, it would be left in the hands of regulatory agencies and potentially legal counsel to decide if they were practicing within the scope of law. Second, if a PT encountered a situation where professional liability was needed to cover an injury related to animal care, the incident would not be covered by the insurer if the PT was practicing outside their scope of practice.

The two scenarios previously described emphasize exactly why I have been so adamant about therapists striving to acquire legal language in all 50 states to explicitly allow for animal practice. It only takes one incident of legal interpretation of language to set a national precedence for PTs in all 50 states. Point being, if a state does not have explicit language or if the language is highly open to interpretation, then PTs are practicing "at risk" when treating animals.

ARSIG Logo:

A *draft* logo for potential use by the ARSIG has been presented to SIG officers for review. The logo was shared at CSM

during the Business Meeting, but will not be shared to all SIG members until finalized. The SIG officers will continue to work on the logo with a goal of approving a final version to be shared during CSM 2016.

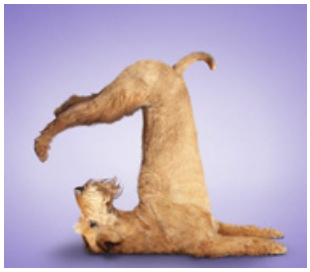
California Veterinary Medical Board:

It is hard to believe I can repeat myself on a topic so many times, but the California Veterinary Medical Board (VMB) public hearing on proposed regulatory language to mandate "direct supervision" over PTs was postponed again until at least April, if not July. The latest deadline to hold a hearing in January 2015 came and went, just like it did back in October 2014 and many times before that as well. I will emphasize one more time that the CA Vet Board position on supervision is a very concerning issue that would directly impact a lot of physical therapists practicing on animals.

Call for *OPTP* Submissions:

To promote, educate, and advance the practice of animal rehabilitation, I encourage members to submit articles related to clinical pearls, critiques of recently published articles, unique case studies, or abstracts of primary research. Please contact the President or Vice President of the ARSIG if interested in submitting an article for review.

Spring Yoga Pose!!



Contact: Kirk Peck (President ARSIG): (402) 280-5633 Office; Email: kpeck@creighton.edu

Professional Liability Insurance for Animal Rehab – Are you Covered?

Stevan Allen, MAPT, CCRT

In recent months, the ARSIG officers have received an increased number of questions concerning Professional Liability Insurance (PLI) for animal rehab. In the last edition of OPTP (VOL. 27, No. 1 2015), several common Questions Regarding PT Scope of Practice were outlined in the President's Message. A note of clarification however is in order for the response given to Question #2. The question asked, *"Does my human PT malpractice liability insurance plan cover me when treating animals?"* The answer provided was "NO," however, a more accurate response is, "It Depends." I will outline some of the nuances to this topic below.

If you are currently insured through HPSO (the APTA sponsored insurance program), animal rehab is a covered entity as long as such practice is legal in your jurisdiction. Previously in *OPTP,* I outlined some of the specifics (including the modification of the exclusion) from a year ago, which specified if you were treating animals greater than 50% of your time, the plan would not protect you. The Healthcare Providers Service Organization modified the program to eliminate that limitation in 2014. The animal rehab coverage is actually included under the category of "damage to property," as animals are considered property in all 50 states. Current limits as outlined in the basic insurance policy are set at $10,000/year, but can be increased to $25,000/year for an additional fee. These policies will cover you regardless of what type of animal you treat (eg, dogs, cats, horses, birds).

Now returning to the point of clarification for Question #2 as to whether or not HPSO insurance covers animal rehab, it truly does "depend." It depends on exactly what is legal by way of scope of PT practice law in your state of residence. The question that must be answered is, *"Are you legally allowed to treat animals based on scope of practice law?"* Point being, exactly how do your state practice laws declare the type of entities you can treat as a physical therapists; eg, individuals, clients, patients, humans, other? If the state law specifically uses the term "humans," then treating animals is clearly not intended to be part of PT scope of practice in that jurisdiction and liability insurance will not cover incidents related animal rehab.

In conclusion, a fundamental policy for animals in the APTA sponsored PLI is currently present, however, coverage does not apply in all state jurisdictions. Therefore, PTs who desire to treat animals in states where language for animal rehab does not exist are encouraged to explore options for change in scope of practice laws to legally allow for an expansion of services offered by physical therapists.

Please don't hesitate to contact me if you have any questions or concerns (Stevan.allen@gmail.com).

Common Injuries Related to the Sport of Equestrian Showjumping

Sharon Classen, PT

Showjumping is a fascinating Olympic level sport that involves an intricate relationship between both horse and rider. It requires strength, agility, and an incredible amount of sheer athletic talent (Figure 1). It is a serious athletic test for both horse and rider. Horses competing in showjumping are required to jump obstacles from 0.90 meters to upwards of 1.7 meters in elite competition at major championships. Not only are the heights a challenge, but the jumping obstacles are presented in combinations at distinct striding intervals to test the horses' ability to shorten or lengthen their stride on course. The stress on horse and rider is increased in classes against the clock, with tight turns placing additional strain on the musculoskeletal system. When performed correctly, it is a beauty of grace mixed with explosive power. There is a rare trust and symbiotic relationship that forms between the Equestrian and Equine athlete not found in any other sport.

