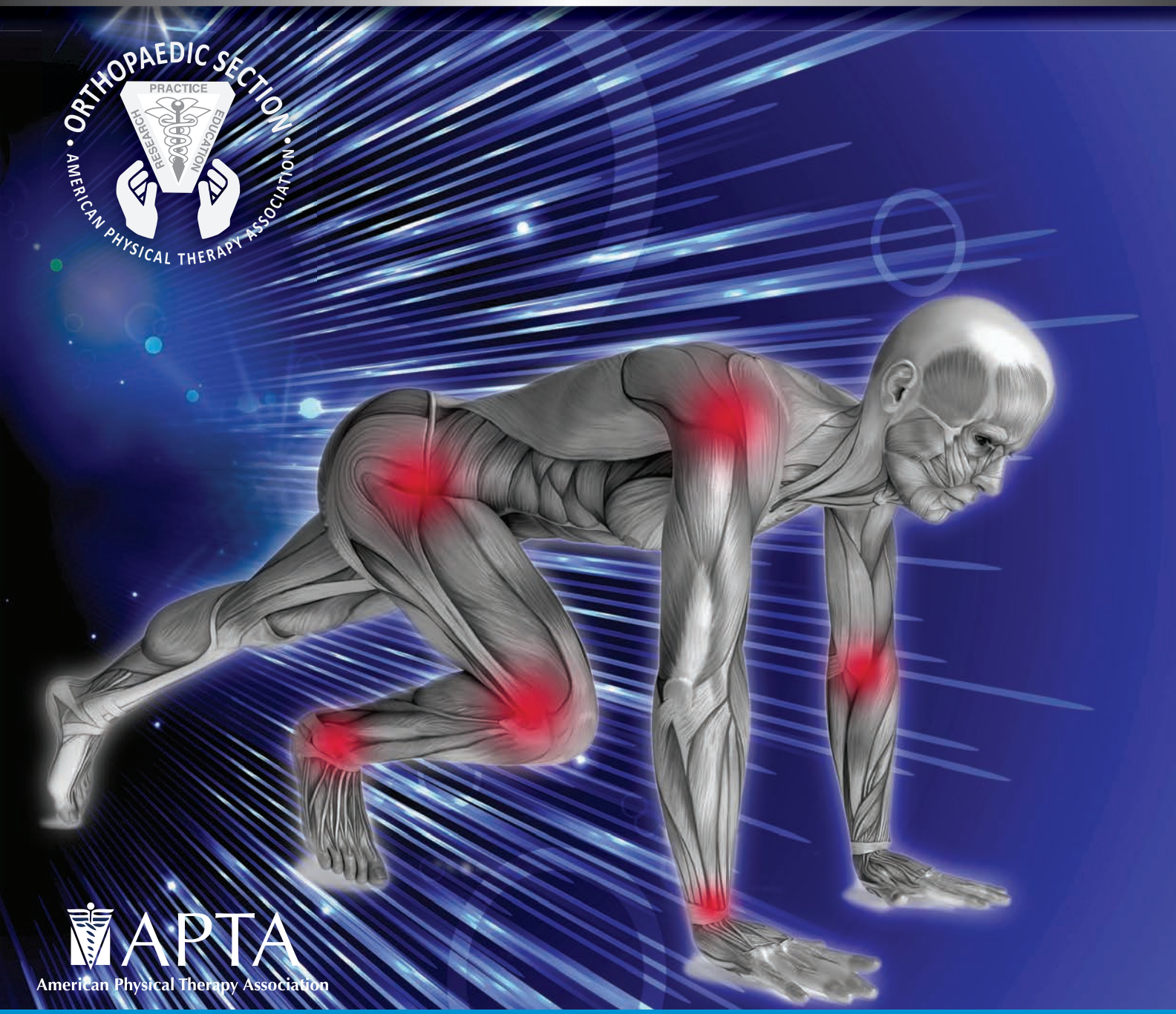
VOL. 29, NO. 1 2017

ORTHOPAEDIC Physical Therapy Practice



THE MAGAZINE OF THE ORTHOPAEDIC SECTION, APTA

ORTHOPAEDIC Physical Therapy Practice

In this issue

Regular features

VOL. 29, NO. 1 2017

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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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Publication Title: *Orthopaedic Physical Therapy Practice* Statement of Frequency: Quarterly; January, April, July, and October
Authorized Organization's Name and Address: Orthopaedic Section, APTA, Inc., 2920 East Avenue South, Suite 200, La Crosse, WI 54601-7202

Orthopaedic Physical Therapy Practice (ISSN 1532-0871) is the official magazine of the Orthopaedic Section, APTA, Inc.

Orthopaedic Physical Therapy Practice is indexed by Cumulative Index to Nursing & Allied Health Literature (CINAHL) and EBSCO Publishing, Inc.

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President's Corner

Board Accountability and the Need and Opportunities for Member Engagement

Good governance by a Board is *"not just about doing work better; it's about ensuring your organization does better work."*[1] Board accountability and performance for doing better work is generally guided by 3 principles for respectable governance. These principles are generally referred to as fiduciary, strategic, and generative.

Fiduciary refers to our stewardship of tangible assets, the overseeing of operations, ensuring appropriate use of resources, and ensuring legal compliance and fiscal accountability. The strategic mode is about setting priorities for the Orthopaedic Section organization, developing and improving various strategies, and then monitoring their performance. In contrast, generative thinking is a broader, more cognitive interactive process that involves viewing outside the usual framework of overall operations and getting at the core of an organization's reason for existence and purpose. It is about determining what to decide, probing assumptions about the organization, and identifying the underlying values that should be driving strategy and tactics. "Generative thinking is critical to looking at fixed data and situations in a more subjective, retrospective way."[1] This type of thinking and activity allows Boards to go beyond the usual problem solving and begin "problem framing."[1]

