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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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JOSPT
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Marquette University
P.O. Box 1881
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(414) 288-3380 (Office)
(414) 288-5987 (Fax)
guy.simoneau@marquette.edu

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Editor's Note

Education of the Therapist: Where the Rubber Meets the Road. Take the Orthopaedic Section for a Ride!

Christopher Hughes, PT, PhD, OCS

The "real" learning starts at graduation. In the field of Physical Therapy this statement rings so true. Much of what we learn for patient care hinges on building on the didactic to the practical, with the practical being partly a function of experience. What works and what doesn't work? What defines our practice? Evidence-based practice (EBP) certainly includes a healthy dose of clinical experience in the paradigm (ie, clinical experience, patient values, best research evidence). Much has been written on the research basis of practice. But clinical experience and expertise in general is a somewhat more difficult measure to package. In part, this aspect of EBP may be partly to blame for varied care by different therapists for the same patient.

The APTA recently promoted the ABIM Foundation's list of 5 things Physical Therapists and Patients should question (see www.choosingwisely.org). Although not surprising, I wonder what other treatment recommendations besides these 5 would be on the list of each INDIVIDUAL therapist. No doubt these 5 scenarios may be just the tip of the iceberg.

I am amazed at how many of my own patients have come from different clinics and share stories of how they received completely different treatment plans for the same injury. Why do we not have consistency on even the basic diagnoses? I can appreciate the individual approaches and autonomy of therapists but one of the traits that makes a profession is the consistency of service it offers by its professionals. How else can positive outcomes be aggregated to further practice? So where does one go to critique his practice?

Enter into the picture the Orthopaedic Section's ICF-based Clinical Practice Guidelines. Over the past recent years, the Section has amassed a very impressive collection of clinical guidelines that have been published in the *Journal of Orthopaedic and Sports Physical Therapy* and also are FREE online at the Section website: https://www.orthopt.org/content/c/icf_project_published_guidelines. Noteworthy is that all of our clinical practice guidelines utilized feedback from numerous reviewers, including several Section members, as they were being created.

These guidelines were created to allow clinicians the tools they need to reference and match their practice to be parallel with these guidelines. Other credible sources exist, but these guidelines are an excellent way to evaluate your practice against the review criteria purported in the guidelines.

With disparities in care, it becomes obvious that all clinicians do not prioritize and learn and apply the same knowledge. Once the minimal competency of a state board is passed, the novice clinician has the option of taking many different career paths. For some, this decision on where to work, and more importantly, how to increase clinical competence can be perplexing. Continuing education may be a mine field of hit and miss courses with regard to quality and cost effectiveness. Even if one chooses to follow into some of the more popular fellowship routes, there are no guarantees on learning effectiveness, and more importantly, that you come away with more clinical competence.

Now enter into the equation licensure renewal, a necessary but anxiety ridden process for most. Licensure renewal requirements vary state by state. Also, specifically obtaining and keeping direct access authorizations in states that allow it varies, along with requirements for a certain amount of credits for ethics and now even the more recent child abuse reporting education. Staying up to date in any profession can be a challenge. The notion of keeping current is a valid ideal, but in reality, it often ends up being a rush by clinicians to take the easiest route possible to reach the golden number of CEUs as quickly and cheaply as possible. And vendors know it. Continuing education comes from a variety of businesses and the marketers aggressively campaign for your dollars. Just recently I must have received 10 different mailers from businesses who all magically knew that my license renewal of December 31 was approaching. Needless to say, many of the courses promised the right amount of credits and an array of easy to obtain courses for prices as low as $45.00 a course. Notably absent however, seems to be a review or critique of speaker requirements and also expertise always seemed to be not so readily available. It is important to note that having a course that has been granted CEUs in no way assures a high standard, but just a standard. The famous line of "CEUs pending" is also no guarantee of anything other than a promise. It is not a certainty, so don't depend on those credits being there during an audit!

Enter into the mix the Orthopaedic Section's Independent Study Courses (ISCs). As you may know, the Orthopaedic Section offers an impressive selection of continuing education materials by way of its independent study course series (https://www.orthopt.org/content/education/available_independent_study_courses).

The courses currently are bundled in 3 and 6 monograph sets and cover a wide variety of topics. Authors are determined based on their level of expertise, and subject matter experts assist the editors in making sure content is of high value. An online post-assessment quiz accompanies each set for learning and credit. Passing the online quiz immediately generates a certificate of completion for your records. Our recent survey data indicates that those who take our courses return for more. The Section recruits authors based on background and experience, and all ISCs offered have been approved by the Orthopaedic Section Board of Directors. In addition, we recently convened an invited panel of leading professionals who serve to guide the Section in topic selection and author recruitment. Additionally, the internal review process goes through numerous reviews by the editor, associate editor, and managing editor and if needed, a subject review expert. The final product yields what we believe are very high quality courses at a fair price and redeemable for a respectable number of CEUs. And of course, as a member you are entitled to a discount. The Section prides itself in offering these products that make up its library of intellectual property.

So when it comes to continuing your education, consider the resources your membership has afforded you. In addition to *Orthopaedic Physical Therapy Practice* and the *Journal of Orthopaedic and Sports Physical Therapy*, you may be surprised that your continuing education needs may be satisfied through the Section's offerings at a very affordable price. Stay tuned for more to come!

A Practical Guide to Integrating Behavioral and Psychologically Informed Approaches into Physical Therapist Management of Patients with Chronic Pain

Leslie Russek, PT, DPT, PhD, OCS[1]
Carolyn McManus, PT, MS, MA[2]

[1]Physical Therapy Department, Clarkson University, & Physical Rehabilitation, Canton-Potsdam, Potsdam, NY
[2]Outpatient Rehabilitation Department, Swedish Medical Center, & Department of Research, Puget Sound VA Health Services, Seattle, WA

ABSTRACT

Background and Purpose: Research shows that integrating behavioral and psychosocial approaches into physical therapist practice results in improved outcomes for patients with chronic pain, however, many physical therapists are unfamiliar with these approaches. **Methods:** Integration of clinical practice guidelines with findings from the literature and practical recommendations. **Findings:** There are a variety of ways in which physical therapists can integrate behavioral and psychologically informed approaches into standard physical therapy for patients with chronic pain. Experts recommend identifying each patient's pain personality and selecting the approaches that are best suited for each patient. Approaches include pain education, cognitive behavioral techniques, mindfulness, relaxation, biofeedback, and exercises that emphasize relaxation, breathing, and mindfulness. **Clinical Relevance:** This article provides suggestions for how physical therapists can integrate behavioral and psychosocial approaches into therapy for patients with chronic pain. Conclusion: Physical therapists can use the approaches in this article to enhance care for patients with chronic pain.

Key Words: mind-body, mindfulness, pain education, pain management

BACKGROUND

Physical therapy literature has recently emphasized the importance of a biopsychosocial, or pscyhologically informed approach to managing chronic pain.[1] The biomedical approach can be effective for acute pain.[2] Acute pain is typically proportional to peripheral nociception and treatment of the injury or disease decreases nociception and pain.[2] However, chronic pain persists after the time needed for tissue healing; chronic pain is considered an error in central processing resulting from abnormal neural plasticity.[3,4] Chronic pain is often more strongly related to psychological and social factors affecting the patient than to tissue damage.[5,6] Hence, to increase the likelihood of a favorable outcome, interventions should address these psychological and social factors.

Clinical practice guidelines for chronic pain recommend that treatment of chronic pain: use a biopsychosocial approach, always include exercise, include a cognitive behavioral approach, be sensitive to culture, include active self-management and not invalidate pain complaints because of psychosocial problems.[7] Behavioral approaches have been shown to be effective in decreasing pain, increasing function,[8,9] and reversing some of the neurological changes that occur with chronic pain.[10] Physical therapists who can integrate a biopsychosocial approach into management of chronic pain can be more effective than purely physical interventions.[11] However, many physical therapists lack the training to apply psychologically informed treatment approaches.[12,13] The purpose of this article is to familiarize physical therapists with concepts and terminology related to biopsychosocial approaches to chronic pain management, and to provide strategies that physical therapists can apply in the clinic.

The Complexity of Pain Perception: Making the Case for the Biopsychosocial Model

Pain is a subjective experience that does not correspond linearly to nociceptive input, but is additionally modulated by cognitive and emotional factors.[14,15] A patient's stress level, expectations, beliefs and attention can directly impact pain perception and endogenous pain inhibitory and facilitatory mechanisms.[16-19] Stress has been implicated in the exacerbation of several chronic pain conditions such as chronic back pain,[20] fibromyalgia,[21] rheumatoid arthritis,[22] and pelvic pain.[23] Supporting this premise, laboratory research on rodents identified both peripheral and central mechanisms generated stress-induced hyperalgesia.[18,24,25] The cognitive lens adopted by a patient through which he or she experiences pain can have a powerful impact on the pain experience. For example, treatment expectations substantially influence pain perception.[17] In addition, changing the meaning of pain from negative to positive can significantly increase pain tolerance through activation of endogenous opioid and cannabinoid inhibitory mechanisms.[16] Researchers also suggest that cognitive factors impact dorsal horn neuron sensitization through modulation of descending pathway inhibitory and facilitatory mechanisms.[19] The effective treatment of pain requires an appreciation of the complex contributions that these and other psychological factors make to pain perception.

Recognizing Pain Personality Types

Two classification systems (Table 1) for pain personalities have been identified: 'fear-avoidance' and 'pain-persistence.'[26] Others have described 4 clusters of pain behaviors: well-adapted, dysfunctional, distressed with little social support, and psychophysiologically reactive.[27,28] Research shows that assigning patients to treatment approaches matched to pain personality resulted in better outcomes than random assignment.[28,29] Improved outcomes may be due to decreased drop-out rates.[28] Although pain personality is relatively stable, studies show that 30% of patients not receiving treatment change characteristics over a 2 to 4 week period.[28,30] The evolving nature of pain personality means that pain personality, like physiological presentation, needs to be reassessed on an ongoing basis.[28] Nicholas and George[1] described a variety of tools for assessing patients' pain beliefs, including pain self-efficacy, catastrophizing, fear-avoidance, and kinesiophobia. It can also be helpful to determine the patient's pain readi-

Table 1. Pain Behavior Clusters

Classification	Characteristics	Recommended Approaches
Fear-avoidance vs pain-persistence		
Fear- avoidance[26]	Pain-avoidant behavior, fear of pain, catastrophizing, hypervigilance, social reinforcement for pain behaviors	Decrease focus on symptoms, set functional goals, gradual increase in activity in spite of symptoms, reinforce healthy behaviors, ignore pain behaviors, graded exposure, movement visualization
Pain- persistence[26]	Ignore or deny pain, continue activity in spite of pain, set unrealistic goals, ignore physical limits, low social support	Realistic goal-setting, pacing, alternating activity & inactivity, cognitive restructuring, gradually progressed conditioning exercises, gradual increase in activity, assertiveness training
Pain behavior clusters		
Well-adapted	Low levels of pain, distress, and interference with life; high self-efficacy and activity	Pain education and pain coping skills, cognitive behavioral therapy
Dysfunctional[28]	High pain intensity, interference with activity, pain behavior, social support and solicitousness; negative pain self-talk	Operant restructuring (reinforce healthy behaviors and do not reinforce pain behaviors), cognitive behavioral therapy
Distressed with little social support[28]	Low self-efficacy, social support, solicitousness of others; "punished" rather than rewarded for pain behavior; high affective distress and perceived daily stress	Cognitive behavioral therapy including stress and pain management, help managing dysfunctional relationships
Psychophysiologically highly reactive[28]	High stress-reactivity, muscle tension, daily stress; low social support, little reinforcement for pain behavior, low activity due to pain	Relaxation, biofeedback, cognitive behavioral therapy

ness to change as patients in the precontemplation, action, and maintenance stages of change are more likely to take an active role in self-management and more likely to be successful in a multi-disciplinary pain management program.[31,32]

Behavioral and Psychologically Informed Interventions

A variety of psychologically informed or behavioral approaches to managing chronic pain have been described (Table 2) and these strategies overlap considerably. The basic premise of these cognitive behavioral approaches is that thoughts, beliefs, and expectancies influence mood and physiological processes, including pain perception. People can learn more adaptive behaviors as well as ways of thinking and feeling, and these changes can alter pain.[1,33] Mann et al[34] described a variety of psychosocial, environmental, and physical factors that can influence the effectiveness of self-management. The text, below, provides more detail about each approach.

Pain Education

Pain education provides patients with an understanding of the multiple factors that give rise to the experience of pain. A recent systematic review of neurophysiology pain education concludes that for chronic musculoskeletal disorders, this education strategy may have a positive impact on pain, disability, catastrophizing, and physical performance.[35,36] Topics covered can include the anatomy of the nervous system, neuroplasticity, peripheral and central sensitization, and how the brain processes nociceptive information. Patients learn that pain is due to a complex interaction of multiple factors and does not arise because of incoming messages from the peripheral nervous system alone. They can grasp the transformative insight that hurt does not mean harm. Louw[37] and Butler and Moseley[38] have produced excellent resources for patient education; additional resources are listed at the end of this article. Key take home concepts for patients include: (1) pain perception shares neuropathways with cognition and emotion,[14,15] (2) the brain can generate pain in the absence of tissue damage,[39] (3) sensitive nerves in the spinal cord can amplify pain-related messages sent to the brain in the absence of tissue damage,[4] (4) the body's stress response can amplify pain generating mechanisms,[40] and (5) active self-management is the key to improvement.[34]

Mindfulness

Mindfulness meditation is the deliberate training of the mind to rest in the present moment with a quality of attention that is stable, accepting, curious, and friendly toward everything that arises.[41-44] A comprehensive literature review concludes that in chronic health conditions, including chronic pain, rheumatoid arthritis, fibromyalgia and post-traumatic stress disorder, mindfulness training contributes to improved coping, well-being, quality of life, and health outcomes.[16,42-47]

Physical therapists can integrate basic concepts of mindful awareness into patient care. For example, patients may have internalized destructive messages about their bodies from media images, childhood influences, or physical or emotional trauma. Add feelings of anger, fear, and confusion that can accompany persistent pain, and patients may be conflicted about and alienated from their bodies. Physical therapists can help patients heal this alienation through integrating the qualities of mindful attention when teaching body awareness. Patients can be invited to notice physical sensations with a quality of attention that is stable, kind, and curious. They can be asked to let go of pre-conceived ideas about their bodies and listen as if for the first time. They can be encouraged to let go of the struggle with their bodies and their pain. Patients can have the direct and healing experience of a stable, compassionate awareness that can observe their bodies and pain yet not be identified or defined by it.

Mindful awareness is also an especially helpful response to catastrophic thinking. Patients are coached to observe their present moment experience and the negative stories they generate about their present moment experience. Patients are asked to be curious, to notice how catastrophic thinking is often about the future, and to observe its influence on distress and pain. Although life is unpredictable, the present moment is often manageable and where patients have the power to

Table 2. Brief Description of Behavioral and Psychologically Informed Treatment Approaches

Approach	Summary
Pain education	Chronic pain neurophysiology, disconnect between pain and tissue damage (hurt ≠ harm), central and peripheral sensitization, impact of stress and negative thinking, pain coping skills
Mindfulness	Non-judgmental, accepting and kind attention to the present moment
Breathing	Diaphragmatic breathing
Relaxation	Diaphragmatic breathing, mindfulness, biofeedback, visualization, progressive muscle relaxation
Problem-solving	Identifying problems, generating ideas, prioritizing, implementing solutions
Cognitive restructuring	Identifying automatic negative thoughts or catastrophizing, challenging negative thoughts and replace with healthy coping strategies
Operant restructuring	Reinforcing health-behaviors and not reinforcing pain behaviors
Pacing	Time-based rather than project or pain-based
Pleasant activity scheduling	Selecting and planning pleasant activities
Sleep hygiene	Managing sleep habits to optimize sleep
Biofeedback	Using devices to provide physiological feedback to relax muscles, increase skin temperature, decrease sympathetic response
Exercise	Mind-body activities, graded motor imagery, quota-based progression, progressive exposure
Cognitive behavioral strategies	See Table 3
Pain coping skills	See Table 3

make skillful choices. Physical therapists can invite patients to take a "mindful" breath, bring awareness back to the present moment, and focus on the skillful choices that can be made here and now.[42,43]

Relaxation

Stress increases pain and fatigue.[18,48-50] Decreasing stress is like 'turning down the volume' on pain. Many people with chronic pain conditions breathe in a shallow manner.[51] Diaphragmatic breathing has been shown to reduce sympathetic nervous system activity and acute pain perception[52,53] while deep and slow breathing decreases pain and autonomic activity.[52] Body awareness activities such as yoga, qigong, and tai chi, which also focus on slow and effective breathing, are also helpful for relaxation and pain management.[54] There are many other relaxation strategies such as: (1) progressive relaxation, (2) relaxation visualization, and (3) autogenic training that patients can employ to manage their symptoms. Progressive relaxation involves selectively tensing and relaxing major muscle groups throughout the body.[55] A brief progressive relaxation intervention has been shown to increase nociception flexion reflex threshold and reduce stress ratings in healthy adults.[55] Research also suggests that progressive relaxation can decrease pain,[56] improve quality of sleep,[56,57] and decrease fatigue.[57] Relaxation visualization is another technique that may be beneficial to patients. Relaxation visualization involves imagining oneself in a safe and relaxing environment, such as a beach or hot tub. While performing relaxation visualization, patients should use several senses and imagine the feel, the smell, and the sounds of this relaxing environment. A third type of relaxation training is autogenic training. Autogenic training involves imagining that your hands and feet feel very warm and heavy.[29] Autogenic training has been shown to increase parasympathetic activation.[58] Patients should be encouraged to practice one or more of the techniques that suit their personalities and schedules.

Problem-solving skills

Patients with chronic pain often struggle to identify and solve problems that contribute to their pain and stress.[59] Instead, patients with chronic pain are more apt to use negative, destructive, or catastrophizing problem-solving styles. As a result, they struggle to meet home or work demands and conflicts with family or co-workers.[59-61] Physical therapists can help patients identify problems, generate potential solutions, prioritize options, find ways to implement solutions, and assess effectiveness.[28,62] For example, a patient who experiences an acute exacerbation of a chronic condition as a result of doing yard work can be guided to identify factors (eg, lifting, bending over, working too long, bad body mechanics, etc) that may have contributed to the acute exacerbation and suggest potential solutions (eg, using a wheel-barrow, working sitting down, taking frequent breaks, and practicing proper body mechanics). Problem solving is also helpful for managing acute exacerbations. Patients should have a set of strategies (perhaps in writing for times of panic) that they can use to manage exacerbations independently (eg, relaxation, meditation, heat or ice, stretching exercises).

Cognitive restructuring

People with chronic pain tend to catastrophize (make a crisis out of everything) and have automatic negative thoughts.[63,64] Physical therapists help patients replace catastrophizing with calming self-statements and replace automatic negative thoughts with healthy coping strategies.[28,33,62] For example, if a patient goes into crisis because of a recent exacerbation, a physical therapist can point out that a patient previously had several good days and that the exacerbation was due to significantly increased activity. We can point out that the patient actually felt so good that she did too much (what an awesome response) and that the exacerbation is already subsiding (she is capable of managing exacerbations), and that next time she could pace herself to avoid exacerbations. Patients can calm themselves by repeating statements such as "Hurt does not mean harm" or "If I stay calm my nerves will stay calm." Patients

might not fully believe in the positive statements at first, but they can gradually change their thinking process with practice.

Operant restructuring

Operant restructuring is a psychological term for the concept that people continue behaviors that are positively reinforced and decrease behaviors that are not reinforced.[28,29] Pain behaviors may be unintentionally reinforced by solicitous family members or health care providers who reward pain behavior with sympathy or solicitousness.[28] For example, people who complain about their pain, grimace, moan, or guard may be relieved of unpleasant housekeeping chores or rewarded with hot packs and massage in the clinic. Instead, clinicians and family members should reward healthy behaviors, such as increased activity and "healthy" soreness after increased exercise.[28,33]

Patients can develop a conditioned response that increases pain.[33] For example, when physical therapists ask patients to think about their pain ("Rate your pain," or "Describe your pain"), it may increase pain intensity through hypervigilance. If we have those same patients exercise, they may then associate exercise with increased pain intensity even though it may be hypervigilance rather than exercise that increases their pain. If patients then come to expect increased pain after exercise, they may be more likely to develop increased pain even with innocuous exercise.[33] Anticipatory fear and anxiety may therefore increase both peripheral and central sensitivity. Physical therapists may inadvertently reinforce negative operant learning by encouraging patients to stop activities or exercise when they (patients) complain of pain.[33] We can instead reinforce health behaviors by explaining that soreness is be a good sign that patients are challenging their bodies in beneficial ways that will make them stronger and healthier.[16,65]

Pacing

Patients should use time-based pacing rather than activity- or pain-based pacing. Activity and pain-based pacing can lead to an over-activity "yo-yo" because patients continue the activity past their physical tolerance. People with chronic pain tend to overdo it when they feel relatively well, but then suffer a exacerbation and are unable to do anything for several days.[26] Those inactive days contribute to deconditioning, resulting in even less tolerance to activity when attempted later. In contrast, time-based pacing encourages the patient to assess how long he can do an activity before causing an exacerbation so that he can stop the activity at 10% to 20% below that threshold. During an exacerbation, patients should be encouraged to decrease activity, perhaps to 50% of normal, but not discontinue it entirely. Time-based pacing also avoids negative feedback operant learning by having patients stop an activity (reward) for complaining of pain.[33]

Pleasant activity scheduling

People with chronic pain tend to neglect pleasant activities for a variety of reasons: belief that they do not deserve to enjoy themselves, as punishment for not being able to do "work" activities, inability to do previously enjoyed activities and failure to identify new activities, or because of generalized depression.[66] However, pleasant activities are important both as motivators and as ways to maintain a positive attitude, healthy social relationships, and successful experience with more normal life activities.[66] Patients should therefore be encouraged to identify appropriate pleasant activities and actually schedule them or set goals to be able to do them in the near future.[62] Patients can also learn to apply pacing skills and activity-rest cycles to help them achieve pleasant activity goals.[13]

Sleep hygiene

Since chronic pain is exacerbated by poor quality sleep,[67,68] sleep hygiene can be beneficial.[68,69] Patients should relax before bedtime (eg, meditation, diaphragmatic breathing, yoga, a hot bath). They should avoid the television and computer at bedtime, as these activities tend to be stimulating. The bedroom should be a comfortable, dark, warm, and quiet place at bedtime. Patients with chronic pain should avoid caffeine, nicotine, and alcohol, especially in the evening. Daily exercise improves sleep.[70] Although the popular media often suggest that vigorous exercise within 3 hours of bedtime interferes with sleep, recent research suggests that exercise just before bedtime is beneficial.[70] The bed should be reserved for sleep and intimacy and not used for paying bills or watching television. Finally, if unable to sleep within 20 minutes, patients should be advised get up and go to a different room and do something relaxing so they do not develop patterns of sleeplessness in bed.

Biofeedback

Biofeedback can be helpful for patients who struggle with standard forms of relaxation training.[58] Electromyogram (EMG) biofeedback teaches patients how to relax tense muscles; it provides immediate feedback and is easy to teach patients; however, EMG units are expensive ($2,000-4,000). Galvanic skin response (GSR), which monitors sympathetic nervous system activity, is more difficult for patients to control; GSR is relatively inexpensive ($200-400) and new interactive video games using GSR may provide patients access to this technology at home. Heart rate variability (HRV) is a newer form of biofeedback that provides immediate feedback and cues breathing to facilitate relaxation. Although the exact mechanism of HRV is not yet known, it works through decreasing the stress response.[71,72] Since HRV units are about $130, motivated patients can purchase one for home use. Skin temperature can also be used as biofeedback; units are inexpensive ($20-40) but, like GSR, it can be difficult for patients to learn to regulate skin temperature. See McKee[73] for more information about implementation and effectiveness of biofeedback.

Exercise

According to clinical practice guidelines,[2,7] exercise is an essential component of any chronic pain management program. In addition to exercises specific to patient complaints (eg, core stabilization for low back pain), they often need conditioning exercises to compensate for their decreased activity level. Graded exercise should be progressed using a quota system rather than pain. Identify a baseline of activity that can be tolerated and, when that quota is met, the quota is increased. Inability to meet the quota results in no reinforcement.[1,74] Mind-body exercises such as yoga, tai chi, and qigong can be beneficial for easing patients into activity while facilitating breathing, relaxation, and body awareness.[54]

Graded motor imagery is a recent approach that addresses problems with body awareness through a graded process of left/right judgment, visualization, and then mirror visual feedback.[75] If patients are extremely fearful of specific movements or activities, graded exposure provides a transition to progressively more stressful activities. Patients start with simple visualization of a position or movement through simplified versions of the feared activity and progress to the feared activity itself.[1,74]

Pain coping skills and cognitive behavioral strategies

Pain coping skills and cognitive behavioral strategies are overlapping sets of approaches

including those described above. Table 3 lists patient skills and strategies typically included in each approach. While research sometimes rigidly includes each component of a pre-set selection of skills,[13] clinicians may select strategies believed to be most appropriate or most acceptable to the patient.[34,76] Given the different pain personalities of patients, this mix and match approach may optimize compliance and effectiveness.[28,77]

Table 3. Pain Coping Skills[13] and Cognitive Behavioral Strategies[7]

Pain Coping Skills	Cognitive Behavioral Strategies
• Pain education	• Pain education
• Progressive muscle relaxation	• Importance of active self-management
• Activity-rest cycles and pacing	• Wellness behaviors
• Pleasant activity scheduling	• Pleasant activity scheduling
• Identifying and challenging negative thoughts	• Avoiding negative thinking
• Calming self-statements	• Elimination of fear-avoidance or pain-persistence
• Distraction	• Progressive activity/exercise
• Pleasant imagery	• Time-based rather than task-based pacing
• Problem solving	• Not using pain as a guide
• Exacerbation management	

Challenges in Working with People with Chronic Pain

Physical therapists face multiple challenges when treating patients with persistent pain. These include patients' often complex psychosocial problems and negative attitudes, as well as the physical therapists' empathy limits and time management. Patients may have a history of repeated treatment failures that can create negative expectations or anger. Poor communication skills, depression, and personality issues that create interpersonal problems elsewhere in patients' lives may also present problems in the clinic.[34,78] Psychiatric problems are beyond the scope of this article though patients may at times benefit from this type of intervention.