Like any sport, there are specific injuries uniquely germane to professional show jumpers, and if not properly addressed, can be career ending. However, with proper fitness and specific exercises targeted toward strengthening core muscles of the equine

athlete, many injuries can be prevented. Some of the most common injuries seen with the equine athlete include back pathology, superficial and deep digital flexor tendon injuries in the forelimb, sacroiliac dysfunction, hock injuries, and desmitis.

BACK PATHOLOGY

A lot of back problems in horses are related to osteoarthritis of the articular facets and repetitive stress on those areas where instability may be present. Improper tack and saddle fit, along with direct rider effects, can also cause back pain and muscle spasms. Common treatments for spinal related dysfunction includes injections, ice, acupuncture, joint mobilization (Figure 2), ultrasound, EMS, laser, myofascial release, and trigger point therapy.

SUPERFICIAL AND DEEP DIGITAL FLEXOR TENDONS

Superficial and deep digital flexor tendon injuries are either traumatic or occur over time, causing micro-overloading and weakness. Overloading, along with stress fatigue, are generally contributing factors to tendon injury. When a horse is on final approach to the fence during competition, the forelimbs are responsible for breaking the stride and providing vertical force upon take-off. This places significant strain on the lower joints of the leg. On landing from jumps, the front lower joints of the horse are hyperextended, placing a significant strain on the flexor tendons and the suspensory ligaments in the forelimbs (Figure 3). Depending on the extent of injury, the initial treatment is much like in humans and includes ice and rest, along with compression. Use of therapeutic agents to reduce pain and swelling, and stimulate the healing process may also be incorporated.

HOCK INJURIES

Injuries to the hock comprise the most common cause of hind limb lameness in jumping horses. It is usually associated with arthritis in the bottom joints of the hock. Since the hind limbs provide the majority of force during takeoff, there is a significant loading of the involved joints. Treatments include intraarticular medication with corticosteroids, corrective shoeing, and a judicious use of nonsteroidal antiinflammatory agents such as phenylbutazone. The horse should be placed on a strengthening program to increase surrounding musculature and provide dynamic support to the joints. In addition, ice, ultrasound, and laser are also common treatment options to control pain and swelling.

SACROILIAC DYSFUNCTION

The hind limbs of the horse are often compared to the engine of a car, and the horse's sacroiliac joint is analogous to the transmission. With show jumpers, the sacroiliac joints are key components in providing stability both in movements on the flat and over fences. Poor conformation, weak musculature, or mechanical limitations lend themselves to creating dysfunction in this anatomic region. Body weight of the human rider hinders lumbosacral flexion in the horse and can cause undue pain and suffering as well. A physical therapist must perform a complete spinal evaluation along with assessment of muscle strength and symmetry while analyzing functional movements to create a comprehensive treatment plan. Modalities are generally not as effective in treating the sacroilliac areas since the joints are anatomically too deep. However, specific joint mobilization techniques and strengthening are key to successful recovery of sacroilliac joint pathology (Figure 4).

DESMITIS

Showjumpers, as seen in human athletes as well, are prone to ligamentous injuries secondary to high loading forces placed on joints and soft tissues. Showjumping places significant repeated loading forces on ligaments that occur both during competition and practice sessions. These injuries are treated similarly to those of human athletes using many of the same techniques. Rehabilitation protocols must allow for proper healing time along with slow loading of soft tissue structures to achieve full recovery.

Human use of the horse for competitive purposes is counter to a horse's evolutionary design. During a course of competitive

Figure 1. Olympic level showjumping.

Figure 2. Spinal mobilization to the lumbar region.

Figure 3. Forelimb extension.

jumps, a horse is required to canter for lengthy periods of time and perform repetitive movements that are not natural during normal conditions. Such lengthy periods of high volume work, and the act of clearing jump after jump in succession, all while balancing the weight of a rider on its back, places the horse at increased risk for injury.

Sports involving horses are designed to challenge both animal and rider, and horses are often pushed beyond their physical limits, leaving them vulnerable to injury and disease. What makes the sport of equestrian showjumping so unique is that you have two athletes - the Equestrian and the Equine - imparting direct mechanical effects on each other. With additional education in equine science, physical therapists offer a unique skill set and knowledge base to evaluate and combine the concept of an "athletic team" consisting of human rider and horse, enabling both athletes to reach peak performance.

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Photo images courtesy of Kelly Davis, 2015.

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Figure 4. Traction pulls for lumbosacral dysfunction.

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