Your Board of Directors takes our accountability to engage in fiduciary, strategic, and generative actions seriously. To implement strategies derived from those interactions, we either engage the board or staff directly or we look to engage members by creating member-guided committees, task forces, or work groups. A Board or member-guided committee informs the Board decision-making on strategies, priorities, and core functions of the Section on long-term initiatives. Currently we have committees under practice, education, and research. A Board-appointed task force informs the Board decision-making on emerging issues and initiatives and are established for short- to mid-term initiatives. Board work groups are established and appointed by either the Board or the President. They inform the Board's decision-making on emerging issues and initiatives through managing focused objectives that require longer-term commitments than task forces.

Approximately a year ago, you may have observed we created and executed a volunteer interest form. The purpose of the form was to recruit a cross section of interested members for assisting the Board in developing and managing specific actions through committees, work groups, or task forces. The form describes the position or title of the task, the expected duration, required volunteer time commitment, travel requirements, fiscal implications, and any essential expertise requirements of the position. The defined form is then distributed for consideration to the entire membership through Osteo-BLAST. Returned forms are reviewed and compared. From that process, members are selected based on their related expertise for the respective initiative. This approach has been very successful and has provided various opportunities for many members to volunteer and share their expertise and efforts across brief encounters such as conference calls to more intense and enduring requirements such as those within a task force or work group. Below are some samples and updates on current task force and work group initiatives.