Most patients with chronic pain have psychosocial issues that alter the likelihood that self-management approaches will be successful,[34] and they make working with these patients challenging.[78,79] When patients with chronic pain have psychological and social problems beyond our training and experience, patients benefit from referral to psychological resources. In-person or online support groups can also be helpful, as well as books and websites that promote pain self-management (Appendix). For optimal patient care and to avoid therapist burnout, physical therapists need to know their own limits and their scope of practice when providing psychological support to distressed patients.[12,79]

Patients with chronic pain often present with maladaptive attitudes toward their body, symptoms, and exercise. Misconceptions about exercise, skepticism of a mind-body treatment approach, and problems with pacing activities can all obstruct the rehabilitation process. All of these factors can reduce a patient's motivation to participate in physical therapy and maintain consistency with a home exercise program.[11,12,79] Patient education and mindful movement training, such as tai chi, yoga, qigong, and Feldenkrais, can help transform maladaptive ideas in to more functional views that promote patient success. In addition, coaching patients to set SMART goals (ie, specific, measurable, achievable, relevant, time limited), "to start low and go slow," and to remember that they are "sore but safe" as they challenge their tissues can promote patient success.

Patients with chronic pain often arrive with multiple physical and emotional complaints that can take considerable clinic time if not well managed, and the thought of adding behavioral techniques on top of already demanding treatments can be daunting. Physical therapists should shift emphasis away from passive interventions (eg, modalities, massage, manual therapy) toward active interventions. Patients should be given more responsibility for self-management through self-care and activities of daily living training that includes both physical and behavioral strategies. Patient education about chronic pain physiology and optimal treatment approaches is essential to elicit patient buy-in to an increasingly hands-off intervention.[2,7]

Treating patients with chronic pain can be stressful for several reasons: their conditions are complex, treatment failures are common, patients have high levels of distress, and they can be very demanding.[79] Working with these patients can contribute to physical therapist stress and burnout. Suggestions to help therapists minimize their own stress:[80]

- Reach out to your support system and discuss your experience with colleagues;
- Get mentoring from more experienced therapists;
- Attend to your own wellness through mindfulness, relaxation, exercise, etc;
- Remember that, although you are responsible for providing evidence-based treatment, multiple factors influencing outcomes are beyond your control;
- Remember that patients are ultimately responsible for their active engagement in therapy;
- Be aware of when a patient triggers your stress reaction and take the time to re-center;
- Be kind and compassionate with yourself by talking to yourself as you would to a colleague treating a challenging patient;
- Review what went well at the end of each day rather than focusing on frustrations;
- Be at peace with pain and problems you cannot relieve in spite of your best efforts.

SUMMARY

Clinical practice guidelines recommend that management of chronic pain use a biopsychosocial approach, include a cognitive behavioral approach, include active self-management, and yet not invalidate pain complaints because of psychosocial problems. This paradigm shift from a biomedical to biopsychosocial approach requires that physical therapists encourage patients to make active changes in both behaviors and thought processes related to pain. We can use an awareness of psychological principles to more effectively educate patients. Physical therapists have an important opportunity to make a difference in the lives of people with chronic pain through integration of behavioral and psychologically informed methods into physical therapy intervention.

(References continued on page 14)

Appendix. Helpful Books, Resources, and Websites

Helpful Books and Resources

- Branch R, Wilson R. *Cognitive Behavioural Therapy for Dummies*. Hoboken, NJ: John Wiley & Sons; 2010. (patient resource)
- Butler D, Moseley L. *Explain Pain*. Adelaide: Noigroup Publications; 2003. (PT and patient resource)
- Caudill M. *Managing Pain Before It Manages You*. New York, NY: Guilford Press; 2008. (patient resource)
- Flor H, Turk D. *Chronic Pain: An Integrated Biobehavioral Approach*. Seattle, IASP Press; 2011. (PT resource)
- Kabat-Zinn J. *Mindfulness for Pain Relief* (CD). Sounds True, Inc; 2009. (patient resource)
- Kabat-Zinn, J. *Full Catastrophe Living: Using the Wisdom of Your Body and Mind to Face Stress, Pain and Illness*. New York, NY: Del Publishing Co; 1991. (patient resource)
- Louw A. *Why Do I Hurt?* Minneapolis, MN: Orthopedic Physical Therapy Products; 2013. (patient resource)
- Otis J. *Managing Chronic Pain: A Cognitive Behavioral Approach*. New York, NY: Oxford University Press; 2007. (patient resource)
- Russek LN. Chronic Pain. In: O'Sullivan S, Schmitz T, Fulk G, eds. *Physical Rehabilitation*. Philadelphia, PA: F.A. Davis; 2013. (PT resource)
- Schubiner H. *Unlearn Your Pain*. Available through Dr. Schubiner's website: www.unlearnyourpain.com (patient resource)
- Sluka K. *Mechanisms and Management of Pain for the Physical Therapist*. Seattle, WA: IASP Press; 2009. (PT resource)
- Turk D, Winter F. *The Pain Survival Guide: How to Reclaim Your Life*. American Psychological Assn; 2005. (patient resource)
- Vierck E, Kassan S, Vierck CJ. *Chronic Pain for Dummies*. Hoboken, NJ: John Wiley & Sons; 2011. (patient resource)

Helpful Websites

Organization/Purpose	Website
American Academy of Pain Medicine Professional organization for physicians has some patient educational material.	www.painmed.org
American Chronic Pain Association Provides education and peer support for patients and families.	www.theacpa.org
American Pain Foundation Educational material for patients and families, including material specifically for military & veterans with chronic pain.	www.painfoundation.org
Australian Transport Accident Commission An extensive selection of physical and psychosocial outcome measures. Go to Provider Resources, Clinical Resources, then Outcome Measures.	www.tac.vic.gov.au
Carolyn McManus Information regarding programs at Swedish Medical Center, for veterans and also audio guided relaxation programs.	www.carolynmcmanus.com
Change Pain A modular approach to understanding pain and its management. Educational resources for clinicians.	www.change-pain.co.uk/
Hunter Integrated Pain Service YouTube patient education video. "Understanding Pain: What to do about it in less than 5 minutes?"	YouTube link: youtube/4b8oB757DKc www.hnehealth.nsw.gov.au/pain
Institute for Clinical Systems Improvement (ICSI) Assessment & management of chronic pain. Clinical practice guideline on chronic pain.	www.icsi.org/guidelines_and_more/gl_os_prot/ search for guidelines on pain
International Association for the Study of Pain (IASP) Professional organization for researchers, clinicians, and educators. Have some public education resources.	www.iasp-pain.org
Mayday Pain Project Educational information for providers, patients, and specific sections for caregivers.	www.painandhealth.org
California Department of Industrial Relations Medical Treatment Utilization Schedule (MTUS). Medical Treatment Guideline for chronic pain.	www.dir.ca.gov/dwc/MTUS/MTUS_RegulationsGuidelines.html select "Chronic pain medical treatment guidelines"
Neil Pearson, PT Canadian physical therapist discusses nervous system sensitization in a 3-part video.	www.Lifeisnow.ca
Pain Treatment Topic Educational material for clinicians, patients, and families. Links to resources on many other sites. Comprehensive section on pain assessment tools.	www.pain-topics.org
Pain.com Educational modules and articles for clinicians.	www.pain.com
PainAction Educational material for patients. Includes self-management tools. Integrated with clinician educational site PainEDU.com.	www.painaction.com
PainDoctor.com Educational material for patients and families.	www.paindoctor.com
PainEDU.org Educational material for clinicians and educators. Includes downloadable PowerPoint lectures. Integrated with patient education site PainAction.	www.painedu.org
UMass Center for Mindfulness List of mindfulness based stress reduction programs.	w3.umassmed.edu/MBSR/public/searchmember.aspx

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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

Orthopaedic Section Preconference Courses

2015 Combined Sections Meeting

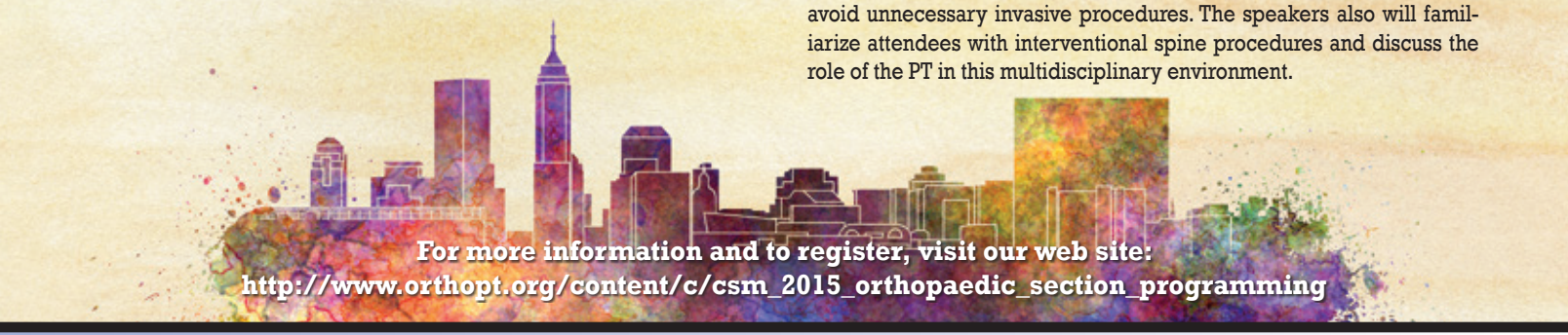
Indianapolis, Indiana • Wednesday, February 4, 2015

Functional Screening and Manual Therapy for the Lower Extremity
Speakers: *Stephanie Albin, DPT, OCS, FAAOMPT; Gail Deyle, PT, DSc, DPT, OCS, FAAOMPT; Jake Magel, PT, DSc, OCS, FAAOMPT; Kate Thayn, DPT, OCS, CSCS*

This 1-day, hands-on, lab-based course will focus on screening for movement disorders of the lower extremity. The course will explore the use of manual therapy and therapeutic exercise techniques for the lower extremity, including the hip, knee, ankle, and foot. The morning session will focus on functional screening of movement disorders for the lower extremity and hands-on manual therapy and therapeutic exercise treatments for hip movement-related impairments. The afternoon session will be a hands-on laboratory session focusing on manual therapy and therapeutic exercise techniques for the knee, foot, and ankle regions to address functional movement impairments. The best available evidence will be integrated into all discussion and laboratory sessions. The intent of this course is to provide attendees with useful, clinically relevant information that can be immediately applied into various practice settings. Patient case studies will be presented.

Multimodal Physical Therapy and Interventional Pain Medicine in Managing Neck Pain
Speakers: *Chad Cook, PhD, PT; Gwendolen A. Jull, PT, MPhty, PhD, FACP; Geoff Schneider, PT, PhD; Ashley Smith, PT, PhD (cand)*

The objectives of this course are to review the physical therapy management of patients with persistent neck pain, particularly in therapeutic exercise. Neck pain is one of the leading reasons why patients visit primary care practitioners. The societal impact of this condition is widespread, fostering significant disability and socioeconomic burden. An episode of neck pain is typically well managed by multimodal physical therapy. However, while the disorder is typically recurrent, physical therapy management generally does not focus on reducing recurrent episodes. It will be argued that specific rehabilitation of the neuromuscular system may begin to address the problem of recurrence. In addition, there are a proportion of patients (in particular with whiplash-associated disorders) who do not respond to conservative care. Physical therapists possess the skillset to identify those with neck pain of facet joint origin who will likely respond to facet joint interventions to avoid unnecessary invasive procedures. The speakers also will familiarize attendees with interventional spine procedures and discuss the role of the PT in this multidisciplinary environment.



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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

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ORTHOPAEDIC SECTION ○ AMERICAN PHYSICAL THERAPY ASSOCIATION ○ PRACTICE RESEARCH EDUCATION

Agreement Between the Upper Limb Tension Test 2a and the Phalen Test in the Diagnosis of Carpal Tunnel Syndrome

Susan Denham, EdD, OTR/L[1]
Jerry Lee, PT, DC[2]
Michelle Wilhite, DPT, RT[3]
Tyler McGrady, DPT[4]
Brian Booth, DPT[5]

[1]Professor, Alabama State University, Montgomery, AL
[2]Assistant Professor, Alabama State University, Montgomery, AL
[3]Doctor of Physical Therapy, Alabama State University, Montgomery, AL
[4]Doctor of Physical Therapy, Alabama State University, Montgomery, AL
[5]Doctor of Physical Therapy, Alabama State University, Montgomery, AL

ABSTRACT

Background: The Phalen test is a commonly used special test to support or exclude carpal tunnel syndrome (CTS) as a diagnosis. While it is an acceptable clinical tool, using more than one appropriate special test is likely to result in a more accurate diagnosis. The investigators sought to identify an additional special test that could be used to assist in the diagnosis of CTS. The Upper Limb Tension Test 2a (ULTT 2a) was chosen as a possible companion special test. **Purpose:** To determine if the agreement between the Upper Limb Tension Test 2a (ULTT 2a) and the Phalen test was acceptable for diagnosis of CTS. **Methods:** Eighteen individuals with the diagnosis of CTS were evaluated using the ULTT 2a and the Phalen test. Twelve participants presented with bilateral CTS, therefore a total of 30 limbs were assessed. The ULTT 2a and Phalen test were performed on each affected limb by separate investigators. The investigators were blinded to the results of the other special test. Statistical analysis was then completed to determine the agreement between the ULTT 2a and the Phalen test. **Results:** Statistical analysis demonstrated a kappa coefficient of 0.7, indicating the ULTT 2a is comparable to the Phalen test for the diagnosis of CTS. **Clinical Relevance:** The results of this study have implications for clinical practice and support the use of the ULTT 2a as a part of a comprehensive physical examination for clients with suspected median nerve compression. The ULTT 2a provides the practitioner with an additional special test to better support or exclude the diagnosis of CTS. It is an accurate diagnostic tool and serves as an acceptable companion to the Phalen test in the diagnosis of CTS.

Key Words: special tests, repetitive stress, median nerve

INTRODUCTION

Carpal tunnel syndrome (CTS) is a common nerve compression and is frequently diagnosed by a wide variety of medical specialists, including surgeons, orthopaedists, primary care physicians, and nurse practitioners. In addition, with the increase in direct access, physical and occupational therapists are often the first line in the diagnostic process. Despite the commonality of CTS, there is no established best criterion for the diagnosis of CTS.[1] Electromyography (EMG) is often viewed as the gold standard for the diagnosis of CTS.[1] However, it is not absolute and results may vary between examiners, yielding both false positive and false negative results.[1] In addition, EMG is costly, time consuming, and mildly invasive. While EMG results are useful, they are not sufficient in the diagnosis of CTS. Accurate diagnosis requires agreement between a detailed medical history and physical examination, including appropriate special tests with confirmation from diagnostic tests such as the EMG.[1] By using more than one special test, practitioners strengthen diagnostic suspicions, leading to more appropriate referral or interventions. Some researchers have questioned the value of special tests in the diagnosis of CTS.[2] However, more recent research has suggested that accurate diagnosis is best achieved when first assessing a client's history, followed by a series of agreeable special tests, with final confirmation from EMG testing.[1,3]

During occupational and physical therapy clinical observations, the investigators noted that the Phalen test was frequently used during the physical examinations of clients with suspected CTS. A literature review verified the Phalen test as a common special test for assessing possible CTS. Kotevoglu and Gülbahce-Saglam[4] validated the Phalen test by using the diagnostic ultrasound to confirm the accuracy of the Phalen test. That study demonstrated a Phalen's specificity of 80% for clients with the confirmed diagnosis of CTS. Other studies have shown the Phalen test to have a sensitivity ranging between 68% to 85% with specificity ranging between 73% to 89%.[5-10] The Phalen test is typically considered the most specific and sensitive special test for CTS and was therefore used as the reference standard in this study.[7,9,11,12]

In order to provide the most accurate diagnosis, the investigators questioned what measures, other than the Phalen test, could be used to strengthen the suspicion of CTS and justify an EMG. In an attempt to find a strong complementary measure, the researchers explored special tests associated with neurodynamic testing. These tests place tensile stresses on the epineurium of the spinal nerve roots and peripheral nerves using traction force on the nerve until the client's symptoms are reproduced.[13-15] The Upper Limb Tension Test 1 (ULTT 1) and Upper Limb Tension Test 2a (ULTT 2a) were developed based on principles of mobility, tension, and excursion.[13] Both tests have been shown to provoke the median nerve when it is compressed in the carpal tunnel.[10] Previous research compared the ULTT 1 to the Phalen test and demonstrated agreement.[16] However, the ULTT 1 requires more complex positioning, making it difficult and even contraindicated for some clients. No literature comparing the ULTT 2a to the Phalen test was found.

The Phalen and ULTT 2a tests are both designed to provoke the median nerve when it is under stress in CTS.[7,17] This study was designed to find the measurable agreement between the ULTT 2a and the Phalen test in the diagnosis of CTS. The researchers hypothesized little to no difference would be present between the two tests based on available diagnostic information and current studies.[5,8,14-16]

METHODS

Individuals previously diagnosed with CTS were recruited from a local physicians' group. The diagnosis of CTS was validated by the treating physician following a physical exam, EMG, and a nerve conduction study (NCS). The treating physician used the NCS to establish the diagnosis based on a prolonged median motor latency of greater than 1.8 ms. Participants signed an informed consent and a liability waiver before any testing by the researchers was initiated. The participants were then screened to determine if there were any contraindications for testing and to ensure the subjects could assume the proper testing positions for both the Phalen test and the ULTT 2a. Those with contraindications or difficulty assuming the testing positions were excluded from the study.

A total of 18 subjects met the inclusion criteria and agreed to participate in the study. Twelve subjects had bilateral CTS; therefore, a total of 30 limbs were assessed. Participants were assigned a random number upon arrival for testing. The assigned number was used as their identification number and to determine which test the subject would undergo first. In an attempt to control any bias that might occur due to the testing order, those with odd numbers performed the Phalen test first, while the even numbers were evaluated first using the ULTT 2a. The first test was performed by a designated investigator, using the same instructions for each subject. Following the first test, the subject received a 3-minute rest period. A second investigator then performed the alternate test. The study was blinded to prevent the investigators from knowing the results of the alternate test. Participants with bilateral CTS were given a second number and treated as additional subjects.

To ensure testing instructions were given consistently, color pictures demonstrating the Phalen test were used in conjunction with instruction and demonstration by the investigator. The testing position for the Phalen test required participants to sit with a relaxed posture, with shoulders flexed to approximately 70° and elbows flexed to approximately 90°. Participants were then asked to actively assume a position of extreme but not forced wrist flexion for one minute (Figure 1). During the Phalen test, the investigator did not make physical contact with the participant. At the end of one minute, participants were then asked to describe any sensory changes in the tested limb. The test was considered a positive indicator of CTS if the participants reported pain, numbness, or tingling along the median nerve distribution. To ensure consistent testing during the ULTT 2a, an audio recording was used to direct each position in the testing procedure. The therapist manually positioned the participants as instructed by the audio recording. The testing position used for the ULTT 2a followed the protocol described by Butler.[18] The subjects were asked to lay supine and relaxed, while the evaluating therapist manually maneuvered the upper extremity. The therapist first depressed the shoulder girdle, while simultaneously abducting the humerus to approximately 10°, fully extending the elbow, laterally rotating the humerus, and extending the wrist, fingers, and thumb (Figure 2). The position was held for one minute, and participants were then asked to describe any sensory changes in the tested limb. The test was considered positive if the participant reported pain, numbness, or tingling along the median nerve distribution.

Figure 1. Correct testing position for the Phalen test.

Statistical Analysis

Following the completion of the examinations, statistical analysis was performed to assess the agreement between the Phalen test and the ULTT 2a. Cohen's kappa coefficient (kappa) was chosen as the statistical measure of agreement.[19] It is commonly accepted as a better determinate of agreement than basic percentages due to its consideration of chance. The kappa was used to diminish the possibility of an investigator guessing or assigning a diagnosis based on chance. Kappa coefficient values range between 0 and 1, with 0 indicating no agreement and 1 indicating total agreement. While there is no universal guideline for magnitude associated with the kappa, multiple researchers have reported .61 and higher as a substantial agreement and .75 and higher as nearly perfect agreement.[19,20]

Additional analyses were also completed to establish the statistical strength of the two tests and to assure that the investigators' results fell within the previously established parameters for these specific special tests.[5-10] The investigators measured diagnostic accuracy, or the test's ability to obtain a true positive or true negative and sensitivity, or the ability to obtain a true positive. As a result of the study design, clients without CTS were excluded from the study; therefore, specificity could not be assessed in this study. However, the investigators were able to determine the false negative rate, positive predictive value, and negative predictive value for the Phalen test and ULTT 2a against a verified diagnosis of CTS.

RESULTS

Thirty limbs with a confirmed diagnosis of CTS were assessed (Table 1). Twenty limbs exhibited a positive result for both the Phalen test and ULTT2a, and one limb displayed a negative result for both tests. Nine limbs presented with a positive result on one of the designated tests and a negative result on the other test. This study yielded a kappa coefficient of 0.7 for agreement between the Phalen test and the ULTT2a.

The Phalen test yielded a diagnostic accuracy of 87.5 %, while the ULTT 2a was 71.9%. The sensitivity level for the Phalen test was established at 88.7% and the ULTT 2a yielded a sensitivity level of 72.6%. The Phalen test elicited a false negative in 3 of the participants, or 11.3%, and the ULTT 2a elicited a false negative in 8 of the participants, or 27.4% of the subjects tested (Table 2). The Phalen test yielded a 98.2% positive predictive value with 27 of the 30 limbs testing positive and the UTLL2a yielded 97.8% with 22 of the 30 limbs testing positive.

Figure 2. Correct testing position for the Upper Limb Tension Test 2a.

Table 1. Contingency Table to Compare the Agreement of the Phalen Test with the Upper Limb Tension Test 2a

Kappa			
	Phalen + Participants testing positive	**Phalen -** Participants testing negative	**Total**
ULTT 2a + Participants testing positive	20	2	22
ULTT 2a - Participants testing negative	7	1	8
Total	27	3	30
Abbreviation: ULTT 2a, Upper Limb Tension Test 2a			

A negative predictive value of 12.5% was found for the Phalen test and the UTLL2a yielded a negative predictive value of 6.0%. There was no significant statistical difference between the Phalen test and the ULTT 2a (Table 3).

DISCUSSION

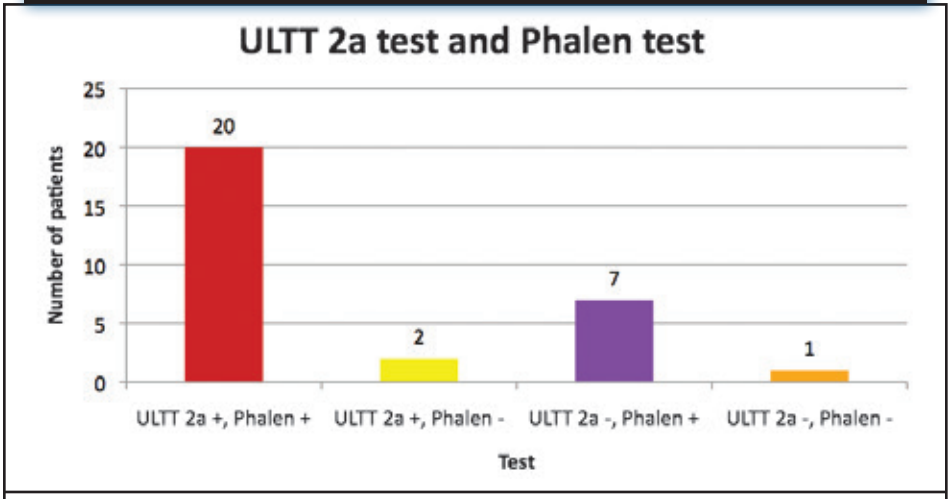
The first step to best practice is accurate diagnosis and the use of appropriately selected special tests strengthens the diagnostic process.[1,3] Treatment will be less effective if the diagnosis is inaccurate. Selection of special tests should be based on strong psychometric properties. This study was designed to evaluate the strength of agreement between the Phalen test and the ULTT 2a in the clinical diagnosis of CTS. The results generated from this study demonstrated that while the Phalen test is slightly more accurate or sensitive than the UTTL2a, the two tests have similar psychometric properties and both have a high level of agreement. The kappa coefficient of 0.7 indicates substantial agreement.[19] Therefore, the Phalen test and the ULTT 2a are appropriate special tests to support the suspected diagnosis of CTS. Based on the kappa coefficient of 0.7, along with additional statistical analysis, the Phalen test and the ULTT 2a were shown to be psychometrically agreeable tests for the assessment of suspected CTS.

As highlighted in Table 1, 20 of the 30 limbs tested positive using both the Phalen test and the ULTT 2a. All participants had a previous diagnosis of CTS confirmed by EMG testing. Two participants tested positive for the ULTT 2a and negative for the Phalen, 7 participants tested positive with the Phalen and negative with the ULTT 2a, and one participant tested negative for both tests. These results indicate that the Phalen test is a slightly stronger diagnostic tool for CTS, but the ULTT 2a is a viable alternative or companion test. The diagnostic accuracy for the Phalen test was 87.5% as compared to 71.9% in the ULTT 2a. The sensitivity levels were established at 88.7% for the Phalen test and at 72.6% for the ULTT 2a. Both of these sensitivity levels were within 8% or less of the norm established for the Phalen test in the literature.[4,5] In addition, the sensitivity level established for the ULTT 2a was higher than the 67% level traditionally established for the more common alternative, the Tinel test.[5] The information obtained for specificity was of no significance, since the study design eliminated subjects without a verified diagnosis of CTS.

The false negative rate refers to the probability of a negative test when the condition is actually present in the individual. This study established a false negative rate of 11.3% for the Phalen test and 27.4% for the ULTT 2a. This indicates that the Phalen is the better diagnostic tool, in that participants were less likely to go undiagnosed when the Phalen test was used. The ULTT 2a had a higher false negative rate, but when used in conjunction with the Phalen test, only one of the 30 previously diagnosed limbs tested negative on both tests. Thus, the two tests used together are more likely to yield an appropriate diagnosis.

Neurodynamic testing is a relatively unvalidated technique and more research is needed to support its use in the examination process. The results of this study have implications for clinical practice and support the use of the ULTT 2a as a part of a comprehensive physical examination process for clients with suspected median nerve com-

Table 2. Comparison of Results Between the Upper Limb Tension Test 2a and Phalen Tests



Abbreviation: ULTT 2a, Upper Limb Tension Test 2a

Table 3. Statistical Analysis of Phalen and Upper Limb Tension Test 2a Results

	Phalen	ULTT 2a
Diagnostic accuracy	87.5%	71.9%
Sensitivity	88.7%	72.6%
Specificity	50%	50%
False negative rate	11.3%	27.4%
Positive predictive value	98.2%	97.8%
Negative predictive value	12.5%	6%

Abbreviation: ULTT 2a, Upper Limb Tension Test 2a

pression. The ULLT 2a provides the practitioner with an additional or supplemental special test to better support or exclude a diagnosis of CTS.

We recognized several limitations of this study. First, our study was derived from one practice setting and included a small sample size. Future studies should include a larger sample size. Secondly, all the participants had a verified diagnosis of CTS by EMG. There were no true negatives in our study. Since participants knew they had been diagnosed with CTS, it is possible they responded to the examiner with an anticipated response. Future studies should include true negative participants. Finally, some participants were tested bilaterally; it is possible that they responded to testing based on the testing results of the previously tested upper limb. In the future, it is recommended that only one limb be tested per participant.

CONCLUSIONS AND CLINICAL APPLICATIONS

Best practice dictates that there is more than one specific test to diagnosis a disorder whenever possible. The ULTT 2a has been shown to be a clinically useful part of the examination process for clients with suspected median nerve compression. The ULLT 2a provides the practitioner with a supplemental special test to better support the results of the Phalen test when confirming or ruling out the diagnosis of CTS.

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Clinical Reasoning and Multimodal Treatment for Dorsal-Lateral Foot Pain: A Case Study

Brad Callan, PT, MSPT, COMT, FAAOMT

Kittitas Valley Healthcare Physical Therapy, Ellensburg, WA

ABSTRACT

Background: Foot pain can be difficult to diagnose and treat due to the complex anatomy and influence of the lower quarter on foot biomechanics. **Case Description:** A 54-year-old male who complained of a 3-year history of worsening dorsal-lateral foot pain referred himself to physical therapy for diagnosis and treatment. **Outcomes:** The patient was successfully evaluated and treated in one visit using multiple clinical reasoning strategies. These strategies helped discover an underlying biomechanical fault that was likely initiating his pain and led to the subsequent intervention of patient education, manipulation, and home exercises. **Conclusion:** With appropriate clinical reasoning and utilization of the relevant research, a well-suited intervention was administered. Six weeks after the intervention, the patient reported no symptoms and he was able to fully resume his exercise regimen without difficulty.

Key Words: differential diagnosis, exercise, manipulation, stress reaction

BACKGROUND

Clinical reasoning has been defined as a way of thinking and taking action in clinical practice.[1] There are many different methods of clinical reasoning used in physical therapy practice.[2,3] However, in a study by Edwards et al,[1] it was found that there are two predominant varieties of clinical reasoning used by physical therapists. The first approach employed is hypothetico-deductive reasoning, which is a branch of the empirico-analytical style.[1] This method is focused on generating and testing a hypothesis in order to make a diagnosis.[3] With this strategy, it is believed that there is a truth or problem that can be uncovered with proper testing.[1,3,4] Therefore, the emphasis is on the scientific process and the use of multiple tests to determine a pathology or impairment.[1,3,4]

Hypothetico-deductive reasoning is used by clinicians of all skill levels.[1,3,4] It is used most often by novice clinicians in everyday situations and by expert clinicians when they are presented with problems that are unfamiliar to them.[3,4] In contrast, when an expert clinician is faced with a problem they are familiar with, they will more regularly use a distinct style of clinical reasoning named forward reasoning.[1-4] Forward reasoning is another branch of the empirico-analytical style.[1,3,4] Forward reasoning relies on pattern recognition and having a highly organized knowledge base that the provider is able to access quickly and efficiently to make decisions.[1,3,4]

The second strategy most commonly employed by physical therapists is termed narrative reasoning.[1] The narrative method is used to understand patients' experiences and determine how this impairment is affecting their lives.[1,3,5] This approach differs from the hypothetico-deductive technique in that it does not rely on formal testing.[1] Instead it uses verbal and nonverbal interactions with the patient to determine the patients' functional impairments.[1,3,5]

Research of narrative reasoning showed that there is a difference in how novice and expert clinicians interact with their patients.[1] In comparison to novice clinicians, experts do not follow a strict set of questions or protocols in their interactions with patients.[1,6] Instead, experts take a more free form approach based on the cues provided by patients.[1,6] Expert clinicians are also more adept at being able to control interactions with patients in order to gather the information that is needed to appropriately manage their condition.[1,6]

In a study investigating clinical reasoning by expert physical therapists, a central finding was that expert clinicians did not use a particular strategy.[1] Instead, they merged multiple methods, often within a single treatment session, in order to facilitate the best outcomes for patients.[1]

The purpose of this case study is to describe the clinical reasoning strategies used to hypothesize a diagnosis and discover a likely pain generator for this patient. Further reasoning and investigation uncovered a biomechanical fault that was most likely causing the pain, which led to the subsequent intervention for this patient.

CASE DESCRIPTION

A 54-year-old male software engineer presented via direct access to the physical therapy clinic with difficulty walking short distances due to right dorsal lateral foot pain. The pain was described as "an ache" that occurred several times a day and was consistently located at the dorsal joint line of the cuboid and fourth metatarsal. When the symptoms were present, he rated his pain on a written analog pain scale at 3 cm, where 0 cm was no pain and 10 cm was the worst pain imaginable. The visual analog pain scale has been found to be valid, reliable, and appropriate for use in a clinical setting.[7]

His functional activity level was assessed using the CareConnections Functional Index (CCFI). The CCFI is a patient-reported survey instrument that is used to assess a patient's limitations in 5 general activities, along with 5 region-specific activities. It is scored from 0 to 100, with the higher the score indicating a higher level of function.[8] The CCFI has been shown to have good test-retest reliability, and its criterion validity has been established when compared to the Lower Extremity Functional Scale.[9] On the CCFI intake form, the patient scored a 98. His only limitation was reported as, "I am able to engage in all my normal recreational/sport activities with some increased symptoms."

He denied any burning, shooting, or radiating pain, and no numbness or tingling was reported. He denied any previous injury or symptoms in the ankle, leg, or lower back. He denied any medical complications such as diabetes, cardiovascular problems, or bone density issues.

His pain was first noticed 3 years prior to examination. He stated that when the pain began, it was only noticeable after he hiked longer than one hour, and when he stopped walking, the pain quickly resolved. He reported that he tried to go hiking at least once a week. One year prior to examination, without incident or a change in his

activity level, the pain grew more frequent and intense and his symptoms occurred with shorter walks of only 10 minutes duration. Once he stopped walking, the symptoms resolved within 30 minutes.

One year prior to attending physical therapy, the patient went to a podiatrist for evaluation and treatment. The podiatrist's x-ray and MRI were negative for pathology. The patient was fitted for and received orthotics, which did not provide relief. The patient also had electrical stimulation, which provided no improvement in his symptoms.

The patient, frustrated by the lack of a diagnosis and the chronic nature of his symptoms, referred himself to physical therapy for evaluation and treatment. His goal was to obtain a firm diagnosis and rapid treatment so that he could resume his weekly hiking without symptoms.

Clinical Examination

Initial observation of the foot demonstrated no redness, swelling, or warmth in or around the foot, and there were no observable abnormalities with his foot or trunk posture.[10,11] Direct palpation at the dorsal base of the fourth metatarsal reproduced his symptoms, but only when the foot was held in full plantar flexion. No other areas of palpation of the foot increased his symptoms. His gait pattern was then observed and no significant gait impairments were appreciated.[10,11]

His range of motion (ROM) was evaluated in both weight bearing and nonweight bearing. He was evaluated for weight bearing dorsiflexion with a standing knee bend and for plantar flexion he was asked to rise up on his toes.[12] He also performed a standing twisting motion to evaluate the quantity and quality of his pronation and supination.[12] He did not have any measurable limitations in his ROM measurements, but he reported symptoms at mid-range dorsiflexion and end-range plantar flexion.

His nonweight bearing motions were evaluated with standard goniometric measurements for dorsiflexion, plantar flexion, inversion, and eversion.[10] For all movements, no measurable limitations were noted. However, with assessment of the end feel, his dorsiflexion demonstrated a firm capsular end feel with restricted joint mobility when compared to the normal capsular end feel on the contralateral side.[13,14] All other motions had a normal end feel. Results are summarized in Table 1.

Manual muscle testing, ligament, and capsular stress tests were all performed as part of selective tissue tension testing in an effort to recreate his symptoms and assess for any pathology in the soft tissue.[10,15] Manual muscle testing was performed in both the neutral and lengthened positions for all muscles in the distal aspect of the leg and foot in an effort to fully stress the tissue.[15] All muscle tests were graded as 5/5 without any increased symptoms (Table 1). The ligaments were individually placed on stretch and then had traction applied and held for 10 seconds in order to maximally strain the tissue.[12,13] All ligaments were without laxity or recreation of pain (Table 1). The joint capsule was tightened by performing a manual joint glide to the end of its motion and held in that position for 10 seconds.[12] There were no manual joint glides that increased his symptoms (Table 1).

Following the selective tissue tension testing of the soft tissue, a detailed manual assessment of the joints of the foot and ankle was performed. All joint glides in the foot and ankle, except for the talocrural joint, were within normal limits.[11] Manual assessment of the joint glides for the talus' posterior glide on the tibia was limited with a restricted firm capsular end feel rather than the normal capsular end feel.[12,13] The talar swing test[13] (Figures 1 and 2) was performed and found to be restricted, with end range posterior and lateral rotation glides of the talus on the tibia.

Based on the combination of information from his subjective history and physical examination, it was determined that he had a physical therapy diagnosis of impaired joint mobility, motor function, muscle performance, and ROM associated with localized inflammation.[16] Specifically, in my professional opinion, he likely had a symptomatic stress reaction at the base of his fourth metatarsal. This stress reaction appeared to be secondary to a mechanical limitation of dorsiflexion at the talocrural joint which, via the kinetic chain, increased stress on the fourth metatarsal.

Table 1. Objective Exam Results

Test/Motion	Findings
Palpation of lower leg, foot, and ankle	Tender at the dorsal base of the fourth metatarsal
Manual muscle testing of all lower extremity muscles: hip, knee, ankle, and foot	All muscles 5/5 without increased symptoms
Ligament stress testing-Anterior and posterior talo-fibular, calcaneal-fibular, deltoid, anterior interosseous, bifurcate, medial and lateral subtalar, and anterior and posterior drawer	Negative for pain or laxity
Gait assessment	No pain or obvious deviations/limitations in motion
Posture assessment	No obvious faults, deviations, or asymmetries noted
Range of motion-hip and knee	All motions full without limitations
Range of motion-ankle	Plantar flexion 50°, inversion 35°, eversion 15°, dorsiflexion weight bearing 25°, nonweight bearing 20°. Reported pain at end range of nonweight bearing plantar flexion and mid-range weight bearing dorsiflexion. Restricted firm capsular end feel at end range of nonweight bearing dorsiflexion.
Range of motion foot	Equal bilateral supination and pronation
Joint mobility of all talocrural, tarsal and metatarsal articulations	Decreased posterior and lateral rotation glide with restricted firm capsular end feel of the talus on the tibia. All others with normal end feel and equal bilateral mobility

Intervention

As the primary cause of the patient's pain appeared to be a limitation in the glide at the talocrural joint, the interven-

Figure 1. Starting position for talar swing test.

Figure 2. The ending position of talar swing test used to assess for posterior and lateral rotation glides of the talus on the tibia.

tion was focused on increasing the mobility of the talocrural joint in an effort to reduce the excess stress on the fourth metatarsal. Due to the restricted firm capsular end feel during joint mobility testing, it was felt that the best treatment approach would be a high-velocity, low-amplitude traction joint manipulation.[14,17]

After deciding that a manipulation was the most appropriate intervention, the patient was provided with an explanation of the technique and verbal consent was obtained. This was followed by dural mobility testing with a straight leg raise and slump test,[11] both of which were negative. Following these precautions, a traction manipulation was applied to the talocrural joint[13] (Figure 3). A cavitation was heard and a palpable distraction of the joint was felt. The joint glides were rechecked and felt to have a normal capsular end feel. The talar swing test was reassessed and it demonstrated full joint mobility with the posterior glide and accessory lateral rotation glide when compared to the contralateral side. His non-weight bearing ROM was rechecked and found to be full with a normal end feel. The patient then performed weight bearing dorsiflexion and plantarflexion and both were full ROM without pain.

His home program was divided into two components. The first part was implemented to stabilize the mid-foot and allow the fourth metatarsal to heal. This was accomplished by encouraging the patient to wear shoes as much as possible for the first week. According to Morio et al,[18] when walking barefoot versus shod, there is significantly decreased torsional inversion, eversion, and adduction ROM when wearing shoes.

The second component of his home program was to maintain the mobility of his talocrural joint via active exercises. The first exercise worked on maintaining dorsiflexion in the joint by doing ankle and knee bends (Figure 4). The second exercise also worked on dorsiflexion, but emphasized lateral rotation of the talus by medially rotating the tibia relative to the talus during a knee and ankle bend (Figure 5). He was encouraged to perform these exercises for 10 repetitions 4 to 5 times per day.

The patient was satisfied with his understanding of his condition, the intervention he received, and his home instructions; thus, he did not wish to schedule any further treatments. However, we discussed talking in a few weeks to obtain a verbal follow-up. Also, he was aware that if symptoms returned in that timeframe he was to come back to the clinic for further intervention. At 6 weeks post-intervention, the patient was contacted by telephone for a verbal update. At that time, he reported that his foot had not bothered him since the evaluation and intervention. He reported that he was able to resume his weekly hiking without any symptoms.

DISCUSSION

In this case, it is observed that no one style of clinical reasoning dominated the thinking process. Instead, multiple strategies were employed to form a diagnosis, find a likely culprit for the pathology, and then determine an appropriate intervention. This follows the model put forth by Jones,[4] who stated that in order to fully understand and manage a patient's problem, 5 steps should be followed. These steps are: (1) find the source of symptoms, (2) discover any contributing factors, (3) note and observe any contraindications or precautions to examination and intervention, (4) manage patient symptoms and underlying contributing factors, and (5) determine a prognosis for the patient to return to the desired activity.

In examining this case, it can be seen how the open narrative approach helped to guide the forward reasoning, as well the hypothetico-deductive reasoning. During the interview, the patient mentioned his frustration with a lack of a diagnosis despite imaging. Also, he was discouraged with how the symptoms were worsening, and how he was not able to engage in painfree hiking, which was his primary form of exercise.

Based on several answers he provided during the narrative process, and using forward reasoning, it was felt that the patient was describing a classic stress reaction in his foot.[19] He described the pain in a localized spot when he pointed with one finger to the joint line of his fourth metatarsal and cuboid. He also noted that the symptoms were worse with walking and got better with rest. By having an understanding of the progression of stress reactions (Figure 6)[20] and how imaging may or may not be helpful in the diagnosis,[21,22] it is easy to understand why the patient felt great frustration.

Although forward reasoning helped to propel the possibility of a stress reaction, there was still uncertainty in the diagnosis of the painful tissue. To differentiate the pain in the foot, a hypothetico-deductive process was followed. Cyriax[15] reported that palpation of the foot has great importance and diagnostic accuracy. With the likelihood of a stress reaction as the source of pain, palpation was carried out to determine if there truly was a local tissue irritation. The patient's response to palpation helped determine the next step in the examination. If localized pain was present, then a full evaluation of the foot was needed. But if it was negative, then it was possibly referred pain that would require a more extensive evaluation of the whole lower quarter.[23]

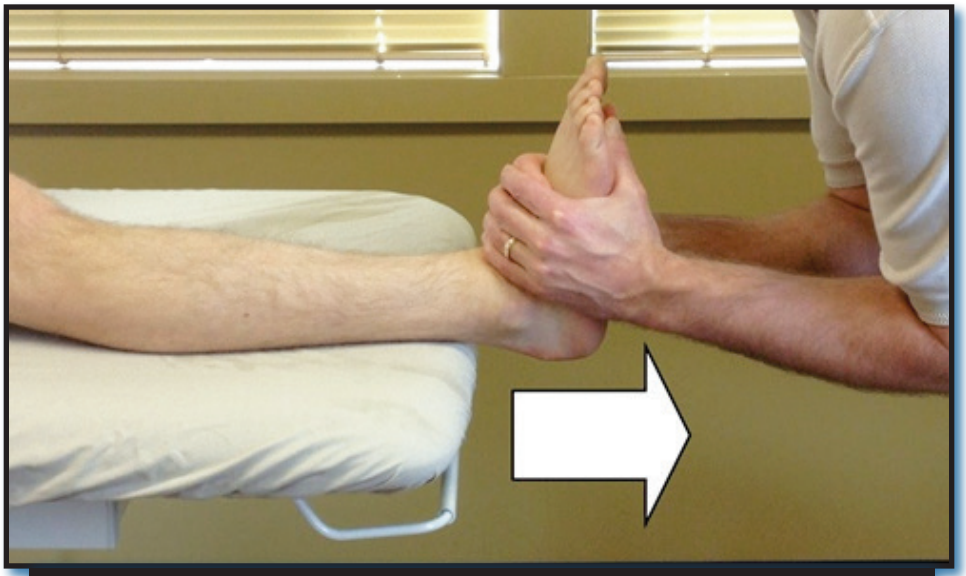

Figure 3. Traction manipulation of the talocrural joint.

Figure 4. Home exercise program emphasizing dorsiflexion at the talocrural joint by doing ankle and knee bends.

Figure 5. Home exercise program working on both dorsiflexion and lateral rotation of the talus under the tibia.

Therefore, with increased symptoms with palpation it was felt that it was a localized foot problem. However, to assess all of the other structures in the foot as potential sources of pain, selective tissue tension testing of all the muscles and ligaments was performed.[15] Since all of the tests that stressed the soft tissue were negative, it was reasoned that the pain was coming from the bone, most likely the fourth metatarsal.

While it was felt with confidence that the source of the pain was coming from the fourth metatarsal, the cause of the irritation was not known. At this time, a combination of the narrative process and forward reasoning was used. The patient described no changes to his training routine. Changes to a training regimen, typically too much volume, duration, or intensity too soon, are the most common ways to develop stress injuries.[19,24,25] With the most likely scenario eliminated, the next most logical step was considered. Since he described the pain as commencing solely with ambulation-based activities, it was then hypothesized that there was a fault in the kinetic chain during the gait cycle.[26]

The theory of the kinetic chain postulates that all parts of the body are connected together like a chain and work synergistically to produce the most efficient movement for the body.[26] Bony articulations are considered the links and the movement at these links are controlled by muscles, tendons, ligaments, and the neuromuscular system.[26] Because of the interconnectedness during closed chain activities, movement at any one link will create constrained and predictable movement patterns in the other links.[27]

Donatelli[28] however, suggests in the foot if there is altered motion in one of the links in the chain, the ability of the foot to attenuate force will be reduced and thus decrease its effectiveness as a shock absorber.[28] With modified shock absorption, the forces that are normally tempered at a particular joint or muscle may be transferred along the chain to another link.[28] This transfer can lead to an abnormal force production at a distant site and create microtrauma in the tissue.[26,28] If this variance is not corrected, it has the potential to progress to a pathologic breakdown of the tissue resulting in an injury such as a stress reaction.[26,28]

Unfortunately, there was no injury that would account for a change in the kinetic chain to help focus the joint examination. Therefore, a more general examination was used to assess the mobility of all the joints in the foot and ankle. It should be noted that a review of the literature found no studies that investigated the reliability of tarsal mobility or end feel testing. As a result a study by Staes and Banks[29] investigating mobility and end feel assessment of the carpals was reviewed. In this study, they found a moderate to good percentage of intra- and interrater agreement with mobility testing and very good intra- and interrater agreement with end feel assessment. In this study, the intrarater reliability was better than the interrater reliability. With moderate to very good agreement for mobility and end feel assessments, it was felt that assessing the joint both pre- and post-intervention was a reliable way to determine success of the manual intervention provided.

During examination, the only restriction noted was in the posterior and lateral glides of the talus on the tibia. Given these results, it was recognized that the talocrural joint had the only abnormal end feel. However, this amount of restriction in joint mobility was not enough to create an observable

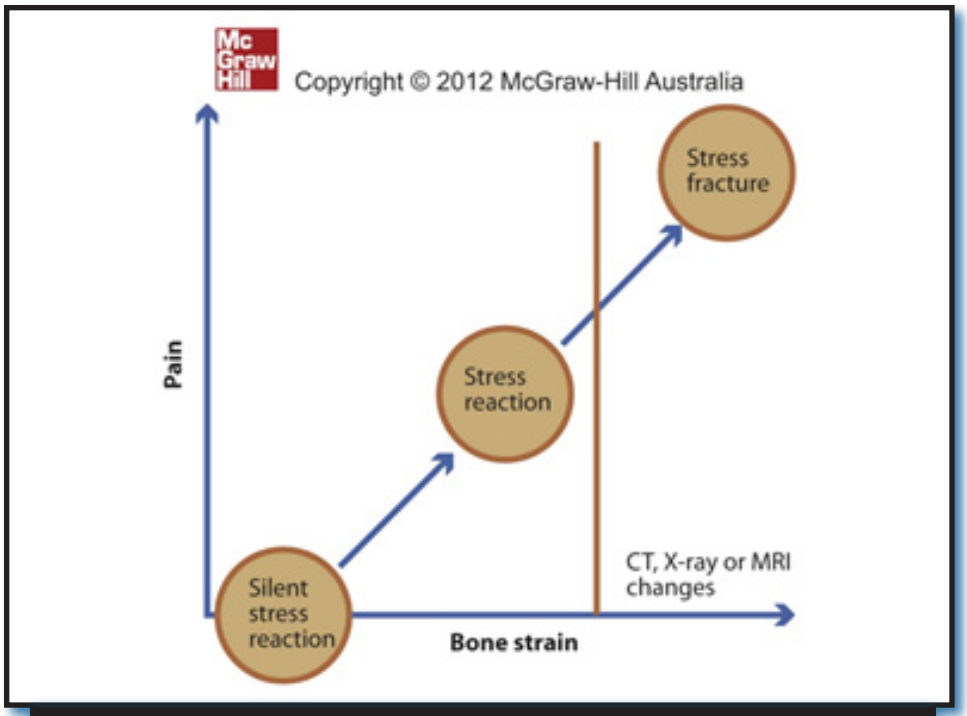

Figure 6. Progression of bone strain from silent stress reaction to stress fracture and changes on imaging. Reprinted with permission from Bruckner P, Kahn K.[20] *Clinical Sports Medicine*. 3rd ed. Copyright 2006, McGraw Hill Education.

or measurable loss of ROM. Knowledge of this limitation and an understanding of joint mechanics during the gait cycle provided a clearer picture of the kinetic chain dysfunction.

In order to obtain maximal dorsiflexion during the normal gait cycle, the talus has to be able to glide posteriorly as well as rotate laterally.[12,26] Therefore, according to the kinetic chain theory, with decreased glides of the talus on the tibia, the forces that are normally attenuated at this location were shifted down the chain.[26] In this case, it appeared to be transferred to the fourth metatarsal where it created excessive compression and microtrauma. Over time, this repetitive microtrauma most likely led to a symptomatic stress reaction.

When the limitations in posterior and lateral glides of the talus on the tibia were discovered, they were immediately treated with a traction manipulation. Since there were multiple glides that were restricted, a general traction manipulation was carried out rather than a unidirectional manipulation. The unidirectional manipulation would theoretically have only affected one glide and not the other. Although there is no evidence in the literature to back up this treatment decision, it was felt to have a sound theoretical framework and the treatment was thus carried out.

Little research is available pertaining to the use of exercise to maintain ROM following an ankle manipulation. However, there are numerous studies that have examined spinal manipulation and the use of ROM exercises following treatment to improve motor control and maintain the newly acquired ROM.[30-32] These studies consistently advocate for the use of exercise in addition to manipulation to achieve optimal patient outcomes. Therefore, it was prudent to reason that using both manipulation and a home exercise program would benefit this patient.

Finally, when looking at the narrative process, the main goal for this patient was to establish a diagnosis for his problem. As he was now armed with an understanding of the pain in his foot, the mechanical forces that are applied to it, and why the imaging was negative, he felt empowered to improve his problem. That knowledge, combined with an effective manipulation and establishment of a home program, gave him all the tools he needed in order to completely resolve his issue.

CONCLUSION

Every day, practicing physical therapists make decisions and judgments about the care they provide to patients. Accordingly, it would benefit all physical therapists to understand how these decisions are made and how they impact the care they provide. By having a deeper understanding of our own clinical reasoning processes, we are able to make improved decisions about our patients and provide exceptional care in the most cost-effective manner. Therefore, we owe it to our patients and our profession to gain a greater understanding of the concept and application of clinical reasoning.