- **Technology Work Group:** This work group has worked to automate our ISC monograph/course submission process by moving it to Scholar One, ready our Independent Study Course content for the new platform, and collaborate with the *Journal of Orthopaedic and Sports Physical Therapy* and the Board of Directors on the various components of the site. This has included creating the design for the user interface, planning for the user migration, and determining the business model for the site. *Keep your eyes open for more information on our expanded launch of our new Internet platform.*
- **Advisory Technology Work Group:** This is a cross-section of Board and staff along with volunteer members whose charge is to create a plan on how to move forward with the new technology platform in facilitating the development of advancing clinical education and other member benefits through various means of technology.
- **Marketing and Branding Task Force:** This Board and member task force just completed its charge to assist the Board of Directors on selecting and engaging a branding consultant. *There will be an announcement and presentation at CSM 2017 in San Antonio sharing our new logo and tagline for the Orthopaedic Section. Please come to the membership meeting to learn more about this.*

These are only a few examples of charges and initiatives the Orthopaedic Section Board of Directors are currently moving forward through task forces and work groups. What should be evident from these samples is that in trying to create respectable governance for the Section, the Board attends to its accountability through fiduciary, strategic, and generative actions. To represent the needs of the membership and be all inclusive, the Board looks to member volunteers. Opportunities for members to work with the Board of Directors does not just "do better work" but enables the Board and the Section to perform its best work. Your Board of Directors believes we need to provide more opportunities for members to participate in the development and promotion of our organization. After all, many hands make light work. We look forward to member engagement because we are in fact, better together.

As always, please keep your Board of Directors advised on any of your member concerns or needs as well as what you like about your membership in the Orthopaedic Section. Thank you for being a member.

Wishing you all success in 2017.

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Editor's Note

When the Going Gets Tough, The Tough _____??

Christopher Hughes, PT, PhD, OCS, CSCS

By the time you read this editorial, winter will be in full swing in the East and CSM will be rapidly approaching. Winter can be a time of opportunity or threat. Some people do not like winter and choose to drudge through it or even hibernate until they come out and not see their shadow, hoping spring arrives early. In contrast many people love winter. They enjoy the holiday season, the winter activities, the winter sports, etc. Once again, it seems to be a question of whether one perceives a glass half empty or half full!

Regardless of the season, the clinical environment remains a challenging and continually changing environment. The election of a new President adds another variable to the health care mix. At present physical therapy (PT) employers have to still fight for every penny of reimbursement and continually justify their existence. Why is it that patients know our value, but payers and third parties continue to squeeze us like a lemon! The media plays a role as well. Stories that show the lessened effect of PT or the people can do it on their own approach seem to be more prevalent in popular media and often overshadow the stories when we shine.

In the coming months and even years ahead, I am sure it will be interesting. Do we as a profession have the stamina and resources to thrive and show our talents? Or will we slide down a slippery slope into the abyss of health care, one that has lost its true intent and become unobtainable and unaffordable. No doubt change is coming once again. The question is always will the new change be better than what we have or will we only tread water and/or even lose more? I think at this point we need to measure our PT IQ. Intelligence has been defined by Merriam-Webster Dictionary[1] as:

> *(1): "the ability to learn or understand or to deal with new or trying situations: The skilled use of reason (2): the ability to apply knowledge to manipulate one's environment…"*

In other words, challenging situations like the one we have now require an ability to adapt. In support of such a contention the field of PT has adapted in not only populating but also implementing a more rigorous evidence-based initiative that filters down to the clinic from the lab. However, times are tough; sometimes the evidence does not sway a cap or does not guarantee extended visits. It is the world we live in. Be thankful for the job but be ready to work harder for the same or less. Well at least we are in the game. But we have to "connect the disconnect." The research and clinical worlds have to build a better bridge to sharing and caring about each other's efforts for the good of patient care. In this regard, the Section is working really hard to foster this by providing resources and opportunities.

Sometimes when the profession has its back up against the wall, we come out fighting and become stronger in the end. It is important that we remain true to the profession. Are we really doing the best job we can? Are we living up to the promises we make? Are we really better than the threatening competition? This "truth in reflection" is often the first step in moving toward innovation and a higher quality product. In order for the profession to move forward, we have to be clicking on all cylinders. It is not just the clinics that need to adapt. Physical Therapy Education has to adapt, students have to adapt, researchers have to adapt, even patients have to adapt in order to stay "in the game" and make sure *Physical Therapy* remains available and affordable. We cannot just repackage the same product, we have to make, deliver, and sell a better product.

In the end educators, therapists, researchers, etc. are all on the same team. The collective whole will outshine any part. Let's get the passion back! Old habits die hard but new habits can be addictive as well. Every time we act, we reinforce the intention underlying that act. My latest read was a book by Charles Duhigg, *"The Power of Habit."*[2] This book is a nice synopsis of the steps underlying habit. The cue leading to the routine and then anticipation of a reward. Successful habit or not, you have to understand the basic urge if you want to transform or exploit the habit.

We have to focus our energies on working the problem and not complaining about it. Above all let's try not to mimic turtles in a tank, whereby we climb over one another to get out of the tank. In that scenario, who is really the smartest turtle? The one climbing or the one at the bottom building the foundation?

Physical therapists are a resourceful group. Their mission is honorable and their hearts are in the right place. Above all PTs are some of the nicest people you will ever meet. Patients confirm this every day and don't you think we often run in the same pack. If any group can overcome what we are about to face in the coming year, it is a Physical Therapist! But the ball is in our court more than we know. This is my "New Year" pep talk; so let's revisit the title of this message. You fill in the blank!

As always I appreciate your time in supporting *OPTP* and all Section initiatives. In addition, a special thank you to our authors who have contributed to this issue. May you all have a great new year and may all your new year's resolutions be realized!

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Manual Therapy, Therapeutic Exercise, and HipTrac™ for Patients with Hip Osteoarthritis: A Case Series

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ABSTRACT

StudyDesign: Case series. **Background**: Manual, long-axis hip traction has been used for centuries to treat pain and dysfunction associated with hip osteoarthritis (OA). The purpose of this case series is to describe a rehabilitation program that was used to treat two patients with hip OA using the HipTrac traction device in addition to manual therapy and therapeutic exercise. **Case Description**: Two patients were treated with manual therapy, therapeutic exercise, and administered the HipTrac device. The manual therapy and therapeutic exercise programs targeted impairments each patient presented with at each treatment session. The HipTrac, applied in the clinic and in each patient's home, was used for mobilizing the joint capsule and to provide pain relief. **Outcomes**: The primary outcome measures were the CareConnections Functional Index (CCFI), the Visual Analog Pain Scale (VAS), range of motion (ROM), manual muscle tests, performance of functional single leg squats and single leg dead lifts. Improvements in all outcome measures were observed for both patients. **Discussion:** Clinically meaningful improvements in self-reported function and pain were described by both patients two years posttreatment. Both patients reported that they had greatly benefited from combining the techniques and procedures used. The use of the HipTrac along with traditional physical therapy procedures may relieve pain and improve function in patients with hip disorders.

Key Words: mechanical traction, stiffness, gluteal muscle weakness

INTRODUCTION

For decades, the first and most widely used manual therapy technique for hip joint pain has been long-axis hip traction. Brackett stated in 1890, "the value of traction in the treatment of the acute condition of hip disease has abundant evidence, both in its relief of the symptoms and in its influence on the course of the disease." Brackett credited Bradford and Conant for describing the position of traction, that is, when the hip is flexed and abducted. Brackett concluded that in "ordinary cases" when continual traction is used, distraction occurs and "this may happen even after disease has existed for some time." Brackett also noted that continual traction is beneficial for alleviating pain and for preventing the mechanical sequelae associated with excessive muscular irritability.[1]

Many manual therapy techniques, including joint mobilization and manipulation, are important in the treatment of hip joint pathology. There is strong evidence in the current literature that shows the benefit of joint mobilization, including long-axis traction, in improving range of motion (ROM) and functional index scores while decreasing pain. There has been much discussion about how joint mobilization might affect hip joint pathology including (1) restoring positional faults and accessory movements,[2] (2) stretching the joint capsule thus restoring normal arthrokinematics, (3) inducing pain inhibition and improving motor control,[3] (4) changing the descending pain inhibitory system and/or central pain processing mechanisms,[4,5] (5) stimulating joint mechanoreceptors thus inhibiting nociceptive stimuli,[6] (6) altering inflammatory mediators,[7] or (7) reducing fear avoidance with movement and exercise.[8]