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Effects of Kinesio Tex Taping on Discomfort Associated with Myofascial Trigger Points

Dawn T. Gulick, PhD, PT, ATC, CSCS
Jeff Cain, DPT
Scott Cheney, DPT
Danielle DeMarino, DPT
Matt Ettaro, DPT, ATC
Holly Green, DPT
Colin Keelan, DPT
Joel Varghese, DPT

Widener University, Chester, PA

ABSTRACT

The purpose of this study was to explore the effectiveness of Kinesio Tex (KT) tape on myofascial trigger points (MTrPs). Healthy participants (n=31) with MTrPs in their upper back participated. Two MTrPs were selected from the same muscle group on the right and left sides. Both MTrPs were assessed for discomfort thresholds (pretest) using the JTECH dolorimeter. One MTrP served as a control (no treatment) and the other was treated with KT tape. The KT treatment side was applied in a "star" format over the center of the MTrP for 3 days and then retested with the JTECH. A third assessment was completed 4 days after tape removal (follow-up). A one-way ANOVA with repeated measures on time revealed no statistically significant differences. Kinesio Tex (KT) tape has been theorized to shorten muscle fibers to decrease afferent 1a discharge from the spindle, decrease motor neurons of anterior horn, decrease H-reflex, and produce MTrP inhibition with decreased pain. This study did not demonstrate a statistically significant improvement in discomfort from MTrP. Further studies should consider the use of another KinesioTaping technique, reapplying the tape each day, or extending the time period of tape application.

Key Words: KinesioTaping, myofascial pain, muscle pain

INTRODUCTION

Travell and Simons clinically defined a myofascial trigger point (MTrP) as "a hyperirritable spot in skeletal muscle that is associated with a hypersensitive palpable nodule in a taut band."[1(p5)] Myofascial trigger points can develop from a number of conditions: genetics, aging, and performing a strenuous activity as part of a sedentary lifestyle.[2] Myofascial trigger points can be the result of an acute injury or occur from cumulative microtrauma. Examples of cumulative trauma are abnormal posture, repetitive motion, or psychological stresses.[1,3,4] Formation and presence of a MTrP is correlated with muscle pain, weakness, and dysfunction.[1,5-13] A variety of modalities have been purported to relieve or diminish the symptoms associated with MTrPs. These include massage,[1,14-19] needling,[1,6,20-25] vapocoolant spray and stretch,[1,13,26] electrical stimulation,[27-30] laser therapy,[2,27,31-33] ultrasound,[34-42] diathermy,[43] and ischemic compression.[44,45]

Taping is a common method of treatment for various injuries. Numerous athletes have used KinesioTaping to address a variety of musculoskeletal pathologies. Although founded in 1979, KinesioTaping became a high profile intervention at the 2008 Olympic Games. Kinesio Tex tape (KT tape) (Kinesio USA, Albuquerque, NM) is a special form of tape that is reported to have a texture and elasticity similar to human tissue. By pulling in distinct ways, these tissues are believed to be either facilitated (proximal to distal) or inhibited (distal to proximal). In the case of a MTrP, KT tape is applied to inhibit muscle firing, thereby reducing the level of discomfort. Kinesio Tex tape has been proposed to place the muscular fibers on slack, which produces a decrease in the afferent Ia discharge from the neuromuscular spindles, causing a reduction in the motor neurons of the medullar anterior horn and diminished amplitude of the H reflex.[46-49] Potentially lowering muscular tone might explain the MTrP inhibition and the decrease of discomfort. Despite its popularity, scientific studies on KT taping are lacking. Anecdotal reports support the efficacy of the use of KT tape for the treatment of MTrPs. This study is a component of a larger research agenda of the primary investigator (DTG) to explore the most efficacious treatment method for MTrP.[42,45] The purpose of this study was to compare the effects of Kinesio Tex taping on MTrP discomfort by comparing to that of a control in which no treatment was rendered.

METHODS

Participants

Healthy participants (n=31) over the age of 18 with two MTrPs in their upper back (one on the left side, one on the right side) were recruited. Exclusion criteria were: (1) individuals with sensory deficits or skin lesions including but not limited to acne, cellulitis, or infections in the area of the trigger points, (2) a personal history of cardiovascular problems, cancer, diabetes mellitus, or tuberculosis, and (3) anyone receiving treatment for, or having a prior history of, shoulder, neck, or upper/midback surgeries.

Materials

An algometer/dolorimeter (JTECH Medical, Salt Lake City, UT) with a one-cm diameter tip was used to measure pressure sensitivity (grams) of the participants' MTrPs (Figure 1). Test-retest reliability of this instrument in assessing muscle soreness has been previously reported as r = 0.91-0.95.[50-52] All equipment was calibrated prior to the initiation of the study. All JTECH assessments were performed by the same researcher (SC) to assure consistency in technique. Kinesio Tex tape was used as the taping treatment. This product brand is a special form of tape that is advertised to have a texture and elasticity similar to human tissue (Figure 2).

Procedures

Participants signed a consent form approved by the University Institutional Review Board for the Protection of Human Subjects. The procedure was explained to the participants but they were not biased by any knowledge of the potential effects of the KT tape. The subjects were positioned with their forearms on a plinth and their head on their forearms, face down on

Figure 1. J-Tech dolorimeter.

Figure 2. Kinesio Tex tape.

a pillow/towel roll. The researcher (DTG) detected the MTrPs by palpating for taut muscle bands in the upper and mid-back. Two MTrPs were selected in a corresponding muscle group on the right and left sides (eg, right and left levator scapula muscles). During the pretest, an algometer/dolorimeter (JTECH Medical, Salt Lake City, UT) with a one-cm diameter tip was used to measure the participants' MTrPs (Figure 1). Test-retest reliability of this instrument in assessing muscle soreness has been previously reported as r = 0.91-0.95.[50-52] The equipment was calibrated prior to initiation of the study. All assessments were performed by the same researcher (SC) to assure consistency in technique. Kinesio Tex tape was used as the taping treatment. This product is a special form of tape that is advertised to have a texture and elasticity similar to human tissue (Figure 2). Pressure was slowly applied by the investigator until the participant reported that the pressure reached the threshold of discomfort. The level achieved was recorded for each MTrP. Measurements were recorded by a different researcher (CK) so that the tester was blinded to the measurements (Figure 3).

Subjects were assigned a number from 1-35 for data collection purposes. Subjects assigned an odd number had the MTrP on the left side treated with the taping procedure and those assigned an even number were treated on the right side. The treatment side had KT tape applied to inhibit the MTrP. Four pieces of 4" long KT tape was applied in a "star" pattern over the center of the trigger point (Figure 4). As per the manufacturer's recommended inhibitory technique, 35% tension was applied to the tape. Tape strips were applied as follows (Figure 5): (1) the first strip was applied from inferior to superior, (2) the second strip was applied from medial to lateral, (3) the third strip was applied from bottom left to top right, and (4) the fourth strip was applied from bottom right to top left.

The nontreatment (control) side received a small, one-inch diameter single piece of KT tape over the MTrP with no tension applied. This single piece of tape simply served as a marker for the location of the control MTrP. The tape was left on the subjects for 3 days. The adhesion of the tape was checked on a daily basis. If edges of the tape began to curl, they were re-secured. At the conclusion of the intervention phase, the tape was carefully removed and a post-test dolorimeter assessment was performed. Another small piece of KT tape was then placed without any tension on each of the MTrPs to mark the location for the final pressure reading made at follow-up 4 days later.

DATA ANALYSIS

A one-way analysis of variance (ANOVA) with repeated measures (time) was performed for the dolorimeter measurements (soft tissue discomfort). Significance was set at the $p = 0.05$ level. A Bonferroni post-hoc analysis was also performed if significance was found.

RESULTS AND DISCUSSION

Thirty-five participants began the study but 4 participants were excluded from data analysis due to lack of thorough adherence of the tape. The means and standard deviations of the treatment and control groups are displayed in Table 1. A graph of the change over time by treatment group is displayed in Table 1. The ANOVA was not significant for either of the main effects of treatment or time, or the interaction of treatment and time ($p > 0.05$). Power for this study was calculated to be 0.809.

Simons[13] proposed that taut bands in a muscle are attributed to excessive acetylcholine release at the motor endplates resulting in compression of capillaries, decreased local blood flow, ischemic tissue, a limitation in oxygen, and glucose availability, and ultimately an "energy crisis." Myofascial trigger points in the upper trapezius muscle have been found to have higher concentrations of inflammatory mediators.[53] They also have a lower pressure point threshold and increased pain intensity.[42,45,51,54]

In the current study, an interesting development was the increased sensitivity of the control MTrP in the post-test assessment. The authors surmise that the use of the dolorimeter for baseline testing may have

Figure 3. Technique used to assess trigger point discomfort.

Figure 4. Kinesio Tex star taping technique.

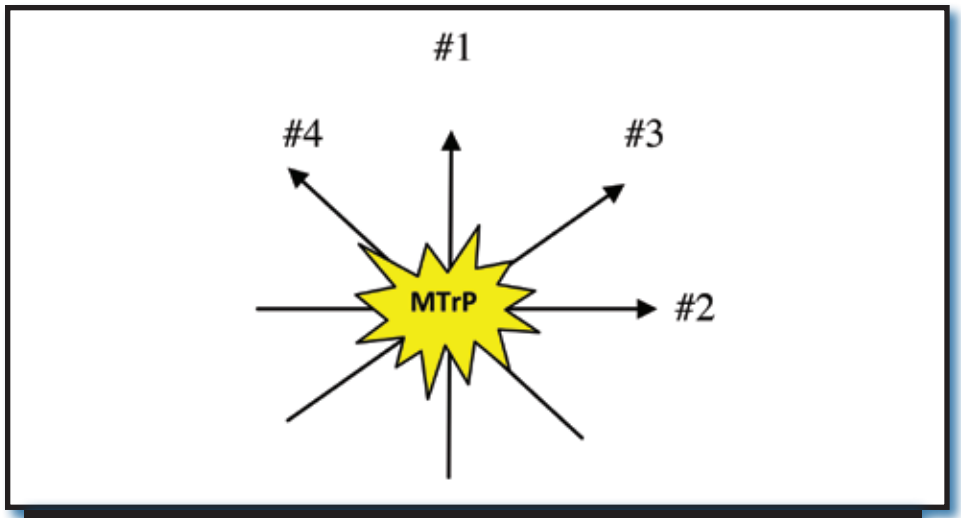
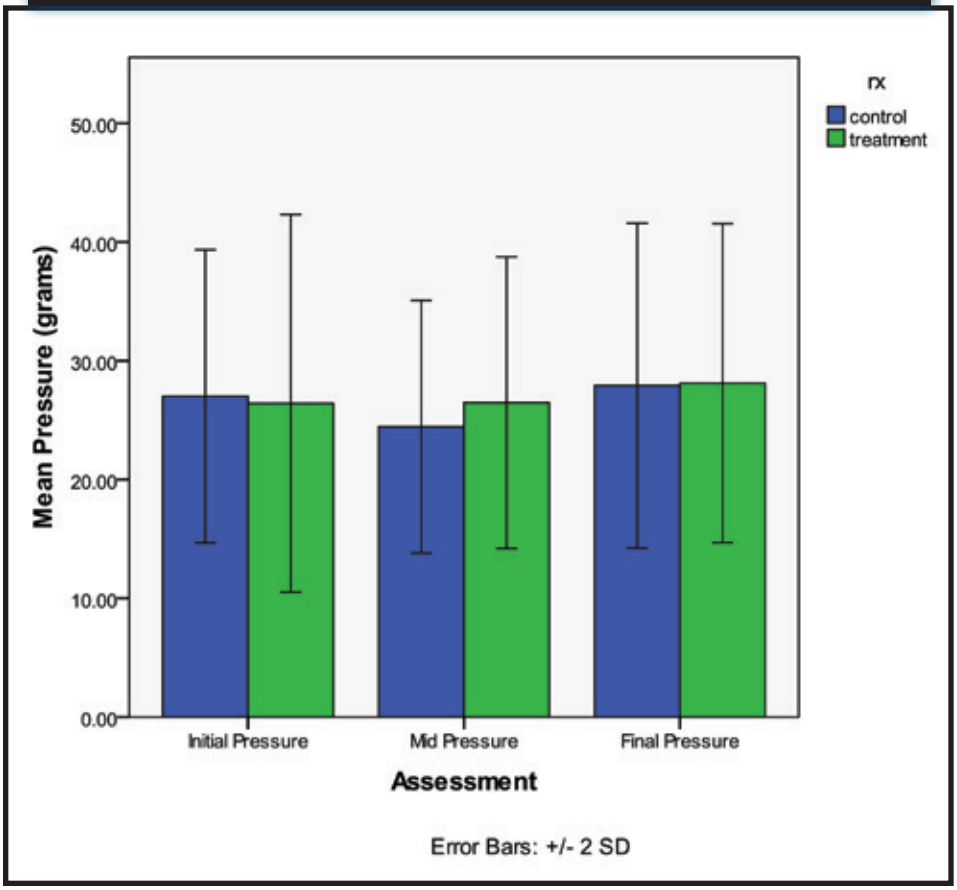


Figure 5. KinesioTex taping pattern for a myofascial trigger point.

Table 1. Means and Standard Deviations of Myofascial Trigger Point Pressure Tolerance

	Pretest	Posttest	Follow-up
KT taping	26.42 ± 7.95	26.47 ± 6.14	28.12 ± 6.71
Control	27.01 ± 6.17	24.45 ± 5.32	27.91 ± 6.84

Table 2. Comparison of Pressure Tolerance in Treatment versus Control Groups



caused the MTrPs to "flare up,"[45,55] resulting in a decrease in pressure tolerance for the control group at the post-test assessment. Although not statistically significant, the taping treatment may have had an influence on the MTrPs to off-set the influence of the dolorimeter pressure. Upon the removal of the KT tape, both MTrPs returned to the baseline measurement by the 4-day post-treatment follow-up. There may be several reasons for these results. Perhaps the KT taping star pattern is not the optimal choice for MTrPs. Another KT taping option might be to identify the muscle in which the MTrP is located and then apply strips of tape from the distal to the proximal attachments to inhibit the muscle tension. Perhaps the tape could have been left on longer or re-taped each day to optimize the inhibitory effect on the MTrP.

In summary, this study did not demonstrate a statistically significant improvement with the use of the KT taping technique for the release of MTrPs in the upper back. Future studies should explore different taping protocols to examine how they influence the signs and symptoms of MTrP pathology.

ACKNOWLEDGMENT

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Return to Running After a Tibial Stress Fracture: A Suggested Protocol

Emily Bolthouse, DPT, CSCS[1]
Allison Hunt, DPT, CSCS[1]
Karen Mandrachia, DPT, CSCS[1]
Lauren Monarski, DPT[1]
Krishinda Lee, DPT, CPT[1]
Faculty Mentor: JK Loudon, PT, PhD, SCS, ATC, CSCS[2]

[1]Doctor of Physical Therapy Student at time of submission, Doctor of Physical Therapy Division, Department of Community and Family Medicine, Duke University School of Medicine, Durham, NC
[2]Associate Professor, Physical Therapy Education, Rockhurst University, Kansas City, MO

ABSTRACT

Background and Purpose: Typical treatment of tibial stress fractures requires cessation of weight bearing activity followed by a gradual return to running. The purpose of this review was to examine the evidence behind increasing running mileage by 10% per week and develop an evidence-based return to running program. **Methods:** A literature search was conducted using search terms related to running, stress fractures, and bone healing. Relevant articles were identified through a 3-stage study selection process. **Findings:** The search produced 15 articles. One article contained a randomized controlled trial examining a graded training program. Eight articles contained return to running protocols. **Clinical Relevance:** This article provides an evidence-based protocol encompassing the most important aspects of stress fracture management. **Conclusion:** An original source or evidence for use of the 10% guideline was not found. Several articles suggested protocols or evidence for certain aspects of treatment, but none provided a complete evidence-based guideline or treatment plan.

Key Words: bone, injury, rehabilitation, sport

INTRODUCTION AND BACKGROUND

Long distance running is a commonly practiced means of engaging in exercise, physical activity, and leisure among the general population. Easy accessibility and a growing interest in disease prevention contribute to its increasing popularity.[1] Although distance running provides many positive health effects, injuries can and do result from this training mode. Overuse injuries frequently occur in the lower extremities due to repetitive tissue stress.[1] Edwards et al[2] estimate that 26% of recreational and 65% of competitive runners will sustain some form of overuse injury in any given year. Further, a higher incidence of injury has been appreciated in runners with previous lower extremity pathology.[1]

One overuse running injury that commonly plagues both elite and recreational athletes is a stress fracture. Stress fractures account for 15% to 20% of overuse injuries in runners.[2] A stress fracture is a mechanical failure of the bone in which activity of the osteoblasts cannot keep pace with activity of the osteoclasts. A repetitive, cyclical loading of the bone with inadequate recovery transpires and the bone is unable to repair itself between exercise sessions.[3] Unfortunately, the repetitive and high loading nature of running creates an ideal environment for stress fracture development. Other factors such as an increase in training intensity, running on hard surfaces, inappropriate footwear, and poor biomechanics may contribute as well.[4] The tibia is reported to be the most common site of stress fracture occurrence, accounting for 35% to 56% of all stress fracture injuries.[5] Tibial stress fractures in runners are most commonly located at the junction of the middle and distal thirds of the tibia along the tibial shaft.[6]

Etiology of Injury and Risk Factors

A number of extrinsic and intrinsic elements are considered risk factors for tibial stress fractures. An extrinsic element is an external factor that can impose additional stresses on the bone while running. Examples include training regimens, footwear, and running surfaces. An intrinsic element is an internal factor that can impose additional stresses to the bone. Examples of intrinsic elements include running mechanics, anatomical variations, and individual health factors including poor bone health (osteoporosis and low bone density).

Evidence suggests that improper training regimens are a key extrinsic factor in the occurrence of stress fractures. According to Reeder et al,[3] it is important to focus on the runner's training regimen and history in order to identify potential injury-causing factors. A sudden increase in the intensity and duration of training puts the runner at risk for developing a stress fracture.[7] A study by Matheson et al[8] states approximately 30% of athletes who had stress fractures incurred the injury within 12 weeks of a change in training regimen. The mileage run per week can also be a factor in the occurrence of stress injuries. Higher mileage per week is associated with increased risk of overuse injuries.[7] Studies show that running more than 64 km/week (approximately 40 miles/week) is a significant risk factor for lower extremity injuries.[9] Likewise, limited evidence suggests running year round without a break from training is a significant risk factor for lower extremity injuries.[1]

Other changes in training regimen such as changes in running surfaces or footwear are associated with injury as well.[3] Both Ballas et al[7] and Taube et al[10] suggest running on hard surfaces consistently (such as concrete) may increase the risk of stress fractures. Conversely, van Gent and colleagues[1] suggest the evidence behind this association is limited. Although some studies show footwear can play a preventative role in stress injuries overall, it may not play a significant role in the reduction of tibial stress fractures specifically.[11] Some evidence suggests that proper footwear may be a protective factor for female runners only.[1]

Inappropriate running mechanics are common intrinsic factors associated with stress factors. Specifically detrimental are running mechanics such as deviations in hip and ankle motions that increase tensile forces on the tibia.[5] Abnormal kinematics during running can also contribute to altered loading patterns on the tibia.[5] Pohl et al[5] identified increased peak hip adduction, peak rearfoot eversion, and peak absolute free moment as significant predictors of tibial stress fractures. Hindfoot and forefoot varus and compensatory hyperpronation were also linked to tibial stress injuries.[12]

Bennell et al[13] describe reduced muscle size and strength, particularly in the calf muscles, as another predisposing factor to stress fractures. Additionally, the interplay between running mechanics and factors related to bone healing suggest that changes in stride length and running speed may also be important to consider as an athlete returns to running.

Anatomical factors play a role in predisposition to stress fractures. Clinically relevant leg length discrepancy is found to increase the likelihood of stress fractures in an athletic population.[13] A pes cavus foot is linked to stress fracture incidence; because this foot type is more rigid, it does not absorb shock and passes impact forces to the tibia therefore increasing risk for a tibial stress injury.[13] Abnormal lower extremity range of motion such as increased hip external rotation and decreased ankle dorsiflexion are also associated with stress fractures.[13]

There are also physiological factors that affect injury risk. A history of injuries is a significant health factor associated with lower extremity injury, as is poor physical fitness before beginning a training regimen.[1,14] Additionally, females are more likely to develop stress fractures.[1] This may be due to lower bone density as compared to males.[5] Females may also suffer from amenorrhea due to high training levels, abnormal eating patterns, and decreased body weight (commonly known together as the female athlete triad). Amenorrhea is linked to low bone mineral density and susceptibility to stress fractures.[3]

Intervention

Typical intervention for a tibial stress fracture requires full cessation of weight bearing activity followed by a gradual return to painfree activities.[15] Raasch et al[11] reported that runners are often noncompliant with the recommended full cessation of running, as they commonly exhibit a "need to run attitude." The high motivation of this population to return to sport quickly calls for the careful compilation of an appropriate and gradual return-to-running protocol that takes into account the many factors involved with successful healing of a tibial stress fracture. Unfortunately, there are few concrete guidelines established to assist runners during the "return to running" process. One such guideline that is commonly referenced in this regard is the "10% rule."[7]

The 10% rule suggests that runners increase their mileage by no more than 10% per week. Incrementally increasing running volume is a factor in preventing an overuse or reinjury as it allows the body to gradually adjust to external impact forces.[16] The 10% rule alone however does not adequately address the variance among runners, or the numerous factors that can contribute to a stress fracture. In fact, Bennell et al[13] reported there are no published studies comparing different return to running programs that include evidence for progressive increases in loading. Despite the lack of evidence, the 10% rule has become a well-known standard rehabilitation protocol for returning runners to their prior level of training. Therefore, the purpose of this review was to examine the evidence behind the 10% rule for return to running following a tibial stress fracture, and to develop an evidence-based and safe return to running program post tibial stress fracture.

METHODS

Search Strategy

The databases of Medline, SportDiscus, EMBASE, PEDRO, CINAHL, the Cochrane Library, and the National Guideline Clearinghouse were searched for relevant literature. The following search terms were used: stress fractures, running/injuries, running/education, athletic injuries, lower extremity injuries, fracture/bone healing, physical education training/rehabilitation, cumulative trauma disorders, and exercise therapy/therapy. The search was limited to English-language articles published within the last 20 years. Initially, all papers associated with lower extremity athletic related injuries were included. Articles were excluded if subjects in the study were either less than 18 or greater than 65 years of age.

Study Selection

The study selection was a 3-stage process. The first stage evaluated relevance to this topic by reviewing the article titles. The article was included if the title met at least one of the following criteria: related to a fracture of the lower extremity, referenced a running protocol, or discussed the rehabilitation process for return to running. A total of 4 reviewers participated in this stage. The articles generated by the initial search were divided in half. Two reviewers were assigned to each half. Each reviewer individually identified articles that met the selection criteria. All articles identified as meeting the search criteria were included in the next stage of review, even if only one of the two reviewers identified it as relevant.

The second stage in the study selection process consisted of one reviewer further assessing the title and qualitatively reviewing the abstract of each paper. For a paper to be retained for further scrutiny, the title or the abstract had to be associated with tibial fractures, use humans as subjects, or allude to running related protocols. Exclusion criteria for this stage of the selection included femur, fibula, tarsal and foot bone fractures, muscular related running injuries, and lower extremity injuries related to athletic activities other than running.

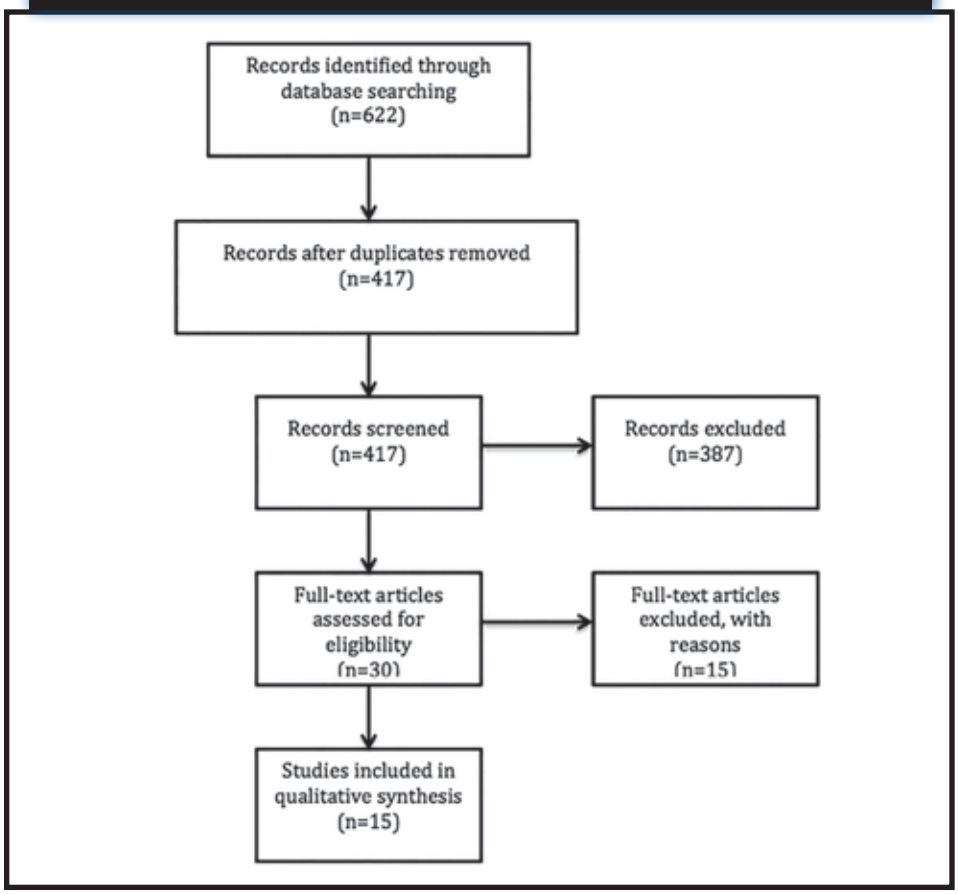
The third and final stage of the study selection involved two reviewers reading the title, abstract, and full text of each article, again searching for relevance to our review's purpose. Papers included during this final stage were confirmed via reading of the full text to include clear references to risk factors associated with stress fracture in addition to return to running protocols, or currently accepted treatment of tibial stress fractures. Papers were excluded if they were opinion pieces/case studies, included only a limited population (females only, military only, professional athletes only), or were determined to be unrelated to our purpose (psychological readiness for return to sport). Each reviewer assessed the articles independently. In the event of a disagreement between the two reviewers, a single third reviewer was asked to read the article and make an inclusion decision. The types of studies that were reviewed for inclusion were randomized controlled trials, case studies, and systematic reviews.