Long-axis traction is one of the techniques that can provide immediate pain relief while also working to improve general mobility in the treatment of hip joint pathology. Based on recent clinical findings obtained with manual therapy and the potential need for prolonged and continual traction as stated by Brackett, can we improve patient care in the treatment of hip joint pathology by combining these two concepts in the short and long term?

The purpose of this case series is to describe a rehabilitation program that included using long-axis hip traction using the HipTrac (MedRock Inc., Portland, OR) for two patients with hip osteoarthritis (OA). In addition to using the HipTrac, the patients participated in an individually-dosed and impairment-specific manual therapy and therapeutic exercise program. The HipTrac is a home medical device that the patient can use independently to perform long-axis hip traction that replicates the manual technique performed in the clinic. It can be applied in supine in any degree of rotation and abduction as well as 4 levels of flexion (0°, 10°, 20°, and 30°). The HipTrac can also be used in sidelying for traction in any degree of extension. The hip joint requires approximately 400 N to achieve distraction[5] and the HipTrac is able to produce forces well over 1000 N. In this case series, the HipTrac was used only for supine long axis-traction in varying positions between close-packed and loose-packed hip positions. This is the first paper evaluating a multi-modal treatment approach to hip OA that allows the patient to receive long periods of hip traction at home as well as in the clinic.

REVIEW OF THE LITERATURE

Within the last decade several authors have investigated the effects of manual therapy, including long-axis hip traction, as a component of the rehabilitation program for patients with hip OA. In a single-blind, randomized clinical trial of 109 patients with OA of the hip, Hoeksma et al[9] reported statistically significant improvements in hip function (Harris Hip Score[10]) and pain (Visual Analog Scale [VAS]) in a group that received manual therapy (which included manual traction of the hip) versus a group that received exercise alone.

MacDonald et al[11] described the outcomes from a series of 7 patients with hip OA who were treated with manual therapy (including long-axis hip traction) and exercise. All patients exhibited reductions in pain (numeric pain rating scale), increases in passive hip ROM, and improvements in function (Harris Hip Score[10]).

Vaarbakken and Ljunggren[12] compared the effectiveness of manual hip traction that was progressed to 800 N in 10 patients (experimental group) to a group (n=9) who received exercises, soft tissue techniques, and self-stretch procedures. Six out of the 10 subjects in the experimental group showed superior clinical posttreatment effects on the

Hip Disability and Osteoarthritis Score[13] whereas none of the 9 subjects in the control group showed as comparable improvement on the same outcome measure. The results suggest that higher known forces with manual hip traction are more effective in reducing self-rated hip disability after 12 weeks of treatment than the application of unknown manual traction forces provided by the clinician.

Wright et al[14] retrospectively analyzed the data from 70 subjects who had participated in a randomized controlled trial. Forty-seven subjects were assigned to an exercise and manual therapy group (which included manual hip traction) and 23 subjects were assigned to a control group who received routine care offered by their general practitioner. Significant differences in the regression coefficients for the Global Rating of Change Scale[15] and the pain scale from the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)[16] were found for the exercise/manual therapy group versus the control group.

Using the WOMAC as the primary outcome measure, Abbott et al[17] allocated 206 adults with hip (n=93) or knee (n=113) OA to the following groups: usual care only (n=51), usual care plus manual therapy (n=54), usual care plus exercise therapy (n=51), and usual care plus combined exercise therapy and manual therapy (n=50). For the patients with no joint replacement surgery during the trial (n=162), the authors reported statistically significant improvement in WOMAC scores for all 3 interventions; that is, manual physical therapy versus usual care, exercise therapy versus usual care, and the combined therapies versus usual care. The manual therapy group showed the greatest reductions in WOMAC scores of all groups overall and these reductions were still present one year later.