After these 3 stages of the initial study selection, we performed a final search to identify any additional relevant articles that could contain helpful information related to our purpose and may have previously been missed. To do this, the references of all articles that remained were compiled into a master list. Duplicates and all articles previously screened out during the selection process were removed from this list. From those articles that remained, we hand searched to identify articles with information relevant to our review and scrutinized each using the same 3-stage process (Table 1) previously described.

Protocol Creation

In order to create our own protocol, we gathered the components of each existing protocol from the articles we accepted for use in our study into one large document, separately listing each component. Components varied widely amongst the protocols and included elements such as a non-weight

Table 1. PRISMA 2009 Flow Diagram



bearing (NWB) phase, cryotherapy, hamstring stretching, strengthening, and return to activity. Using the literature we identified through our original search, as well as separate searches if necessary, we cited the existence and level of evidence behind each component separately (Table 2). If there was no evidence available for any listed component, it was excluded from the final protocol. Once all the evidence was graded, we organized it in such a way that the order and progression was logical. We used the Agency for Healthcare Research and Quality criteria to grade the evidence (Table 3).[22]

RESULTS

Search Results

Through database searching, 623 records were identified. After duplicates were removed, 417 publications met the inclusion and exclusion criteria for the title. Of these 417 publications, 387 were excluded based on the title and abstract. This left 30 full-text articles to be assessed for eligibility for inclusion. Fifteen of those articles were excluded due to inappropriate sample population and lack of protocol relevance, leaving 15 articles for inclusion in this study. The final hand search did not generate any additional articles used in this review (Table 1).

Validity of 10% Rule

Of the 15 articles produced by this search, none specifically examined and demonstrated the validity of the 10% rule for increasing mileage in running. Arendt et al[17] examined the occurrence rate of stress fractures in Division I athletes (in all sports including track and cross country but excluding football) at the University of Minnesota over a 10-year period. Although, this study was able to show that 48% of the stress injuries to bone could be correlated to a change in training regimen.[17] This study however did not specifically examine a 10% increase in mileage per week in the running athletes. The study also indicated higher grade stress injuries required a significantly longer time to return to full activity than lower grade stress injuries.[17]

Existing Protocol Review

Eight of the articles located through our search included protocols for return to running after stress fracture. We extracted categories of information from each article including the initial weight bearing status of the patient, recommendations for cross-training, and intervention based on specific identified intrinsic and extrinsic risk factors. There were several discrepancies and differences between these protocols regarding each of these categories. For example, recommendations related to weight bearing ranged from NWB to weight bearing as tolerated (WBAT) by the patient. Similarly, intervention recommendations ranged from modalities such as ice, transcutaneous electrical nerve stimulation (TENS), and ultrasound to changes in training surfaces. The lack of standardization regarding stress fracture management and return to running postinjury indicates validity of our purpose, the necessity of careful examination of existing evidence. Additionally, it indicates the usefulness of compilation of the best-supported portions of each protocol into a new and comprehensive return to running program. It should be noted that we do not support a "one size fits all" approach to treatment of any dysfunction. We do however, support the creation of a general protocol that includes specifically graded evidence for each intervention and allows clinicians to make educated decisions as they adapt it to each individual patient. In recognition of this, although several protocols were identified, we noted that none offered evidence that the interventions included had been tested in a systematic scientific fashion, nor did any of the identified protocols specifically grade their evidence.

DISCUSSION

While compiling the current evidence regarding return to running after a tibial stress fracture, multiple protocols were found. Although many of these protocols call upon the existing evidence regarding factors such as running mechanics and bone healing, none of the protocols grade the evidence behind their protocol development and activity recommendations. Since these protocols do not contain graded evidence for their interventions, we identified a need for an updated evidence-based return to running protocol for athletes with tibial stress injuries. This new protocol (Appendix) compiles the evidence behind the causes and the modifiable risk factors of tibial stress injuries and the existing return to running protocols. Again, the graded evidence behind each component of the new protocol is presented in Table 2.

Table 2. Graded Evidence

<table>
<tr><td colspan="4">Phase I: Rest</td></tr>
<tr><td>PHASE I: 3-10 days</td><td colspan="3">Initial Exercises</td></tr>
<tr><td>Goal</td><td colspan="3">Minimize pain, inflammation, and edema
Promote proper tissue healing
Strengthen proximal musculature
Stretch tight musculature</td></tr>
<tr><td>WB</td><td colspan="3">Nonweight bearing until walking pain-free</td></tr>
<tr><td>Precautions</td><td colspan="3">Do not force weigh bearing status, progress as pain allows</td></tr>
<tr><td>Progression Criteria</td><td colspan="3">Painfree during all exercises
May progress to Phase II exercises when walking is pain-free for half mile</td></tr>
<tr><td>Treatment Suggestions/Precautions</td><td colspan="3">Education: etiology, footwear, training factors, nutrition, risk factors, biomechanics, the recovery process
Pain management: rest, cryotherapy
Exercises:</td></tr>
<tr><td></td><td>Name</td><td>Level of Evidence</td><td>Description</td></tr>
<tr><td></td><td>Cryotherapy (Hubbard and Denegar, 2004)</td><td>Moderate</td><td>Use until swelling subsides</td></tr>
<tr><td></td><td>Sidelying hip abd/ER (Reiman et al, 2012)</td><td>Moderate</td><td>Sidelying with hip flexion, raise flexed lower extremity</td></tr>
<tr><td></td><td>Bird-dog quadruped (Reiman et al, 2012)</td><td>Moderate</td><td>Kneel on all 4 extremities, with contralateral arm/leg lift</td></tr>
<tr><td></td><td>Gastrocnemius and soleus stretch (Fredericson M, 1996)</td><td>Moderate</td><td>Long-sitting, use foot strap for gastrocnemius. Seated, knees flexed with foot strap for soleus</td></tr>
<tr><td></td><td>Hamstring stretch (Fredericson M, 1996)</td><td>Moderate</td><td>Long sitting, reach for toes</td></tr>
<tr><td></td><td>Nonweight bearing until painfree (Arendt et al, 2003)</td><td>Strong</td><td>Do not load the lower extremity until pain is 0/10</td></tr>
<tr><td colspan="4">Phase II: Cross Training</td></tr>
<tr><td>PHASE II: 4-7 weeks</td><td colspan="3">Transition Exercises</td></tr>
<tr><td>Goals</td><td colspan="3">Gradually increase muscle strengthening activities into weight bearing activities
Incorporate cardiovascular conditioning via low-impact cross-training
Reintroduce multi-planar movement
Continue to stretch tight musculature
Begin core strengthening
Reintroduce jogging</td></tr>
</table>

WB	No limitations in weight bearing for daily activity
Precautions	Do not overstress during strengthening activities Proper education and supervision are required for elliptical use No more than 30 minutes daily for lower extremity conditioning, but no limitations for upper extremity conditioning Alternate strength and cardiovascular training by every other day For any pain, regress exercise protocol by one week Do not start jogging before week 3
Progression Criteria	Painfree during all exercises May progress to Phase III exercises when patient can jog 10 minutes painfree
Treatment Suggestions/Precautions	Exercises:

Name	Level of Evidence	Description
Low impact cardiovascular training (Arendt E et al, 2003)	Strong	Walking, deep water pool running, aqua walking/jogging, stationary bike, elliptical training
Non-competitive freestyle swimming	Moderate	Freestyle swimming using upper and lower extremities to propel the body forward
Upper extremity ergometry (Taube RR & Wadsworth, LT 1993)	Moderate	Adjust arm resistance as tolerated
Gastrocnemius, soleus and hamstring stretch (Fredericson M, 1996, Taube RR & Wadsworth LT, 1993)	Moderate	Stand on slant board with LE extended or flexed for gastrocnemius and soleus, respectively. Long sitting with foot strap for hamstrings
Heel raises (Taube RR & Wadsworth LT, 1993)	Moderate	Standing and lifting heels off of the ground
Bridge/plank and side bridge (Reiman et al, 2012)	Moderate	Prone or sidelying, raise trunk while WB through forearms and knees/toes
Side stepping with abductor band (Reiman et al, 2012)	Moderate	Initially, side step without a band; Place band proximal to ankle and step laterally
Two leg bridging (Reiman et al, 2012)	Moderate	Supine, knees flexed and feet flat on the table. Raise pelvis off the table. Maintain neutral spine and pelvic alignment
Lunge (Reiman et al, 2012)	Moderate	Standing, flex single hip and knee forward into lunge position. Make sure knee does not pass toes and hip, knee, and 3rd toe are in proper alignment

(Continued on page 42)

Table 2. Graded Evidence *(Continued from page 41)*

Phase III: Running			
PHASE III: 4 weeks	**Running Exercise**		
Goals	Restore muscular strength Restore cardiovascular endurance Incorporate sport-specific plyometrics Educate proper running form, biomechanics, and training Maintain strength training and flexibility from Phase II exercises Progress to pain-free running at moderate intensity		
Precautions	Two week progression and one week regression If any pain, regress exercise protocol by one week		
Progression Criteria	Make appropriate adjustments to running stride (cadence, stride length, speed) Gradually increase mileage and intensity		
Treatment Suggestions/Precautions	Exercises:		
	Name	**Level of Evidence**	**Description**
	Elliptical training (Raasch WG & Hergan DJ, 2005)	Moderate	Lower extremity and upper extremity cyclic movement on cross trainer
	Sport-specific drills (Podlog et al, 2010)	Moderate	Progress forward hops, bounding, step hops, high knees, etc.
	10% stride length reduction (Edwards B et al, 2009)	Moderate	Smaller steps while running
	Decrease running speed by 1 m/s (Edwards B et al, 2010)	Moderate	Reduce running pace
	Running progression (Liem BC, Truswell HJ & Harrast MA, 2013)	Low	Progress conservatively; watch for compensations in gait

Suggested Protocol

Our return to running protocol comprises 3 phases. The first phase (Phase I) is a resting phase. This phase begins as soon as a tibial stress injury is identified. Once diagnosed, the runner is then classified into one of two groups. Group I contains runners that are at a high level of fitness (clinician estimated VO_2max ≥ 45 ml/kg/min), are of younger age (≤ 35 years of age), have good bone health, do not have a history of previous stress injury, have minimal pain at rest (≤ 3/10 as measured by a numeric pain rating scale) and early detection of their stress fracture (within one month of pain onset). Group II contains runners who have a high pain level at rest (> 3/10), history of previous lower extremity running related injury, low to mid-level fitness levels, later identification of injury after initial pain onset, poor bone health (evidence of osteopenia, osteoporosis, or other factors such as the female athlete triad), or for any other reason are not appropriate for Group I. During this phase, runners in both groups are recommended to be NWB until the athlete is painfree at rest and cleared to weight bear by their physician. The focus of intervention will be on educating the athlete, pain management, assessing muscular imbalances, strengthening and stretching. After the runner is painfree at rest, they can begin walking/weight bearing as part of their normal activities of daily living (ADLs).[10] Once the member of group one can complete their ADLs for 3 to 5 days painfree, they move on to the next phase (Phase II).[17] Members of Group II must be painfree with ADLs for 7 to 10 days before moving to the next phase.[7] If at any time the runner starts to experience pain again, they must return to Day 0 of their painfree rest day count and progress through the phase as before.

Phase II of the protocol is the transition and cross-training phase. The focus of this phase is to progress strengthening exercises and introduce cross-training as tolerated. This phase also begins to introduce high impact activity in a cyclical nature in order to allow for proper bone healing. Our research suggests that one full cycle of bone healing will take 16 to 24 days (about 3 weeks), and that extra care should be taken during the last 6 to 10 days of this cycle to avoid overstressing the new deposition.[4] Submaximal loading is important during the first two weeks as this stress stimulates the activity

Table 3. Agency for Healthcare Research and Quality (AHQR) - Strength of Evidence

Strong	**High confidence that the evidence reflects the true effect.** Further research is very unlikely to change our confidence in the estimate of effect.
Moderate	**Moderate confidence that the evidence reflects the true effect.** Further research may change our confidence in the estimate of effect and may change the estimate.
Low	**Low confidence that the evidence reflects the true effect.** Further research is likely to change the confidence in the estimate of effect and is likely to change the estimate.
Insufficient	Evidence is either unavailable or does not permit a conclusion.

of osteoblasts. Given this, our cycles are 3 weeks in length with the third week reserved for reduced loading. During this phase, the runner must remain painfree in order to allow continuation through the protocol. If the runner experiences pain, they return to the previous week's activity level. By the end of this phase, runners of both groups will complete 10 minutes of painfree light jogging before moving onto the final phase of the protocol.

Phase III of the protocol is the return to running phase. This phase focuses on continued education of the runner as well as making minor adjustments to running speed and stride length to reduce the risk of reinjury. Edwards et al[14] suggest that reducing running speed is an effective kinematic adjustment that can be implemented during the regimen's initial stages to reduce the probability for tibial stress fracture. Additionally, as return to running progresses, it must be considered that changes in stride length are naturally occurring in conjunction with changes in running speed.[2] The reduction in external ground reaction forces appears to be more related to decreased stride length rather than changes in speed.[2] Therefore, the athlete further into recovery can benefit from attention to cadence as an increase in cadence allows a reduction in stride length without sacrificing running speed.

The early portion of this phase is structured as the runner increases the amount of high impact activity and introduces different running surfaces. Group I will complete a minimum of one structured training cycle and then be given recommendations on how to progress to their previous activity level if they remain painfree. Members of Group II will remain on the structured program for 4 cycles before beginning their independent progression to their previous activity level. Four cycles allows adequate time for complete maturation of the new bone in this more high risk group.[4]

Many factors were considered in the development of this protocol. Athlete education is introduced early in the protocol to keep the runner from making training choices in the future that may lead to reinjury. Strengthening and stretching are also introduced early on to address some of the biomechanical factors that predispose a runner to injury. A cyclic approach to training that incorporates a rest phase reduces the risk of reinjury during the weaker phases of bone remodeling. Forms of low impact exercise are used during the cross-training phase to help maintain the athlete's fitness level without over-stressing the bone. It should be noted as well that along with the suggested protocol presented here, clinicians should always tailor interventions to the unique risk factors and specific needs of each patient based upon subjective history reports as well as physical examination findings.

CONCLUSION

The purpose of this review was to examine the evidence behind increasing running mileage no more than 10% per week, and to compile existing evidence regarding tibial stress fracture rehabilitation and return to running protocols. The majority of the articles produced by our search referenced gradual training progression and many of them specifically mentioned a 10% per week increase in mileage per week, but none of the articles cited a specific source or origin of the 10% guideline. Furthermore, none of the articles have tested or provided evidence for use of the 10% guideline. With regard to our protocol creation, it should be noted that although we are confident in the content and evidence behind our suggested protocol, we recognize that its validity is also limited until it too has been tested in a formal, randomized trial.

CLINICAL APPLICATIONS

Tibial stress fractures are a common injury plaguing runners across the ability spectrum, and can be difficult to treat. Runners are often instructed to "rest and return gradually," but this treatment suggestion is ambiguous and may be misinterpreted. It also does not take into account each athlete's unique characteristics such as previous bone health, age, running biomechanics, and training status, all of which are important factors in rehabilitation. The clinical application of the literature review culminates in our creation of a return to running protocol.

Given the complexity of the rehabilitation from stress fracture to a return to running, we identified a need for an evidence-based set of guidelines considering the most important aspects of stress fracture management: bone healing time and phases, pain as an indicator of healing, and a multimodal approach to the return to activity and running.[17] We researched and considered carefully the effects each of these have on a safe progression. Although we acknowledge that it has not been tested formally, we believe that the evidence and research behind each component make it a useful resource for physical therapists treating this injury.

Overall, this protocol is easily adapted for use with a wide range of athletes. It uses pain (a very individual experience) as an indicator for progression through the phases, so that each athlete is considered uniquely and appropriately for his or her personal response to the rehabilitation. This, along with suggestions for interventions along the recovery continuum, and explicit evidence grading for each, make these guidelines useful widely in the clinic.

ACKNOWLEDGEMENTS

We would like to thank Dr Robert J Butler, PT, DPT, PhD, Dr Adam Goode, PT, DPT, PhD, and Leila Ledbetter for their assistance with this manuscript.

Appendix. Return to Running Protocol

Phase I: Rest (Duration: 3-10 days)

Initially, subjects are classified into either Group 1 or Group 2.

Criteria for Group 1:
- Stress fracture diagnosed within one month of onset;
- Higher estimated fitness level (VO2 max>45ml/kg/min);
- Age ≤35 years;
- Good bone health;
- Hormonally 'normal';
- Resting pain level at onset ≤3/10.

Criteria for Group 2:
- Stress fracture diagnosed after one month of onset;
- Lower estimated fitness level (V02 max<45ml/kg/min);
- Age ≥35 years old;
- Poor bone health (e.g. osteopenia/osteoporosis);
- Previous running related injury;
- Resting pain level at onset ≥3/10.

Baseline: Nonweight bearing until painfree at rest and released to weight bearing by physician

Suggested interventions include:
- Education: recovery protocol, etiology, footwear, training (surfaces, intensity, progression), nutrition, risk factors, biomechanics
- Assess muscular imbalances, biomechanical errors (distal and proximal)
- Hip strengthening: open chain exercises (e.g. sideling hip abduction, bird-dog)
- Pain management: cryotherapy
- Stretching (eg, gastrocnemius, soleus, hamstrings)

"Painfree Transition"
Patients in Group 1 must be painfree with walking for 3 to 5 days before transitioning to Phase II while patients in Group 2 must be painfree with walking for 7 to 10 days before transitioning to Phase II.

Phase II: Transition/Cross-training (Duration: 4-7 weeks)

Baseline: Patient is painfree in normal weight bearing activities and can complete activities for daily living for 3 to 5 days painfree.

Suggested interventions include:
- Progress core/hip strengthening into weight bearing multi-planar activities
- Monitor impact with running
- Low impact cross-training (cycling, pool running, swimming, upper extremity ergometry)

- Phase II guidelines:
  - Cardiovascular training (cross-training or jogging) every other day with strength exercises (sidelying hip abductors, etc.) on off days.
  - A cycle consists of a two week progression (increasing jog time) and one week regression (decreasing jog time).
  - Unlimited UE activity is allowed for cardiovascular health.
  - Total daily cardiovascular training time (cross training time + jogging time) will be 30 minutes each day.
  - Jogging time is recommended approximately halfway into the cardiovascular training time.
  - If any pain is present, regress protocol by one week.

Group 1 (one cycle)			Group 2 (two cycles)		
	Cross-train time (mins)	Jogging time (mins)		Cross-train time (mins)	Jogging time (mins)
Week 1	20, 25, 30	0, 0, 0	Week 1	20, 20, 25	0, 0 ,0
Week 2	29, 27, 25	1, 3, 5	Week 2	25, 30, 29	0, 0, 1
Week 3 (rest)	30, 30, 28	0, 0, 2	Week 3 (rest)	30, 30, 30	0, 0, 0
Week 4	25, 23, 20	5, 7, 10	Week 4	29, 27, 25	1, 3, 5
			Week 5	25, 23, 21	5, 7, 9
			Week 6 (rest)	30, 28, 26	0, 2, 4
			Week 7	22, 21, 20	8, 9, 10

If 10 minutes of jogging is painfree, progress to Phase III

(Continued on page 45)

Appendix. Return to Running Protocol *(Continued from page 44)*

Phase III: Return to Running (Duration: 4+ weeks)

Baseline: Patient must be painfree with activities of daily living for 7 to 10 days and can jog painfree for 10 minutes.

Suggested interventions include:

- Education: shock attenuation activities, biomechanics, training surfaces, gradual mileage increase.
- Biomechanics adjustments: decrease running speed by 1m/s and reduce stride length by 10%.
- Maintain strength training and flexibility from previous phases.
- Progress to painfree running.
- Continue training cycle of 2 week progression and 1 week regression.
- Workout days may progress from 3 to 4 days/week.
- Surface changes are introduced in week 4 if painfree.
- If any pain is present, regress protocol by one week.
- Group 1 and Group 2 begin Phase III with the same treatment protocol and progression shown below.

Phase III Sample Protocol

	Cross-train time (mins)	Jogging time (mins)
Week 1	15, 10, 5	15, 20, 25
Week 2		25, 30, 35
Week 3 (rest)		35, 30, 30
Week 4		35, 35, 40
Week 5	If patient is painfree and is educated on gradual mileage progression, patient may progress individually from this point forward.	

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An Independent Study Course Designed for Individual Continuing Education

Independent Study Course 25.1

Course Description

This 3-monograph set addresses the unique aspects of evaluating and treating the patient following an automobile accident. Using an evidence-based approach, the authors present classification models and special considerations that need to be included to achieve an ideal outcome for this type of patient. Unique legal aspects of care are also covered. These include documentation, expert witness, and disclosure protocols for auto accident patients.

Topics and Authors

- **Evaluation and Treatment Strategies for Care of the Injured Cervical and Upper Thoracic Spine**
  Karen Walz, PT, MA, OCS, COMT, FAAOMPT
- **Evaluation and Treatment Strategies for Care of the Injured Lumbar Spine after a Motor Vehicle Accident *(Includes 26 online accessible video clips)***
  Terry Pratt, PT, MS, COMT, FAAOMPT
- **Management of Auto Injuries: Legal and Documentation Perspectives**
  Ronald W. Scott, PT, JD, LLM, EDD, MSBA, Esquire

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.

Editorial Staff

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:

- Review the current literature and apply findings to the musculoskeletal management of patients with cervical and upper thoracic spine injuries following an automobile injury.
- Discuss the evidence underlying motor vehicle trauma with regard to the neuromuscular somatosensory systems and its influence on tissue healing.
- Discuss the unique assessment and disposition of a patient following a traumatic automobile injury to the cervical and/or upper thoracic spine dysfunction.
- Perform the key tests to assess the tolerance to shear, torque, and compressive forces at the lumbar spine.
- Identify the key red flags in the subjective evaluation of the spine following auto injury.
- Design a treatment plan that is progressive and optimizes healing.
- Apply classification systems to categorize and treat spine injuries and highlight the distinguishing aspects of examination that differentiate between these categories.
- Discuss the biopsychosocial approach treatment of the lumbar spine after a motor vehicle accident.
- Utilize strategies to decrease fear-avoidance behaviors and encourage confrontational strategies in a patient recovering from an injury as a result of a motor vehicle accident.
- Discuss the importance of patient education for appropriate self-pain and ergonomic management techniques following motor vehicle accident injury.
- Discuss the unique legal obligation requirements for treating patients who have been injured in an auto accident.
- Effectively interact with auto injury patients, safeguarding the legal positions and rights of treating physical therapists and patients under care.
- Discuss the role of the therapist in communicating with legal counsel when caring for patients following an auto accident.
- Review the role of a physical therapist as percipient and expert witnesses in administrative and judicial proceedings.
- Review clinical documentation and communication protocols taking into account the legal protection of the patient and physical therapist.
- Develop, in consultation with practice attorneys, legally and ethically correct patient informed consent and disclosure protocols for auto accident patients and workers' compensation clients under care.
- Understand the responsibility of the physical therapist in preventing reimbursement fraud.

For Registration and Fees, visit orthopt.org/content/c/25_1_Orthopaedic_Care_in_Auto_Injury
Additional Questions—Call toll free 800/444-3982

Finance Committee Report

Steven R. Clark, PT, MHS, OCS
Treasurer

The Finance Committee met August 2014 to review financial operations and to make recommendations for the 2015 budget. The Gillette & Associates audit of the 2013 Section income/expenses has ascertained that Section operations and its cash flow is in conformity with accepted accounting principles through December 31, 2013.

AUDIT REPORT 2013
STATEMENT OF ACTIVITY
Years Ended December 31, 2013 and 2012

	2013	2012
UNRESTRICTED NET ASSETS		
Unrestricted Revenues, Gains, Losses		
Membership dues	785,692	771,307
Registration, meetings	838,016	732,466
Advertising income	49,835	39,034
Shipping and handling income	27,161	22,210
Publishing and administrative	53,360	37,565
Sale of promotional items	3,355	1,465
Miscellaneous	7,345	8,997
Investment income	116,626	89,095
Rental income	49,209	49,878
Sale of assets	(90,284)	(21,040)
Total Revenue	1,840,315	1,730,977
Less: Administrative Expenses	(290,733)	(272,944))
Program Expenses	(1,452,769)	(1,120,295)
Add: Unrealized Gain (loss) on Investments	560,112	226,216
Change in Unrestricted Net Assets	656,925	563,954
Net Assets at Beginning of Year	4,422,760	3,858,806
Net Assets at End of Year	$5,079,685	$4,422,760

MARKETABLE SECURITIES

	2012	2013	2014 (10/14)
LPL Investment Reserve	$977,968	$1,176,983	$1,192,576
LPL Building Fund	$372,393	$437,022	$ 441,108
Wells Fargo Research, Practice, Education	$1,8260,582	$2,317,642	$2,466,356

The 2013 audit demonstrates an increase of $656,925 in unrestricted net assets. The net asset increase correlates with an increase in marketable securities and income generation greater than expenses for 2013. Marketable securities remain strong as of 8/20/2014 giving the Section continued financial strength for operations. The Section Executive Director Terri DeFlorian continues to maximize a staff operation which allows the Section to utilize its finances to advance orthopaedic physical therapy practice.

The following operating budget for fiscal year 2015 has been approved by the Section Board of Directors at their October meeting in LaCrosse.

2015 OPERATING BUDGET

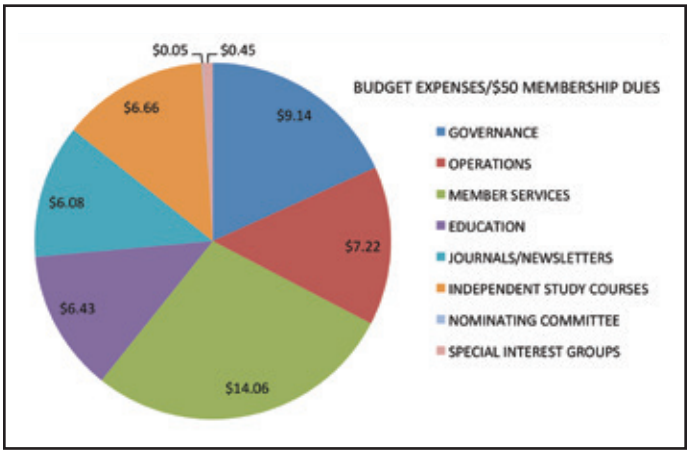
	Income	Expense
GOVERNANCE	210,126	409,192
OPERATIONS	49,534	346,803
MEMBER SERVICES	830,000	576,446
EDUCATION	473,675	234,016
JOURNALS/NEWSLETTERS	130,505	181,816
INDEPENDENT STUDY COURSES	301,560	230,277
NOMINATING COMMITTEE	0	1850
OCCUPATIONAL HEALTH SIG		$2,500
FOOT AND ANKLE SIG		$2,500
PAIN MANAGEMENT SIG		$2,500
PERFORMING ARTS SIG		$2,500
ANIMAL REHABILITATION SIG		$2,500
IMAGING SIG		$2,500
TOTAL OPERATING	1,995,400	1,995,400

The 2015 budget will continue the Sections' effort to progress education, practice and research. The budget provides funding for the Foundation for Physical Therapy, Orthopaedic Section Research Network (3rd year), National Orthopaedic Outcomes Database as well as ICF guidelines. The Section will have their 3rd Annual Meeting in Phoenix, AZ providing an opportunity for advanced clinical practice.

The strong reserve that the Section has been able to develop over the last several years allows the Section to cover cost of operations without a dues increase for 2015. The Section has been able to retain annual dues at $50.00 since 1994. The Finance Committee is committed to retaining a strong reserve as it allows for opportunities for advancement that might not be possible without these funds. It also allows the Section to maintain adequate operations without increasing dues. Without funding from the Section's reserves, the 2015 projected income would not be sufficient to maintain current operations without a dues increase. The Research, Practice and Education Fund and the Reserve Funds accounted for $210,056 or 10.53% of the budget.

At this time, the real estate market in LaCrosse does not support the Section moving forward with further rental property unless a potential tenant comes forward making this a benefit to the Section. The Board of Director policy is to keep the Building Fund as an opportunity to build in the future should an opportunity present.

If you have questions regarding the audit report for 2013 or the budget for 2015 please contact me at Steven@coreptiowa.com.



Orthopaedic Section, APTA, Inc.

OCTOBER BOARD OF DIRECTORS MEETING MINUTES

October 17-18, 2014

Stephen McDavitt, President, called a regular meeting of the Board of Directors of the Orthopaedic Section, APTA, Inc. to order at 1:15 PM CDT on Friday, October 17, 2014.

Present:
Stephen McDavitt, President
Gerard Brennan, Vice President
Steven Clark, Treasurer
Tom McPoil, Director
Pam Duffy, Director
Tess Vaughn, Education Chair
Duane Scott Davis, Research Chair
Joe Donnelly, Practice Chair
Kathy Cieslak, Practice Vice Chair (guest)

Tara Fredrickson, Executive Associate
Terri DeFlorian, Executive Director

Absent:
None

Guests:
Beth Jones, Director Candidate
Keelan Enseki, Director Candidate (via phone)
Casey Weiss, Access Commercial Real Estate
Robin Swartz, Wells Fargo Advisors

The meeting agenda was approved as printed.

The September 8, 2014 Board of Directors Conference Call Meeting minutes were approved as edited.

The schedule of future Board of Directors conference calls/meetings were presented. Conference calls will be at 8:00 PM EST:

- November 10, 2014 – Board Conference Call
- December 1, 2014 – Board Conference Call
- **NOTE:** All Director and Treasurer Candidates will be invited guests to the November call and only the elected Treasurer and Director will be invited to the December and January calls.
- January 5, 2015 – Strategic Plan Conference Call (1 hour)
- January 12, 2015 – Strategic Plan Conference Call (1 hour)
- Determine regular January Board Conference Call

Invited guest, Casey Weiss, commercial real estate broker, presented information on the local lease rates for commercial property. Currently new space at the top of the market is going for $14-$16 a square foot. The majority of tenants are looking for 2,000 square feet or less.

Invited guest, Robin Swartz, Wells Fargo Advisors, informed the Board they are looking at property in the La Crosse area to lease, one of which is the Section's footprint building. They are looking for a long term lease arrangement (15-20 years) and about 3 – 4,000 square feet. They currently have 17 employees. They will be making a decision in the next 2-3 months on where they will be re-locating.

Invited guest, Eric Araneta, Deml Controls, presented on the HVAC equipment options the would best suit our current building as well as any future building expansion.

The following motions were presented on the consent calendar –

=MOTION 1= Stephen McDavitt, President, moved that the Orthopaedic Section Board of Directors appoint Matthew Haberl, PT, DPT, ATC, FAAOM, OCS, as Chair of the Residency EIG. (CV attached)
Fiscal Implication: None

=MOTION 2= Stephen McDavitt, President, moved that the Orthopaedic Section Board of Directors approve the attached Board of Directors policies and cover page.
Fiscal Implication: None

=MOTION 3= Stephen McDavitt, President, moved that the Orthopaedic Section Board of Directors approve the attached Board, Committee and SIG policies.
Fiscal Implication: None

=MOTION 4= Stephen McDavitt, President, moved that the Orthopaedic Section Board of Directors approve the attached Web Site policy cover page.
Fiscal Implication: None

Stephen McDavitt, President, reminded the Board to respond to policy reviews even if they had no comments. A comment was raised that when changes are submitted the individual submitting should be notified if those comments will be sent to the Board for consideration.

The following motions were presented via e-mail – None

=MOTION 5= Stephen McDavitt, President, moved that the Orthopaedic Section Board of Directors approve sending an NC-1 form for Bill Boissonnault for Vice President of the APTA.
ADOPTED (unanimous)
Fiscal Implication: None

=MOTION 6= Stephen McDavitt, President, moves that the Orthopaedic Section Board of Directors approve the following editorials to the Board Meeting Ground Rules:

Previous:
Board Meeting Ground Rules

- Share the air – we want to hear everyone's opinion, even if it is a dissenting one
- Silence implies agreement
- Agree to disagree without being disagreeable
- Honor confidentiality
- Respect all participants and all differences of opinion
- Listen to the person who is talking
- Work to build consensus

I would like to editorialize to:
Board Meeting Ground Rules

- Create and support an exploring atmosphere. Share the air – we want to hear everyone's opinion, even if it is a dissenting one.
- Silence implies agreement.
- Agree to disagree without being disagreeable. No one dominates; no personal attacks.
- Honor confidentiality.
- Encourage contributions. Respect all participants and all differences of opinion.
- Listen to the person who is talking.
- When speaking state your assumptions and relax your grip on certainty.
- Work to build consensus.

Fiscal Implication: None

Steve Clark, Treasurer, reported a change to correct the amount reported for the LPL reserve fund. The monthly financial statements are being reviewed. The Section continues to do well financially. Following is a review of the recommendations made by the Finance Committee during their August 2014 meeting –

=MOTION 7= Steven Clark, Treasurer, moved that the Orthopaedic Section Board of Directors accept the 2013 audit report. ADOPTED (unanimous)

Fiscal Implication: None

=MOTION 8= Steven Clark, Treasurer, moved that the Orthopaedic Section Board of Directors not pursue a dues increase at this time but the Board of Directors should revisit this issue after the 2014 Strategic Planning session to determine if significant expenses are presented which would require an increase. ADOPTED (unanimous)

Fiscal Implication: None

=MOTION 9= Steven Clark, Treasurer, moved that the Orthopaedic Section Board of Directors approve the Finance Committee cover page and policy document as revised. ADOPTED (unanimous)

Fiscal Implication: None

Steve Clark, Treasurer, presented the following Finance Committee recommendation –

The Board of Directors review their future financial needs and if additional dollars will be required the following could be considered:

a. Offering continuing education programming to generate additional non-dues revenue
b. Increase Dues – would not be effective until January 1, 2016
c. Up to 4% of the Research, Education and Practice Endowment fund would be available to meet financial needs based upon research, education, and practice initiatives.
d. Additional funds could come from the Reserve Fund as deemed appropriate by the BOD (staying within the Section policy of 40 to 60% in reserves).

The Board reviewed and had no further comments.

Gerard Brennan, Vice President, gave the following National Outcomes Registry update –

1) Expenses for the neck pain, knee, and shoulder work groups are under budget for 2014.
2) A conference call is scheduled with Justin Moore at APTA to begin discussions on the financial implications of the outcomes registry agreement.

Stephen McDavitt, President, reported that we are waiting for the PTA work analysis survey to be pilot tested before sending to all Orthopaedic Section members. Target date is early spring 2015.

Gerard Brennan, Vice President, reported on a possible location for the 2015 October Board meeting in Park City, Utah. Tara Fredrickson, Executive Associate, stated the Hotel Park City has availability for October 14-17, 2015.

=MOTION 10= Stephen McDavitt, President, moved that the Orthopaedic Section Board of Directors charge Tara Fredrickson, Executive Associate, to contact the Hotel Park City in Park City, Utah, and negotiate a contract for the Board meeting October 14-17, 2015. ADOPTED (unanimous)

Fiscal Implication: None

Terri DeFlorian, Executive Director, gave the following Section office update –

A. 2014 Independent Study Courses
- Injured Worker (6 monograph course) mailed in May – 58 registrants to date
- Injuries to the Hip (6 monograph course) mailed in June – 149 registrants to date
- Biomechanics of Gait (6 monograph course) mailed in September – 67 registrants to date
- Evaluation of the Canine Rehab Patient (2 monograph course) mailed in October – 9 registrants to date

B. Part-time Administrative Assistants
- Barb Chaney, Publishing Assistant – hired as part time (20 hrs/wk) Section employee October 1st
- Megan Busse, Administrative Assistant – started work part time (20 hrs/wk) through the temp agency on September 24th

C. Web Site Re-design and YourMembership.com
- Still in the information gathering phase. Will obtain more information at the CSM Council of Component Executive Meeting

=MOTION 11= Gerard Brennan, Vice President, moved that the Orthopaedic Section Board of Directors approve providing editing resources (office staff) to edit the entry level curriculum guidelines for imaging as requested by the Imaging SIG. FAILED (unanimous)

Fiscal Implication: None

ADJOURNED for Friday 4:20 PM

Stephen McDavitt, President, called a regular meeting of the Board of Directors of the Orthopaedic Section, APTA, Inc. to order at 8:00 AM CDT on Saturday, October 18, 2014.

Present:
Stephen McDavitt, President
Gerard Brennan, Vice President
Steven Clark, Treasurer
Tom McPoil, Director
Pam Duffy, Director
Tess Vaughn, Education Chair
Duane Scott Davis, Research Chair
Joe Donnelly, Practice Chair
Kathy Cieslak, Practice Vice Chair (guest)

Tara Fredrickson, Executive Associate
Terri DeFlorian, Executive Director

Absent:
None

Guests:
Beth Jones, Director Candidate
Aimee Klein, Director Candidate (via phone)
Lori Michener, CRN Coordinator (via phone)

=MOTION 12= Joe Godges, ICF-based Coordinator, moved that the Orthopaedic Section Board of Directors approve the following:

The Neurology Section, Orthopaedic Section and the Sports Section will collaborate and utilize their combined resources to create clinical practice guidelines on Post-Concussion Syndrome Management under the following conditions:

1) The guidelines will be coordinated by the Orthopaedic Section ICF-based Clinical Practice Guidelines Coordinator and Advisory Panel,
2) will be published in JOSPT,
3) will be entitled: *Clinical Practice Guidelines linked to the International Classification of Functioning, Disability, and Health from the Neurological Section, Orthopaedic Section and the Sports Section of the American Physical Therapy Association*,
4) will utilize the following copyright and permission statements: ©201_ Neurology Section American Physical Therapy Association (APTA), Inc., Orthopaedic Section American Physical Therapy Association (APTA), Inc., the Sports Section, APTA, Inc., and the *Journal of Orthopaedic & Sports Physical Therapy* consent to the reproducing and distributing this guideline for educational purposes, and
5) will be submitted as a guideline on www.guidelines.gov

ADOPTED (unanimous)

Fiscal Implication: None

=MOTION 13= Joe Donnelly, Practice Chair, moved that the Orthopaedic Section Board of Directors award the South Carolina Chapter a $5,000 advocacy grant for their continued effort to pursue referral for profit. ADOPTED (unanimous)

Fiscal Implication: $5,000 (budgeted in 2014)

Tess Vaughn, Education Chair, led a discussion on the review of the Section's speaker policy.

=MOTION 14= Tom McPoil, Director, moved that the Orthopaedic Section Board of Directors limit the number of speakers for a 2 hour educational session to one non PT speaker and that they be reimbursed for airfare and per diem only, no honorarium. ADOPTED (unanimous)

Fiscal Implication: None

The current policy for PT speakers will remain the same.

=MOTION 15= Tom McPoil, Director, moved that the Orthopaedic Section Board of Directors approve the following speaker policy –

- A 1 day pre-conference course will be limited to no more than 3 speakers.
- A 2 day pre-conference course will be limited to no more than 4 speakers.

ADOPTED (unanimous)

Fiscal Implication: None

Tess Vaughn, Education Chair, led a discussion on the number of treatment tables needed for educational sessions. The Board agreed that the maximum number of individuals per table was 3. This will be taken into account when planning courses in the future.

Tess Vaughn, Education Chair, informed the Board on the 2016 Annual Meeting topic discussions. The Board agreed the focus should be on clinical practice guideline topic areas. Tess will contact Joe Godges, ICF-based Guidelines Coordinator, and discuss using the work group individuals for possible speakers. Formatting of the meeting to include more lab time was also discussed. The Board will investigate sending out another survey to obtain more feedback now that 2 meetings have been held.

Tara Fredrickson, Executive Associate, presented information she had gathered from east coast cities for the 2016 Annual Meeting. Most of these proposals came back high. The Board recommended the following additional cities to contact – Atlanta, GA; Nashville, TN; Savanah, GA.

=MOTION 15= Scott Davis, Research Chair, moved that the Orthopaedic Section Board of Directors approve the Research Committee to provide the Foundation with the requested information as it relates to the identification of #1 Physical Activity as the High Priority Orthopaedic Physical Therapy Research Topic. ADOPTED (unanimous)

Fiscal Implication: None

Scott Davis, Research Chair, gave a brief summary on the progress of the Clinical Research Network (CRN). Lori Michener, CRN Coordinator, presented a more detailed progress report via phone. A decision will need to be made by spring 2015 on how to move forward upon completion of the 3-year charge. The Board of Directors will continue this discussion at their meeting at CSM 2015.

=MOTION 16= Scott Davis, Research Chair, moves that the Orthopaedic Section Board of Directors approve the following individuals to serve on the Research Committee with a term from February 2015 to February 2018:

- Jo Armour Smith PhD, PT
- Chad Cook PT, PhD, MBA, FAAOMPT
- Rogelio Coronado PhD, PT, CSCS, FAAOMPT

ADOPTED (unanimous)

Fiscal Implication: None

Joe Donnelly, Practice Chair, gave an update on the State Government Affairs Forum. Detailed information can be found in the Practice Committee Report on the web site.

Joe Donnelly and Aimee Klein are working on getting residency information regarding site licenses on the web site.

Joe Donnelly, Practice Chair, announced that Kathy Cieslak, Practice Vice Chair, will be taking over as Practice Chair at the close of this meeting. Kathy will also be the Section Delegate for 2015.

=MOTION 17= Stephen McDavitt, President, moved that the Orthopaedic Section Board of Directors appoint Gerard Brennan, Vice President, and Chris Hughes, ISC Editor, to negotiate and develop a contract with JOSPT regarding the Section's technology platform and report back to the Board. ADOPTED (unanimous)

Fiscal Implication: None

=MOTION 18= Stephen McDavitt, President, moved that the Orthopaedic Section Board of Directors develop an Intellectual Technology Platform Task Force chaired by Chris Hughes, ISC Editor and co-chaired by Gerard Brennan, Vice President, to assign members and develop and implement intellectual property. ADOPTED (unanimous)

Fiscal Implication: None

Charge from July 2014 Board of Directors Meeting Minutes (below) was completed. No further action needed at this time.

=MOTION 12= Tom McPoil, Director, moved to charge Terri DeFlorian, Executive Director, to contact a consultant to assess availability and fees needed to evaluate report information relevant to the needs and resources for the Section's educational and media materials.

ADOPTED (unanimous)

Fiscal Implication: None

Stephen McDavitt, President, led a discussion on expanding the Board of Directors. Pam Duffy will work with Stephen on collecting information pertaining to advisory Board members having a vote on the Board and bring back to the Board at a future meeting.

Gerard Brennan, Vice President, led a discussion on ISC profit/loss using information submitted by the ISC Managing Editor. It was agreed that a standard reporting mechanism would be developed and then brought back to the Board for a generative discussion.

Development of a candidate pool for voting, non-voting and contracted positions was discussed. Continued discussions will take place on the weekly President, Vice President, Executive Director calls and a recommendation brought back to the Board at a future meeting.

Stephen McDavitt, President, led a discussion on SIG programming for CSM. The Board agreed that Tess Vaughn, Education Chair, would inform the appropriate Board Liaison whether or not their SIG's programming was accepted.

=MOTION 19= Steven Clark, Treasurer, moved that the Orthopaedic Section Board of Directors approve each SIG submit a budget stating how they will use their $2,500 beginning with the 2016 budget. If no budget is submitted, any requests for money, after Board approval, would be taken out of their encumbered funds. If a budget is submitted for less than $2,500 the amount submitted, is what will be budgeted. ADOPTED (Stephen McDavitt – in favor; Gerard – in favor; Steve Clark – in favor; Tom – opposed; Pam – in favor)

Fiscal Implication: None

The Board agreed to appoint Pam Duffy, Director, as the Liaison to the Residency EIG. All Board Liaison assignments will be revisited at the CSM 2015 Board of Directors meeting.

=MOTION 20= Steven Clark, Treasurer, moved that the Orthopaedic Section Board of Directors approve the 2015 budget as revised. ADOPTED (unanimous)

Fiscal Implication: None

The following Board Liaison updates were given –

- Pam Duffy, Director
  - A recommendation was made the Web Site Policies be incorporated into the Public Relations Committee policies since that committee is the one responsible for fulfilling the policy. This will be addressed at a future Board meeting.
  - Orthopaedic Specialty Council – refer to the report located on the web site. The next Specialty Council Chair will be Stephanie Greenspan beginning in December 2014.
  - The OHSIG clinical practice guideline development grant was approved by APTA in the amount of $10,000. The SIG will be contributing $20,000.
  - A member consultant has been recruited to review the FASIG entry-level curriculum. The document is scheduled to be completed by December 2014.

- Tom McPoil, Director
  - Membership Committee – refer to their report on the web site.
  - Pain Management SIG – refer to their report on the web site.
  - Performing Arts SIG – refer to their report on the web site.

- Gerard Brennan, Vice President
  - ISC and OPTP – refer to reports on the web site.
  - The ISC Advisory Board held a conference call to firm up the monograph titles and authors for the outcomes course schedule for 2016.
  - Imaging SIG has been working on a draft entry level curriculum.

- Stephen McDavitt, President
  - Refer to the ICF-based Clinical Practice Guidelines for Common Musculoskeletal Conditions report on the web site.
  - The Animal Rehabilitation SIG held a course at Springfield College in Springfield, MA. For more information refer to their report on the web site.

Stephen McDavitt, President, asked for closing comments and then adjourned the meeting.

ADJOURNMENT 4:12 PM CDT

Submitted by Terri DeFlorian, Executive Director

OCCUPATIONAL HEALTH

SPECIAL INTEREST GROUP

President's Message

Lorena P. Payne, PT, MPA, OCS

While attending a recent conference, I had the opportunity to visit with a Physical Therapist from Brazil. In small groups, we were assigned a task related to the coordination of teams in patient care. As we struggled to articulate the global goals of teams, she astutely reminded us of the International Classification of Functioning, Disability and Health (ICF). By applying this construct, our task was then neatly framed and focused. In 2002, the World Health Organization released the paper, "Towards a Common Language for Functioning, Disability, and Health." The authors of the study penned these words worth repeating and critically important in Occupational Health Physical Therapy; "Studies show that diagnosis alone does not predict service needs, length of hospitalization, level of care, or functional outcomes. Nor is the presence of a disease or disorder an accurate predictor of receipt of disability benefits, work performance, return to work potential, or likelihood of social integration."[1(p4)] Successful interventions directed at the worker and work place focus on **activity**, defined as, "the execution of a task or action by an individual, and on **participation**, involvement in a life situation." It must be understood that impairments of body functions and structure, may play only a small role in the person's ability to participate in work.

Please join us, Friday, February 6 at 8 a.m., at the Combined Sections Meeting in Indianapolis for a lively discussion of applying the ICF model to the work setting. This session will be preceded by the OHSIG membership meeting.

REFERENCE

1. World Health Organization. Towards a common language for functioning, disability, and health. http://who.int/classfications/icf/training/icfbeginngersguide.pdf. Accessed November 25, 2014.

Physical Therapists can Provide Critical Services for the Health and Wellness Along with Injury Prevention for Fire Fighters

Douglas P. Flint, DPT, OCS,
Manager of Intermountain WorkMed PT
Nathan Foote, MD,
Occupational Health Physician Intermountain WorkMed
Tyler K. Sedgwick, DPT, OCS,
Physical Therapist Intermountain WorkMed
Nicole M. Stephens, PTA,
Physical Therapist Assistant Intermountain WorkMed

Over the last few decades, on-the-job injuries have become one of the largest costs to employers. According to a study done at UC Davis, injuries and illness are the largest health care costs in America. In 2010, the cost of injury and illness in America was approximately $250 billion. This exceeds the costs for cancer, diabetes, and strokes.[1]

These costs have had a negative impact on health care providers, insurance companies, employers, and employees. The rising cost of health care due to rising group health insurance premiums for employees and rising workers compensation costs have had a major impact on smaller cities. Municipalities, like city fire departments, have had difficulty adjusting their budgets to cover these costs without negatively impacting the benefits offered to firefighters and the potential safety of the communities they serve.

The importance of injury prevention and improved overall health is essential in reducing these out of control costs. Several recent studies have focused on the injuries sustained by firefighters. In 2013, Poplin et al[2] published data that revealed that persons with a VO_2 max less than 43 were 2.2 times more likely to sustain an on-the-job injury than those with a VO_2 max greater than 43. Those with a VO_2 max between 43 and 48 were 1.3 times more likely to have an injury. Their study suggests that increasing firefighter fitness by 1 MET can reduce the risk of injury by 14%.[2]

In 2012, Burgess et al[3] stated that heart disease is the leading cause of firefighter line-of-duty deaths. They studied carotid intima-media thickness (CIMT) and the risk factors predicting increased CIMT and carotid plaque. They found that the low-density lipoprotein cholesterol (LDL-C) of 100 mg/dl or more and high-density lipoprotein were significant independent predictors of increased CIMT. Cardiac risk factors for firefighters may also be reduced by effectively monitoring and decreasing cholesterol levels.[3]

The Cable News Network (CNN) reported in 2014 that more than 70% of domestic firefighters are overweight or obese. Even though the need for firefighters to be fit is obvious, accord-

ing to the CDC their rate of obesity is slightly higher than that of the general population. The CDC also reports that cardiovascular events account for nearly half the deaths of on-duty firefighters and obesity has been linked to an increased risk of job-related disabilities.[4]

In the *Journal of Occupational Medicine*, Brown et al report that the prevalence of overweight and obesity among firefighters exceeds that of the US adult population despite a physically demanding work environment. They also state that obesity among firefighters is associated with markers of poor cardiovascular health, job disability, and injuries. Their findings identified that firefighters with a BMI of 35 kg/m^2 self-reported 19 more days of poor health annually than those firefighters with a BMI of 25kg/m^2.[5]

To address these occupational concerns, the National Fire Protection Agency (NFPA) published updated guidelines for recommended fitness levels for active firefighters in 2011. These recommendations included guidelines for strength, flexibility, and aerobic capacity.[6] In 2013, Intermountain WorkMed started providing annual fitness testing for local fire departments. The following are the results of this testing for the largest fire department in that area for 2013 and 2014.

One hundred twenty-two firefighters from the same department were screened over a two-year period at Intermountain WorkMed. This screening was just one component of their annual, comprehensive work physical. Standardized anthropometric and physiological measurements of height, weight, blood pressure, resting HR, BMI, VO_2 max, and MET levels were measured and calculated for all the firefighters from that department in 2013 and 2014.