Using a randomized participant and assessor-blinded protocol trial with a 12-week intervention period, Bennell et al[18] compared manual therapy, home exercises, education, and advice in 49 patients to a group of patients (n= 53) who received a sham treatment intervention. All participants met the hip OA classification criteria of pain and radiographic changes set by the American College of Rheumatology.[19] The inclusion, criteria were as follows: 50 years of age or older, pain in the hip or groin for more than 3 months, a VAS score of 40 or higher on a 100 mm scale and at least moderate difficulty with activities of daily living. Major exclusion criteria included participation in physical therapy/chiropractic treatment in the past 6 months, prescribed exercises for the hip or lumbar spine in the past 6 months, current participation in a daily walking program for 30 minutes, or current participation in a regular structured exercise routine more than once weekly. The primary outcome measures were the VAS and the WOMAC. After 10 treatment sessions over 12 weeks, the investigators reported no significant difference between the treatment group and the sham treatment intervention. Based on the results of their study, the investigators concluded that "there is limited evidence supporting use of physical therapy for hip osteoarthritis."

CASE DESCRIPTION AND OUTCOMES

Each patient was informed that his physical therapy chart notes could be used in a publication or presentation. Each patient was informed that his identity would not be disclosed in a publication or presentation and fictitious names would be used.

Patient One

Jill is a 50-year-old female with a diagnosis of moderate right hip OA by her orthopaedic surgeon and supported by radiographic evidence. Her symptoms began 6.5 months ago and she describes her pain as sharp, dull, aching, throbbing, and constant in the groin and buttock regions. Her pain is aggravated by sitting, rising from sitting, walking, ascending/descending stairs, and crossing her legs. It is relieved by stretching, rest, and medication. She has been given the recommendation for total hip replacement at any time when she can no longer subjectively tolerate her pain and dysfunction. Jill's CareConnections Functional Index (CCFI) score prior to receiving physical therapy was 52%. A change greater than 11 points has been reported as representing the minimal clinically important difference (MCID) for the lower extremity.[20] Jill takes over-the-counter nonsteroidal anti-inflammatory medications as needed. Jill rates her pain as 3 out of 10 on the Visual Analog Pain Scale. An MCID of 1.37 cm has been determined for the 10 cm VAS.[21] Jill's ROM on intake and discharge appears in Table 1.

Jill had the following positive signs on the right: Trendelenburg gait, flexion abduction external rotation (FABER) test, and a capsular pattern of restriction (defined here as loss of closed-pack position, FABERs, and flexion/internal rotation quadrant). She has increased hip pain with compression and decreased pain with traction. Jill's manual muscle test for sidelying hip abduction was 4-/5 on the right and 4+/5 on the left. Jill could not perform a functional single leg squat with gluteal emphasis or a single leg dead lift without loss of balance, pelvic drop, or pain. The following goals and expected outcomes by time of discharge for her were as follows: independence and compliance with her home exercise program, pain rated as 1 out of 10 or less on the VAS, an increase in hip ROM (flexion to at least 110°, extension to at least 15°, internal rotation to at least 10°, and external rotation to at least 50°), to walk safely and independently all distances, and to perform all normal work tasks without limitations.

Jill received 17 physical therapy sessions over a span of 6 months with therapy provided 2 times per week for 4 weeks, then once per week for 6 weeks, then one time per month for 2 months, and finally 1 discharge visit 2 months later. Manual therapy in the clinic was focused on improving hip joint mobility and decreasing pain. Techniques are described in Appendix A. Home and clinic therapeutic exercise programs focused on increasing lower extremity and lumbopelvic mobility, neuromuscular control, biomechanics, strength, flexibility and stabilization (Appendix B). The HipTrac was used at home, after the eighth clinic visit, and to be used between visits and after discharge for pain-control and to augment the hip mobility gains that she achieved with her clinical treatments (Appendix C – protocol).