Descriptive statistics were performed looking at weight, BMI, VO_2 max, and MET levels (Table 1). The mean age of firefighters testing in 2013 and 2014 was 38.35 and 37.68 years old, respectively.

Firefighters were arbitrarily separated into 3 categories based on MET testing results. The categorical delineations were as follows: moderate risk ≤ 10.5, low risk 10.6-11.99, and no risk ≥ 12. In 2013, 73% of the tested firefighters met the minimum NFPA recommendation of ≥ 12 MET and only 65% in 2014 (Figure 1 and 2).

Single factor ANOVA's were computed to determine any significant differences with a 95% CI for MET, BMI, and VO_2 max measurements between 2013 and 2014. No statistically significant differences were noted between the two years (Tables 2, 3, 4). When a single factor ANOVA analysis was computed for MET levels ≥ 12 with a 95% CI, it was shown that a statistically significant difference occurred between 2013 and 2014 ($P < .047$) (Table 5).

The 2011 NFPA fitness guidelines recommend that active duty firefighters should be able to function at a ≥ 12 MET level. These recommendations are based on the estimated energy expenditure requirements to safely perform essential job duties. Following two years of testing, it was determined by the medical provider, physical therapy staff, and fire department that greater gains in overall fitness levels of firefighters were recommended to meet national guidelines for reducing health risks and line-of-duty injuries.

As part of an ongoing relationship with the fire department, a pilot program has been developed and implemented to improve the overall fitness of the firefighters in this department.

Table 1. Demographics of Firefighters Tested in 2013-2014

	2013	2014
Male	99	94
Female	5	6
Age, y	38.27	37.74
Mean weight (lbs.)	192.41 ± 32.18	195.49 ± 33.35
Mean Height (in.)	70.44	70.63
Mean resting HR	78.24	74.32
Mean BMI	26.79 ±3.74	27.47 ± 3.86
Mean VO_2Max mL/ (kg × min.)	44.10 ± 4.11	43.82 ± 4.22
Mean MET level	12.60 ± 1.17	12.52 ± 1.21

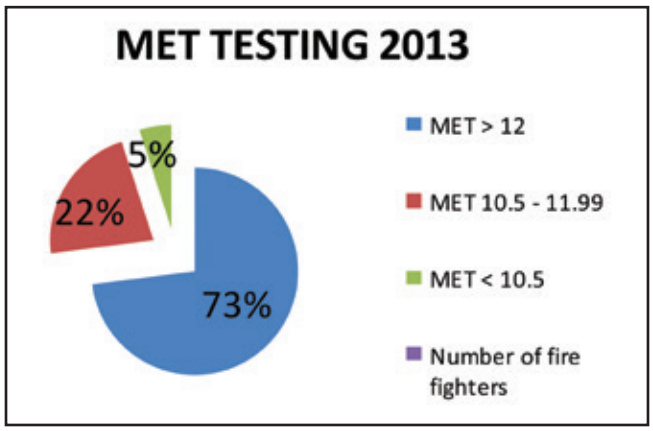


Figure 1. Percentages of MET for 2013.

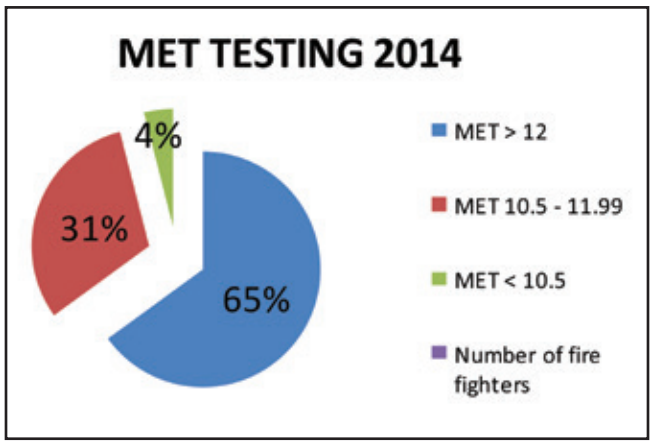


Figure 2. Percentages of MET for 2014.

This program will be implemented and monitored by the physical therapy clinic over the coming year and will be re-evaluated following repeat testing in 2015.

It is the opinions of the authors that Occupational Physical Therapists can be a critical resource for helping increasing the health and well-being of firefighters while in turn reducing injuries and the cost of those injuries on individuals and society. This pilot program will continue efforts to accomplish this by providing fitness testing and by designing personalized work conditioning programs for firefighters.

Table 2. Single ANOVA Statistical Analysis for BMI

ANOVA: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
2013 BMI	104	2786.43	26.79	14.018
2014 BMI	100	2747.25	27.47	14.93

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	23.57	1	23.57	1.63	0.20	3.89
Within Groups	2921.61	202	14.46			
Total	2945.17	203				

Abbreviation: BMI, body mass index

Table 3. Single ANOVA Statistical Analysis for VO2 max

ANOVA: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
2013 VO_2max	104	4586.16	44.09	16.87
2014 VO_2max	100	4382.59	43.82	17.84

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	3.76	1	3.77	0.22	0.64	3.89
Within Groups	3503.67	202	17.34			
Total	3507.44	203				

Table 4. Single ANOVA Statistical Analysis for MET

ANOVA: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
2013 MET EQUIV	104	1310.28	12.59	1.38
2014 MET EQUI	100	1252.36	12.52	1.46

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.29	1	0.28	0.20	0.65	3.88
Within Groups	287.08	202	1.42			
Total	287.37	203				

Table 5. Single ANOVA Statistical Analysis for MET ≥ 12

ANOVA: Single Factor

SUMMARY

Groups	*Count*	*Sum*		*Average*	*Variance*
2013 MET ≥ 12	35	435.66	12.45	0.09	
2014 MET ≥ 12	35	441.26	12.61	0.13	

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.45	1	0.45	4.08	0.05	3.98
Within Groups	7.46	68	0.11			
Total	7.91	69				

REFERENCES

1. Revisions to the 2010 Census of Fatal Occupational Injuries (CFOI) counts. http://www.bls.gov/iif/oshwc/cfoi_revised10.pdf. Accessed December 10, 2013.
2. Poplin GS, Roe DJ, Peate, W, Harris RB, Burgess JL. The Association of Aerobic Fitness ith Injuries in the Fire Service. *Am J Epidemiol*. 2014 Jan 15;179(2):149-55. doi: 10.1093/aje/kwt213. Epub 2013 Oct 31.
3. Burgess JL, Kurzius-Spencer M, Gerkin RD, Fleming JL, Peate WF, Allison M. Risk factors for subclinical atherosclerosis in firefighters. *J Occup Environ Med*. 2012;54(3):328-335.
4. KSL TV. Firefighter obesity a big problem. http://www.ksl.com/index.php?sid=30780431&nid=481. Accessed November 21, 2014.
5. Brown AL, Wilkinson ML, Poston WS, Haddock CK, Jahnke SA, Day RS. Adiposity predicts self-reported frequency of poor health days among male firefighters. *J Occup Environ Med*. 2014;56(6):667-672.
6. National Fire Protection Association. NFPA 1582: Standard on Comprehensive Occupational Medicine Program for Fire Departments. http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=1582. Accessed November 25, 2014.

PERFORMING ARTS

SPECIAL INTEREST GROUP

President's Letter

Annette Karim, PT, DPT, OCS, FAAOMPT

CSM 2015 will be in Indianapolis, IN, at the Indiana Convention Center. The dates are February 4-7, 2015. Registration and housing information can be found at http://www.apta.org/csm/.

The Orthopaedic Section Performing Arts SIG is pleased to announce this year's PASIG speaker is Dr Clare Frank, PT, DPT, OCS, FAAOMPT.

Dr Frank serves as a clinical instructor for both Spine & Sports Rehabilitation Fellowship programs at Kaiser Permanente, Los Angeles. She served on the injury prevention and rehab team for the National Training Center in Beijing, China (2010-2013) and the medical team for the 2009 World Figure Skating Championships held in Los Angeles. Dr Frank is a certified instructor for Janda's Approach to Musculoskeletal Pain Syndromes, and Kolar's Approach to Dynamic Neuromuscular Stabilization.

Dr Frank will speak on and demonstrate *Dynamic Neuromuscular Stabilization in Spinal Rehabilitation & Performance.*

It will be an informative and helpful session, as Dr Frank will teach about the clinically applicable use of Dynamic Neuromuscular Stabilization (DNS) in evaluating and treating performing artists.

When will this be? The PASIG programming will begin with our ***Business Meeting before the PASIG speaker, from 7 a.m.-8 a.m., in the Indiana Convention Center, Wabash Ballroom 1, followed by our course on DNS from 8-10 AM***. All APTA members are welcome. This is a great opportunity to connect, meet others, investigate how you might become involved, and voice your ideas.

The PASIG website has been updated. Please check out our page:

http://www.orthopt.org/content/special_interest_groups/performing_arts

If you are thinking about a clinical question related to performing artists, you might find your answer in our monthly citation blasts, which is emailed to all PASIG members. Past monthly citation blasts are available, with citations and EndNote file, listed on the website: http://www.orthopt.org/content/special_interest_groups/performing_arts/citations_endnotes

If you are interested in writing a citation blast, contact Brooke Winder at BrookeRwinder@gmail.com

PASIG membership is free! All Orthopaedic Section members are welcome:

http://www.orthopt.org/sig_pa_join.php

Current PASIG members, update your profile here:

https://www.orthopt.org/login.php?forward_url=/surveys/membership_directory.php

Performing Arts resources are available to members for free:

https://www.orthopt.org/content/special_interest_groups/performing_arts/pasig_resources

Tweet Tweet! We have a Twitter page!
PT4Performers

Post your articles, info on your site.
Let's get connected!

Check out the Orthopaedic Section Facebook page, where you can find and post PASIG info: https://www.facebook.com/pages/APTA-Orthopaedic-Section/121020534595362

If you are currently using a screening exam on dancers, please contact Sarah Wenger, as she is seeking input on a single screen that she will make available to our members: Sbw28@drexel.edu

Lastly, the quarterly publication of *Orthopaedic Physical Therapy Practice* magazine is an interesting and useful resource of clinically relevant information presented in the form of case reports, case series, clinical pearls, and original research. Please consider submitting your case report or research on performing artists to the PASIG pages. If you are interested in submitting your writing, please contact Annette Karim at neoluvsonlyme@aol.com

Considerations in Dancer Screening

Annette Karim, PT, DPT, OCS, FAAOMPT

At CSM 2014, our PASIG members asked for dancer screens. For physical therapists working with professional dancers, we recommend contacting the Dance USA Taskforce on Dancer Health.[1] The Dance USA screen was created by content experts and is updated annually. While the physical therapist working with professional dancers has access to a remarkable screen through Dance USA, there are few tools for screening the pre-professional dancer, none standardized to date, and many are proprietary.

Frequently asked questions are as follows:

- When do we screen our dancers?
- Do we screen in large group settings, in college programs, in dance studios, in the clinic?
- Why do we screen?
- Is screening different from an evaluation?
- How do we define wellness PT vs. direct access physical therapy rehabilitation? Is there an APTA Orthopaedic Section Performing Arts SIG screen?
- What do we include in a screen?

There are many ways to conduct a screening exam. I can speak from my experience, as a basis for future dialogue and collaboration among our membership, but not as a final answer to the screening inquiries. This issue's commentary serves as an invitation to you to submit clinical pearls in regards to the development of a pre-professional dancer screen, and to discuss screening with Sarah Wenger, our dancer-screening chair, and each other as members of the PASIG. In *OP* Vol 26, No. 2, we discussed movement-based evaluations of the young dancer. At CSM this year, the PASIG programming will contain screening and treatment through dynamic neuromuscular stabilization (DNS).

A few great resources to look into are the following:

1. Annual Post-Hire Health Screen for Professional Dancers,[1] the Dance USA screen for professional dancers and used with professional dance companies, created by the Task Force on Dancer Health.
2. Developing a dancer wellness program employing developmental evaluation.[2] Terry Clark et al take a look at the "one size fits all" approach to screening and developing a wellness program among professional ballet dancers. They use the Dance USA screen in this study, and get feedback from the dancers to develop a site-specific wellness program.
3. Screening in a Dance Wellness Program,[3] by the International Association for Dance Medicine and Science. The resource paper discusses the purpose of screening, factors to consider and types and components of screening. Broad categories are medical, musculoskeletal, fitness, technical dance skills, psychological, and nutrition.
4. Screening for Functional Capacity in Dancers: Designing Standardized, Dance-Specific Injury Prevention Screening Tools,[4] by MJ Liederbach, a great primer for creating a screening tool.
5. Dynamic evaluation of the student dancer: enhancement of healthy functioning and movement quality,[5] by Marika Molnar, one of the pioneers of dance medicine and dancer screening.
6. A screening program for dancers administered by dancers.[6] An interesting concept, increasingly used by dance programs, gives insight to the dancer point of view.
7. Dancer Wellness Project,[7] organized by Gary Galbraith. This site can store your dancer screens and make them individually available to your dancers with you as the administrator.
8. Thoughts on Starting a Dance Screening Program,[8] by Jan Dunn, a blog from a dance teacher's perspective, supporting a dance medicine team collaboration.
9. Physiological differences between students, pre-professional, and professional dancers,[9] a PowerPoint presentation by Terry Clark and others from the Trinity Laban Conservatoire of Music and Dance, under Emma Redding, who has produced excellent dance medicine research, and is past president of IADMS.
10. Dynamic neuromuscular stabilization and sports rehabilitation, by Clare Frank et al. I encourage you to read this article as a primer for CSM, as Dr Frank will teach evaluation and treatment of the dancer using DNS.

I would now like to discuss a few considerations in screening the pre-professional dancer. In a 15-minute musculoskeletal screen, I look at static and moving posture, muscle activation patterns, compensatory overuse of tonic muscle groups, morphology, underlying conditions, overall health, dancer goals, prior health care experience, and level of dance experience. In bilateral parallel stance, what do you see? Is there a forward head, anterior pelvic tilt, thoracic cage behind the pelvis with abducted scapulae, or loss of the tripod of the foot? When I see any of these, I think of looking at the recruitment of the short foot muscles, hip abductor and lateral rotators, external oblique, lower abdominal and pelvic floor, serratus, lower and middle trapezius, intrinsic cervical spine flexors vs. overuse of the flexor digitorum longus, flexor hallucis longus, rectus femoris, tensor fascia latae, upper rectus abdominis, upper trapezius, and sternocleidomastoid.

Next, have the dancer move into unilateral stance or tandem stance. Is there an adduction and/or medial rotation of the femur, and subsequent loss of medial-lateral stability of the foot? Is there gripping of the toes?

Then, watch the dancer move into and out of a bilateral, then unilateral parallel fondu, or mini squat. Look for additional compensations, such as a ribcage shift, pelvic tilt, increased forward head.

Into and out of parallel relevé, or bilateral plantar flexion, look for loading and unloading at the ankle/foot/toes, look for calcaneal inversion, medial talar glide, great toe rotation into pronation, elevation of the medial cuneiform on 1st metatarsophalangeal (MTP), movement of the fibula, as well as everything you looked at prior. Weight shift to unilateral relevé, and look for loss of heel height, balance, and how the ear/shoulder/hip/knee/ankle and nose/sternum/umbilicus/pelvis and occiput on atlas/cervicothoracic junction/thoracolumbar junction/lumbopelvis stack up.

With knees straight in bilateral parallel stance, have the dancer port de bras. Look for scapulohumeral dyskinesia, the ribcage, clavicles, occiput on atlas extension, sternocleidomastoid firing. Is the dancer an upper chest breather, or breath holder? If so, it is unlikely the dance will have good lumbopelvic stability. Look at what the eyes are doing. Often, I find I can improve the dancer's balance in any position by stacking up to midline, including the eyes.

Have the dancer fondu in parallel unilateral stance, then rotate the torso and pelvis on the femur into a turned out position, maintaining the fondu. You may see the dancer struggle, or use poor movement patterns. The parallel to turned out unilateral fondu is a good exercise, but often an unnecessary screening test. Other dance-specific movement to look at is rolling down from pique arabesque, in parallel or turned out position, and tendu á la seconde.

In the tendu, do the hip abductors and lateral rotators activate first, or do the two joint hip flexors initiate the movement? Does the dancer point the ankle and then the foot, or the toes first? Train the former, not the latter, in both cases.

What do these findings mean? When placed together, the loss of one piece of the chain can affect another part of the chain. From these few movements, I can see poor muscle activation in a muscle sling,[11] usually the anterior and posterior oblique sling, and confirm with tests such as unilateral stance push/pull (Figure 1), seated hip flexion, resisted shoulder flexion, DNS

sidelying to low oblique sitting (see *OP* 2014;26(2):131-134). Follow-up with range of motion, strength, palpation, passive physiological and accessory mobility, neurodynamic, and laterality recognition testing as needed. Your clinical reasoning and keen ability to interpret movement is what distinguishes you as a physical therapist. Take a look at the Janda upper and lower crossed syndromes.[12] I find the inhibited muscles are inhibited together in both the upper and lower crossed syndromes in the dancer.

The following 3 examples are dancers used to demonstrate screening considerations. The dancer in Figure 1 tends to load with excessive tibial external rotation during single limb jumping. His femur is then relatively internally rotated, pulling the pelvis of the landing limb anterior-medially. This movement creates a response of lumbar extension and rotation, inhibits the posterior gluteus medius and then the dancer overuses the flexor digitorum longus, rectus femoris, and tensor fascia latae. The result is medial tibial stress syndrome, limited dorsiflexion, and difficulty with balance into and out of relevé. This particular dancer did well with the unilateral push/pull perturbation, and use of the DNS, in addition to manual mobilization of the foot/ankle, and strengthening exercises. Recruiting his inhibited muscles helped inhibit his overused muscles.

In Figure 2, the dancer has a forward head, with shoulders and thoracic cage behind the pelvis. Correcting her alignment assisted her balance, but she needed to work on recruitment of several phasic muscles: her standing limb posterior gluteus medius, opposite serratus, and deep neck flexors. This was done with DNS exercises, Pilates reformer work, deep neck flexor exercises, and the exercise in parallel to turned out fondu with a hula hoop (Figure 3). One note about this dancer is her excessive hip external rotation. The wall lateral rotation exercise (Figure 4) is helpful, as she loses rotation control when lowering her limb, as the lever becomes longer.

The dancer in Figure 5 (HB) has chronic patellar subluxation. The tibial external rotation and lateral shift is visible at the popliteal crease and tibial tuberosity (Figure 6). After manual correction, her exercise was to correct unilateral stance in a low arabesque, again, facilitating the standing hip lateral rotators and tripod of the foot with a Thera-Band, keeping the 1st MTP on the floor, cuing opposite serratus anterior (Figure 7). The DNS breathing exercises were used to help her recruit her external obliques.

These are a few thoughts in regard to the screening, evaluation, and treatment of the dancer, to be shared, critiqued, and improved on. The DNS photos have deliberately been left out, as Dr Frank will provide great instruction and photos at our PASIG course during CSM. I look forward to our discussions, and you sharing about your screening in future *OP* publications!

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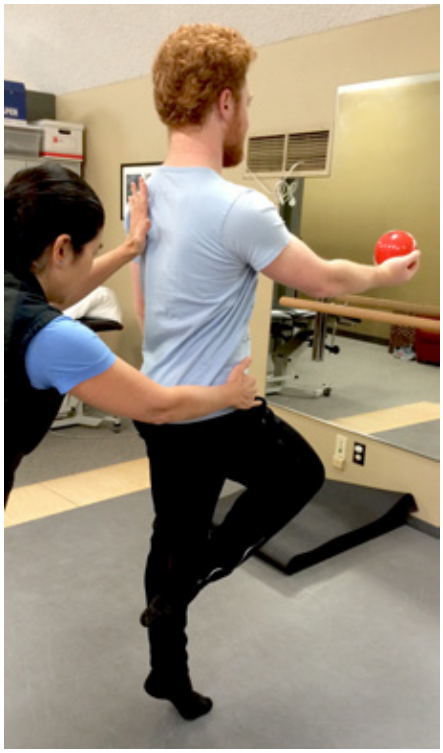

Figure 1. Push/pull.

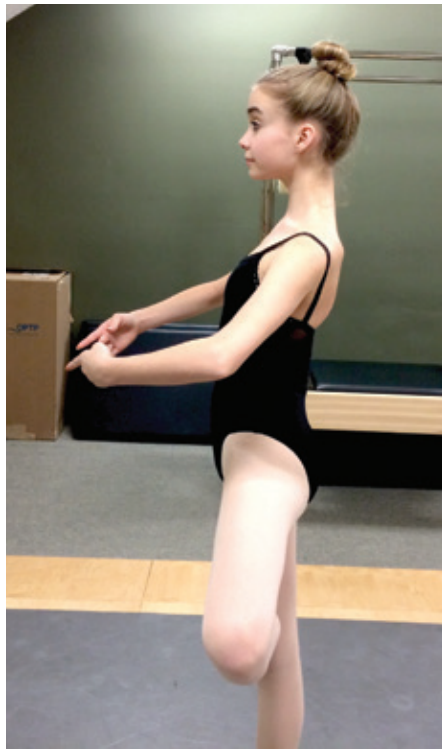

Figure 2. Posture.

Figure 3. Fondu with hula hoop.

Figure 4. Wall lateral rotation.

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Figure 5. Popliteal crease.

Figure 6. Tibial tuberosity.

Figure 7. Thera-Band cues.

FOOT & ANKLE

SPECIAL INTEREST GROUP

Dry Needling for Plantar Pain: A Ten Year Follow-up

Clarke Brown, PT, DPT, OCS, ATC

As President of the Foot and Ankle SIG and a member of the New York State Board for Physical Therapy, answering questions about the current state practice of physical therapy (in New York and elsewhere) is a frequent activity. Questions regarding the use of dry needling (DN), by physical therapists for the treatment of orthopaedic conditions, often present as: "Is dry needling effective?" and "Can physical therapists perform it?" Now, I am not an authority on DN, but I can review current literature and pass along the state of the practice regarding DN. The following is what I learned.

Because FASIG members are interested, the intent of this column is to review the current and potential use of DN for plantar foot pain, including plantar heel pain and plantar fasciitis. This very publication is devoted to idea/treatment information sharing. So, why not encourage some of the most talented foot and ankle specialists to re-visit this area and perhaps kindle discussion, and even more importantly, spur research? In fact, this column celebrates the 10-year anniversary of a very similar column written by Jan Dommerholt, PT, MS, titled "Dry Needling in Orthopaedic Physical Therapy Practice."[1] Since this publication, significant progress has transpired; more therapists have been trained in DN. Some physical therapists are trained at the university level (4 entry-level programs now teach DN), and more states specifically allow DN (4 in 2004: Maryland, New Mexico, New Hampshire, and Virginia; 26 in 2014).[2] Unfortunately, some of the same issues that hinder our progress in providing DN to our patients remain. In particular defining what DN is (a manual skill) and what it is not (acupuncture).

Confusion surrounding the research and applications of DN runs counter-productive to our collective use of this skilled intervention. Research has shown that DN can be effective in reducing pain and short-term disability.[3-5] Dry needling deserves further exploration as a treatment for orthopaedic conditions, particularly with regard to the establishment of optimal protocols across different diagnoses. Orthopaedic physical therapists should closely critique the literature on DN for safety, efficacy for pain relief, and for the practical application patient care because the definitions of the various uses of DN are often misinterpreted.

Precisely What is Dry Needling?

Dry needling is the insertion of thin monofilament needles into and/or around muscles, tendons, ligaments, fascia, peripheral nerves, scar tissue, Ah-Shi (painful) points, and neurovascular bundles with the purpose of treating a number of neuromusculoskeletal syndromes. Wet needling, in contrast, uses hollow-bore needles to deliver agents, including corticosteroids, anesthetics, sclerosants, and botulinum toxins.

Precisely What is the Target of the Needle?

The target tissue specifically defines the purpose of DN performed:

Ah-Shi (painful) points: The practice of acupuncture targets the monofilament needle at body locations established by traditional Chinese/Oriental practice. The word "acupuncture" translates to "needle penetration" and "Ah-Shi" translates to "where it hurts," which is the foundation of acupuncture needle placement.

Trigger points: The insertion of a monofilament needle into nodules within taught bands of muscle is a DN technique used in the treatment of myofascial pain. The literature abbreviates this type of DN as myofascial trigger point (MTrP) treatment, as needles are targeted to trigger points (TrPs).

Neuromusculoskeletal tissues: The insertion of a monofilament needle into and/or around muscles, ligaments, tendons, fascia, peripheral nerves, scar tissue, and neurovascular bundles. Research continues to investigate various applications of DN. These areas include the biomechanical, chemical, endocrinological, vascular effects of DN, and also treatment of tendonopathies. Furthermore local, proximal, and distal needling (regional interdependence), and the addition of manual manipulation or electrical stimulation to DN, are also under investigation.

Is Dry Needling Safe?

Dry needling while invasive, is safe. The insertion of a monofilament needle presents little risk to patients, provided the administrator of the treatment has sound anatomical knowledge.[6]

Interestingly, the discomfort that may be encountered during DN is considered an adverse event and as Cotchett et al[7] estimated, one in 3 patients have an adverse event. However, Yamashita et al,[8] in a study of 65,482 patients, found that no patients had a serious or severe adverse event such as pneumothorax, infection, or spinal cord injury and that minor adverse events occurred in only .04% of the cases. These adverse events were defined as failure to remove needles, ecchymosis or hematoma without pain, ecchymosis or hematoma with pain, burn injury, discomfort, dizziness, nausea or vomiting, pain in the punctured region, minor hemorrhage, aggravation of complaint, malaise, suspected contact dermatitis, fever, and numbness in the upper extremity. Directly from the CDC website the adverse effects of getting a flu vaccination include "soreness, redness, or swelling where the shot was given, fainting (mainly adolescents), headache, muscle aches, fever, and nausea. If these problems occur, they usually begin soon after the shot and last 1 to 2 days," and these adverse effects are similar to those of DN. When comparing side effects of DN and influenza vaccinations, DN is as safe as getting a yearly vaccine for the flu.

Further validating the safety of DN, a 2012 review of the CNA insurance claims database revealed no significant claims were reported involving physical therapists performing DN and that the practice of DN by a physical therapist does not present

a significant risk factor. Presently, CNA does not foresee the administration of DN by a licensed physical therapist as having any immediate claim or rate impact.[9]

Is Dry Needling the Same as Acupuncture?

The actual procedure of inserting fine monofilament needles in acupuncture and DN is identical; however, acupuncture terminology, theoretical constructs, and philosophies are different than those of DN. Acupuncture theory claims to move qi along meridians or channels particularly with diagnoses such as bi syndrome, qi, blood (yin) stagnation, and kidney (yang) deficiency. These are terms, diagnoses, and theories not used in the context of western medicine's definition of DN and use of monofilament needles. Interestingly, acupuncture studies often use western medical diagnoses such as chronic neck pain, plantar fasciitis, knee osteoarthritis, and carpal tunnel syndrome as validation to insert needles into Ah-Shi points. Differentiating DN from acupuncture by physical therapists is not new. In fact, Dommerholt discussed the obvious similarities and differences 10 years ago.[1]

Obviously, DN involves the use of needles inserted into and removed from the human body; however, that is the only similarity between DN and acupuncture. Similarly, if a hammer is associated with carpenters, do plumbers become carpenters every time they use a hammer? The objective of DN is not to control and regulate the flow and balance of energy and is not based on Eastern esoteric and metaphysical concepts. The fact that needles are being used in the practice of DN does not imply that an acupuncture board would automatically have jurisdiction over such practice. If so, physicians and nurses would also need to conform to the statutes of acupuncture, as they also "insert and remove needles."

Can Physical Therapists Legally Perform Dry Needling?

Yes. Physical therapists must be trained appropriately and the practice act of the state in which they practice must allow DN. Presently, 26 states (or jurisdictions), according to their practice acts, specifically allow DN by physical therapists. Two more states do not prohibit DN and 5 more leave it unresolved. A full 20 more states have no position or prohibit DN. The primary issues related to practice act or regulatory change include the perceived overlay of acupuncture and the insertion of a needle to penetrate the skin.[2]

Made available from the Federation of State Boards of Physical Therapy, a 2013 Resource Paper by the World Health Organization (WHO) published a number of reports on acupuncture. Specifically, the report discussing traditional medicine refers to DN in acupuncture, but in context, the reference is comparing needling alone with needling in conjunction with complements such as laser, TENS, and electro-acupuncture. The WHO report does not describe DN in the same context as intramuscular manual therapy or trigger point DN. Many of the WHO's reports regarding acupuncture including "Acupuncture: Review and Analysis of Reports on Controlled Clinical Trials," do not contain the term dry needling at all. According to WHO, dry needling is not acupuncture.

Are There Recommended Protocols and Dosages?

Optimal dosage (frequency of treatment), intensity (number of needles used and amount of manual manipulation or electrical stimulation), and duration (length of time needles are left in situ) have yet to be fully investigated. It seems clear that the duration of needle retention, meaning the amount of time the needle is left in situ, is important to effectiveness. It is also clear that continued research on all the variables related to needling, including, but not limited to, entry point of needle, angulation of needle, depth of needle, numbers and combinations of needles, and manipulation and electrical stimulation of needles, must be done.

If One Wants to Dry Needle a Trigger Point, Can One Find the Correct Spot?

Maybe. Inter-examiner reliability for the palpation and location of trigger points is poor. If clinicians are not consistently and correctly determining TrP locations, then clinicians cannot consistently or reliably penetrate the nodules within the taut bands of an active TrP. Further, if researchers cannot reliably detect, isolate, and dry needle TrPs, then studies that claim to measure the effects of DN at TrPs are questionable.[10] So far, the evidence suggests that TrPs cannot be reliably found, or needled.[11] Results of studies that attempt to determine the efficacy of DN TrPs should be viewed with extreme caution.[12]

What Research Exists Regarding Dry Needling for Plantar Fasciitis?

Typical of most research regarding DN techniques, DN is performed with or without acupuncture principles, with or without TrP principles, and often in comparison to wet needling; discerning the impact of DN alone is impossible. As an example of the inconsistencies in research regarding DN, a recent trial by Cotchett et al,[7] suggested that DN "provided significant reductions in plantar heel pain," but the level of minimally important difference was insufficient. The goal of the study was to use DN, but to do so (1) at palpated TrPs and (2) with needles left in situ for 5 minutes. (Note: this article has been cited as having needle treatment for 30 minutes, but the actual protocol called for 5 minutes needle placement duration over multiple sites.)

1. Multiple studies report that the reliability of any examiner accurately and consistently locating and needling TrPs is poor.
2. No previous case study, cohort study, or randomized trial limited needle duration dosage to 5 minutes.

To date, limited evidence exists for the effectiveness of DN associated with plantar heel pain. Research that could include greater clarity and control of variables and which might include principles of highly effective DN at the knee and for carpal tunnel syndrome has not occurred for the past 10 years begs the question…where is the research regarding plantar heel pain and dry needling?

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IMAGING

SPECIAL INTEREST GROUP

SAVE THE DATE

Open Forum on the draft, *Imaging in Physical Therapist Education Manual* is scheduled for Thursday February 5, 2015 at CSM. All APTA members are welcome to attend this portion of our Business Meeting. Please join us and provide feedback on this important initiative.

Research Committee

The Research Committee is exploring federal funding organizations for a conference proposal.

Imaging Education Manual

Work progresses on the writing of our Imaging Education Manual. By the time you receive this, the manual will be circulated to targeted stakeholders. At CSM we will present the manual at our Business Meeting. This portion of the meeting is open to all APTA members and anyone with an interest in imaging in physical therapist education. All are encouraged to attend and provide input to the manual. We hope to publish the manual in a yet-to-be determined manner in the spring of 2015.

The Steering Committee writing the manual is comprised of:

Douglas White, DPT, OCS, RMSK Chair
Bill Boisonnault, PT, DHSc, FAPTA
Bob Boyles, PT, DSc
Chuck Hazel, PT, PhD
Aimee Klein, PT, DPT, DSc, OCS
John Meyer, PT, DPT, OCS, FAFS
Becky Rodda, PT, DPT, OCS
Rich Souza, PT, PhD
Deydre Teyhen, PT, PhD, OCS

AIUM Ultrasound Guideline

The Imaging SIG participated in the development of the recently published AIUM Practice Guideline for the Performance of Selected Ultrasound-Guided Procedures available at www.AIUM.org and will also be published in an upcoming issue of the *Journal of Ultrasound in Medicine* 2014; 33:2223–2262. doi:10.7863/ultra.33.12.2223.

The guideline has implications for physical therapist practice, particularly for dry needling.

CSM Programing

Please plan to attend the ***Imaging and Low Back Pain: What's Useful, What's Not?*** with George Beneck, PT, PhD, OCS. Combined Sections Meeting in Indianapolis, Thursday, February 5, 2015, 11:00 AM – 1:00 PM

Call for Imaging Submissions

The Imaging SIG is soliciting submissions for publication in this space. Types of submissions can include:

- Case Report: A detailed description of the management of a unique, interesting, or teaching patient case involving imaging. Case reports should include background, case description including imaging, outcomes, and discussion.
- Resident's Case Problem: A report on the progress and logic associated with the use of imaging in differential diagnosis and/or patient management. Resident's case problem should include background section, diagnosis section which details the examination and evaluation process leading to the diagnosis and the rationale for that diagnosis, including a presentation of imaging studies. Interventions section used to treat the patient's condition and the outcome of treatment; however, the focus of the resident's case problem should be on the use of Imaging in the diagnostic process and patient management. The discussion section offers a critical analysis of how the Imaging guided the management of the patient.
- Clinical Pearl: Clinical pearls are short papers of free standing, clinically relevant information based on experience or observation. They are helpful in dealing with clinical problems for which controlled data do not exist. Clinical pearls should describe information pertaining to imaging which influence clinical practice.

Submissions should be sent to: Douglas M. White dr.white@miltonortho.com

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LEADERSHIP

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Gerard Brennan, PT, PhD – Ortho Section Board Liaison

Case Report: Clinical Decision Making with an Undiagnosed Post-Traumatic Osteolysis of the Distal Clavicle

Holmes LA, Cheung AC, Perry TL
Nova Medical Centers, Houston, Texas, USA
Corresponding Author: anthonycheung@n-o-v-a.com

BACKGROUND: Post-traumatic osteolysis of the distal clavicle should be considered in the differential diagnosis of an acute injury of the shoulder. **DESCRIPTION:** A 43-year-old male mechanic experienced sharp pain in his left shoulder while pulling a crowbar to move an engine. Initial plain radiographs 4 weeks postinjury were read as normal and negative for a fracture or dislocation (Figure 1). Upon initial evaluation, pain was reported along the left acromioclavicular (AC) joint and anterior glenohumeral joint. Flexion and abduction range of motion (ROM) were limited due to pain. External and internal rotation ROM were normal with pain. Palpation revealed tenderness to the AC joint, anterior glenohumeral joint, and the area of the rotator cuff interval. Positive special tests included the Hawkins/Kennedy Impingement, supraspinatus, Yergason's, Modified Yergason's, and Speed's tests. Negative special tests included the Drop Arm and O'Brien's tests. Mobility testing of the AC joint (shear test) and glenohumeral joint (load and shift) were normal. Manual muscle testing of flexion, abduction, and external rotation were weak and painful. **OUTCOMES:** After 3 weeks of conservative management, the patient presented with no subjective or objective progress. An MRI was recommended by the physical therapist and ordered by the physician. The MRI revealed post-traumatic osteolysis of the left distal clavicle (Figure 2). **DISCUSSION:** The earliest radiographic findings of post-traumatic osteolysis may not occur until 4 weeks postinjury. Physical therapists should consider the rare condition of post-traumatic osteolysis of the distal clavicle when a patient's symptoms and physical examination are not consistent with plain radiographic images. A physical therapist can contribute to the promotion of the diagnostic pathway of discovering rare pathologies and avoidance of unnecessary and potentially harmful interventions.

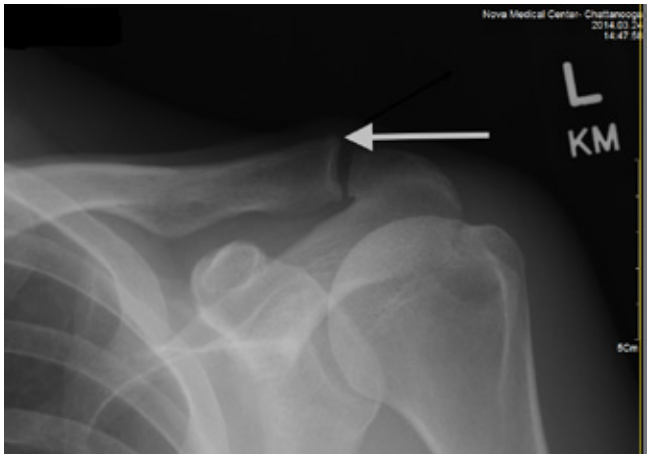

Figure 1. Initial plain radiograph of the left shoulder taken in the coronal projection. The white arrow identifies the left distal clavicle with no visible abnormalities.

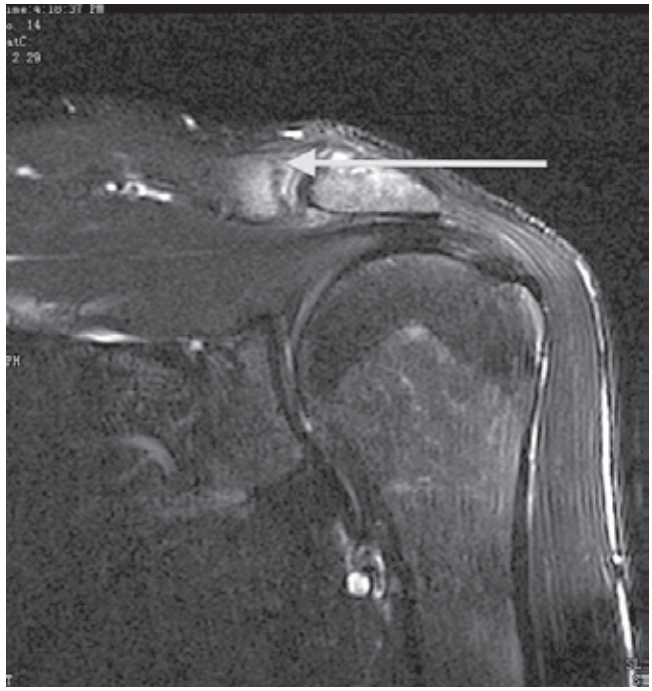

Figure 2. An MRI T2 TSE sequence of the left shoulder taken in the coronal projection. The white arrow indicates periarticular edema at the AC joint with cortical irregularity and a developing insufficiency type of fracture line at the lateral head of the clavicle. The findings are suggestive of osteolysis.

ANIMAL REHABILITATION

SPECIAL INTEREST GROUP

President's Message

Kirk Peck, PT, PhD, CSCS, CCRT

News Briefs:

CSM - The APTA Combined Sections Meeting being held in Indianapolis in early February is fast approaching and the ARSIG has exciting programming planned for those who attend. Lisa Bedenbaugh, PT, CCRP, will present on the topic of, *"Designing an Effective Therapeutic Exercise Program for Canine Clients."* In addition, the SIG will hold its annual business meeting which is intended to gain in-depth member feedback and discussion. The ARSIG events are scheduled for Saturday, February 7, from 7:00 a.m. - 10:00 a.m. Please mark your calendars for this exciting opportunity to learn and engage in collegial dialogue.

Strategic Planning - In October, Board members and SIG Presidents of the APTA Orthopaedic Section participated in a two-day strategic planning session. The process resulted in a successful revision of the Mission, Vision, and Goals that will guide Section activities and initiatives over the next several years. Two primary foci resulting from the revised plan included an emphasis on the advancement of educational opportunities for members and the promotion of innovative research to enhance Orthopaedic practice. These initiatives are aligned with the goals dedicated to the ARSIG and add significant value and benefit to being a Section member.

State Legislative Alerts:

I continue to receive inquiries from physical therapists regarding the legalities of animal rehabilitation in various state jurisdictions. Although I am pleased to learn that a few states are contemplating a change in practice laws to enable PTs and PTAs to practice on animals, the number of jurisdictions getting "actively" engaged in the process remains far too limited.

In an ideal world, all 50 states would have at least some form of legal language to support animal rehabilitation as part of PT scope of practice. Although this reality remains far into the future, achieving such as a worthy goal will only occur if states begin to take action now as opposed to ignoring a growing number of therapists who wish to expand their practice. The simple fact remains, however, if PTs and PTAs wish to practice on animals then laws need to be changed to publically and legally recognize the realities of an evolving profession. In support of member involvement, I offer the following Q&A section below to highlight a few additional issues that routinely surface in my communications with colleagues.

Common Questions Regarding PT Scope of Practice:

Since being elected President of the ARSIG, I have received multiple inquiries regarding the legal practice of animal rehab around the country. Therefore, to alleviate a need for constant repetition I have decided to share a few insights from past questions below:

1. ***Question:*** "I cannot find explicit language in the PT scope of practice referencing non-veterinarians treating animals so does that mean it is legal for a PT to practice on animals in my state?"
   Answer: In short, a PT or PTA is practicing "at risk" when treating animals without explicit legal scope of practice language. Crossing the human threshold to begin treating animals is relatively new territory for the profession of physical therapy and PT practice laws that were originally codified by state legislatures were not intended to be applied to the animal kingdom. Therefore, it is not prudent to automatically interpret old laws as if they apply to present day practice.

2. ***Question:*** "Does my human PT malpractice liability insurance plan cover me when treating animals?"
   Answer: No, unfortunately the health provider insurance industry has not caught up with the fact that many therapists are in the business of treating animals as part of PT practice. However, as states begin to legalize animal rehab in either PT or Veterinary laws then insurance companies will hopefully take a more serious look at their policies. Stevan Allen, VP of the ARSIG, has been lobbying a few insurance companies to consider offering coverage for PTs treating animals. His efforts successfully influenced HPSO to increase the amount of coverage allowed for canine malpractice insurance. Policies for equine rehab remain challenging however as the risk-benefit ratio is much greater in equine vs. canine practice.

3. ***Question:*** "Why are states that currently have language allowing PTs to treat animals do so by requiring veterinary referral or medical clearance? Why can't PTs just treat by direct access since all 50 states now have direct access language?"
   Answer: The answer is simple, and yet complex…it all relates to the concept of "evolution" within the practice of physical therapy. The PT profession is essentially starting over in many areas of professional negotiations when dealing with veterinarians vs. health providers in human medicine. Therefore, I offer the following two explanations to help answer the present question.
   a) History is clear on this point, veterinarians have only recently been confronted with the idea that non-veterinarians have a seat at the table in treating animals. This is a very new paradigm for some veterinarians, so the idea of PTs simply jumping on board to provide animal care and then demanding direct access rights is somewhat preposterous. Just consider how many years it has taken to demonstrate educational competencies in human practice to acquire direct access privileges. Simply put, there is a vast difference in the evolution of PT practice on humans vs. the practice on animals. For example, since animal rehabilitation is not an entry-level skill, issues such as educational competencies and safety in practice must be addressed to ensure PTs are qualified to cross species.

b) A very different and unique paradigm of practice has occurred in animal rehab that simply does not exist in human medicine. Veterinarians, who are essentially the MDs of the animal kingdom, are themselves getting educated to perform rehab services on animals. These services include the use of physical agent modalities, hands on skills such as manual therapy, and instruction in therapeutic exercise. In contrast, human physicians are not applying to PT schools to practice human rehabilitation. With that said it should not require a great imagination to recognize why some veterinarians are reluctant to share in the care of animals with non-veterinarians, especially accepting the idea of allowing others to have direct access. This attitude will hopefully change over time as PTs continue to publically demonstrate excellence in quality of animal care.

California Veterinary Medical Board:

The California Veterinary Medical Board (VMB) public hearing on the proposed regulatory language to mandate "direct supervision" over all non-vets treating animals has once again been postponed. The latest deadline to hold a hearing in October 2014 came and went so the next option for a scheduled date is January 2015. As a friendly reminder, the California proposal is a significant concern to the ARSIG and to all PTs, now and in the future, who practice on animals.

ARSIG Logo:

Since mentioning the importance of developing an ARSIG logo in the last newsletter I have received absolutely no responses from members as to possible designs. Therefore, I once again encourage any SIG member who has an imaginative mind to consider proposing a marketable idea for a creative SIG logo. Adding a personalized logo to letters of public correspondence, brochures, and other targeted materials will add overall credibility and integrity to the ARSIG.

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.

Happy Winter Season!!

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

Available ISC

Stevan Allen, MAPT, CCRT
VP, ARSIG

The ARSIG, in conjunction with the Orthopaedic Section, is pleased to announce the newest addition to our library of Independent Study Courses. This ISC is comprised of two different monographs. The first, entitled "PT Evaluation of the Animal Rehab Patient" was authored by Lisa Bedenbaugh, PT, CCRP, and Evelyn Orenbuch, DVM, CAVCA, CCRT. Author, Michael R. Lappin, DVM, PhD, DACVIM, authored the monograph titled, "Zoonosis and Animal Rehabilitation," completes the set. The course description of these two monographs presents animal rehabilitation for the canine population. The importance of using clinical reasoning skills to guide the assessment for each animal patient is emphasized, as is a team approach to rehabilitation of the animal patient. A companion monograph covers recognition of the clinical signs of disease in humans and animals that are associated with zoonotic diseases. Implementation of proper infection control and intervention is the focus. Case studies are provided for each of the monographs. We are confident that these two monographs will be an excellent addition to your reference library. You can order both on the Orthopaedic Section Website, at www.orthopt.org

The Importance of Core Strengthening (and Manual Therapy of the Spine and Pelvis) for the Long Term Benefit of the Canine Athlete Following Tibial Plateau Leveling Osteotomy: A Case Study

Karen Atlas, MPT, CCRT

PAST MEDICAL HISTORY

Skye is a 7-year-old male neutered Golden Retriever and a well-accomplished obedience, rally, agility, and flyball athlete. He originally presented to rehabilitation in May 2012 after undergoing a tibial plateau leveling osteotomy (TPLO) for surgical stabilization of a torn cranial cruciate ligament. After undergoing significant therapeutic interventions that included cold laser therapy, underwater treadmill, land-based exercises focusing on limb and core strengthening, and manual therapy, Skye returned to function, but continued to demonstrate unloading of the affected limb and palpable tenderness at the pes anserine. In October 2012, the TPLO hardware was removed as the surgeon suspected plate irritation as the cause for the continued unloading of the affected limb. After plate removal and additional rehabilitation, the lameness subsided and Skye returned to competition.

In February 2014, Skye came up lame on the same limb after an agility trial. Though no significant findings were identified by the referring veterinarian, it was recommended that Skye rest for 2 weeks and began a round of anti-inflammato-

ries. Skye's lameness persisted, so he was referred to the board certified surgeon who diagnosed bilateral sciatic nerve pain or cauda equina syndrome and was placed on gabapentin and further activity restriction. He was also referred back to a physical therapist certified in canine rehabilitation.

PT PHYSICAL EVALUATION

In late March 2014, an evaluation was performed by the canine rehab-trained physical therapist and the following significant findings were observed: (1) gait at a walk: 2/4 lameness in left pelvic limb (LPL off loaded and slightly externally rotated), (2) palpable tenderness in the following areas: left pes anserine, bilateral iliopsoas (left greater than right), bilateral sacrotuberous ligament, lumbosacral junction, and multilevel zygapophyseal and costovertebral joints of the thoracic spine, (3) pelvic asymmetry was noted with a dorsal and caudally positioned ilium on the left, as compared to the right, and moderately restricted mobility of the sacroiliac joints bilaterally (left worse than right), and (4) positive modified left straight leg raise indicating sciatic involvement.

INTERVENTION

Skye received a variety of treatments to meet his specific needs to initially reduce pain and inflammation including manual therapy techniques (to spine and pelvis, ie, grade II and III zygapophyseal and costovertebral joint mobilization, tail traction, sciatic nerve dural mobilizations, and soft tissue mobilizations including trigger point release to the iliopsoas and epaxial muscles), cold laser therapy (class 3b), and ultrasound to the pes anserine and distal hamstring tendons. He was kept conditioned in a low impact environment using the underwater treadmill.

FOLLOW-UP VISITS

Once Skye's acute pain was successfully managed with the above interventions, his treatment plan was modified to better meet his long-term needs of improved postural alignment and more intense core strengthening to enable him to safely return to sport. Employing grade III and IV joint mobilizations, the sacroiliac joints were effectively mobilized to correct Skye's pelvic alignment. Achieving a properly balanced pelvis and adequately mobilized zygapophyseal and costovertebral joints were critical to Skye's recovery since he had been compensating for the left-sided TPLO for so long.

The specific manual techniques implemented to achieve improved postural alignment were as follows: (1) unilateral dorso-ventral pressures of the affected zygapophyseal joints, (2) transverse pressures using the spinous process for the restricted zygapophyseal joints, (3) distraction and rotational mobilization techniques for the costovertebral joints, (4) cranial/caudal translations for the SI joints, (5) dorsal/ventral rotations SI joints.

The above techniques were employed as described by Laurie Edge-Hughes, PT, in the Basic and Advanced Manual Therapy for the canine spine book and continuing education course, respectively.

Exercises were advanced to work both on static and dynamic core strength. Static strengthening exercises included thoracic limbs on a BOSU ball with pelvic limbs first on solid ground with head perturbations (cookie to hip to facilitate weight shifting), then progressing to the pelvic limbs on an air disc, and finally to a 3 legged stand with the affected limb on the air disc and thoracic limbs on a more challenging air-filled donut (Figure 1).

To incorporate more dynamic core strength, Skye worked on a land treadmill with his thoracic limbs balancing on a BOSU ball. Once he mastered that, he was challenged more with simultaneous rhythmic stabilization techniques to the hind end (Figure 2).

With the above core strengthening exercises, an ace-wrap was used around Skye's trunk to provide proprioceptive input to his lumbar spine and abdominals. Concurrent manual tapping to the abdominals was done to elicit greater awareness to contract those muscles specifically. Following a successful comprehensive rehabilitation program, Skye fully returned to sport without limitation (Figure 3).

Figure 1. Skye working on static core strengthening exercises. Incorporating manual tapping to the abdominals further facilitates muscle contractions.

Figure 2. Skye working on dynamic balance on the land treadmill. He is required to balance on the BOSU ball with his thoracic limbs while walking on the treadmill. The proprioceptive band along with manual tapping of the abdominals helps to facilitate core strength.

CLINICAL SIGNIFICANCE

As physical therapists, we are accustomed to treating the body as a whole. A stifle injury does not just require stifle rehab. Treatment goals not only need to address short-term functional use of the affected limb, but the long term functional use of the

entire body. For athletes, the desire to return to sport runs deep, and your rehab program needs to highlight exercises that take into account the repetitive stresses on the whole body which requires and relies on a strong core.

Figure 3. Skye successfully returns to competition.

CONCLUSION

Pelvic and spinal alignment and core motor control are important aspects to consider during the rehabilitation of the postoperative TPLO. Even small compensations at the stifle can lead to significant problems in the spine that can severely affect performance and long term postural health in a canine athlete.

RESOURCES

1. Edge-Hughes L. *Basic Manual Assessment and Treatment of the Canine Axial Skeleton*. Published by Four Leg Rehab Inc. Copyright 2012.
2. Edge-Hughes L. Advanced Manual Therapy for the Canine Spine (Course Manual). Copyright 2014.

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Orthopaedic Section, APTA, Inc.
2920 East Avenue South, Suite 200
La Crosse, WI 54601