Jill's CCIF increased from 52% (intake score) to 86% (discharge score); this met the MCID of 11 points. Jill's VAS decreased from 3 (intake score) to 0.4 (discharge score); this met the MCID criteria of 1.37 cm. Jill also reported that her global rate of change was 5/7 at discharge. Between intake and discharge from physical therapy, Jill's ROM retest scores for her right hip increased by 30° for flexion, 11° for extension, 7° for abduction, 18° for internal rotation, and 27° for external rotation (Table 1).

When Jill was discharged, she reported that she rarely needed to take over-the-counter medications and was much more active now, participating in yoga twice per week in addition to her weekly home exercise program developed during treatment. Jill's hip abduction manual muscle test at discharge was 4+/5 on the right as compared to 4-/5 at intake. In addition, Jill was able to perform functional single leg squats with gluteal emphasis and single leg dead lifts without loss of balance, pelvic drop, or pain great than 1/10 (2 sets of 10 of each) at discharge. Jill reported that she felt that she had greatly

Table 1. Jill's Hip Range of Motion Over 17 Visits in a 6-month Period

	Intake		Discharge	
Hip ROM (deg)	Right	Left	Right	Left
Flexion (supine knee flexed)	90	115	120	124
Extension (prone, knee extended)	9	15	20	25
Abduction (supine)	28	40	35	45
Internal rotation (90° flexion)	0	19	18	30
External Rotation (90° flexion)	35	65	62	73

benefitted from home manual therapy using the HipTrac as well as her home exercise program. She verbalized understanding that her OA will progress and that consistent home manual therapy and exercise may continue to help her have less pain, increased mobility, and increased functionality. She reports her new goal is to more comfortably delay her surgery as long as possible. As of completion of this case series two years later, she has yet to have surgery and reports that she continues to maintain her higher level of function, reduced pain, and a more active lifestyle.

Patient Two

Travis is a very active 40-year-old male with a diagnosis of moderate left hip OA and left femoral acetabular impingement (FAI) by his orthopaedic surgeon and supported by radiographic evidence. He reports his symptoms began two years before with a gradual onset, which he noticed while running. His chief complaint is a dull and constant ache in the left groin, thigh, and buttocks. Walking, stairs, and recreational sports such as running, skiing, cycling, hiking, and surfing aggravate Travis' symptoms; he reports that nothing relieves his symptoms. He has been given the recommendation for total hip replacement. Travis' CCIF score on intake was 80%. A change of greater than or equal to 11 points has been reported as representing the MCID for the lower extremity.[20] Travis takes over-the-counter nonsteroidal anti-inflammatory medications as needed. Travis rates his pain as 3.7 on the VAS. An MCID of 1.37 cm or greater has been determined for the 10 cm VAS.[21] Travis' ROM on intake and discharge appears in Table 2.

At intake Travis had a positive left Trendelenburg gait, positive FABER test, and significant capsular restrictions. He had increased pain with compression and decreased pain with traction. His hip abduction muscle strength was 4/5 on the left and 4+/5 on the right. Travis could not perform a functional single leg squat with gluteal emphasis or a single leg dead lift without loss of balance, pelvic drop, or pain.

Expected goals and outcomes for Travis were as follows: home exercise program independence, pain rated as 1/10 or less on the VAS, improved hip ROM (flexion to at least 110° and internal rotation at 90° of hip flexion to at least 10°), and participation in most of his recreational/sports activities with decreased symptoms less than 1/10.

Travis received 15 physical therapy visits over a 5.5 month period with therapy provided 2x per week for 4 weeks, then 1x per week for 4 weeks, followed by 3 visits over the next 4 months. Manual therapy in the clinic focused on improving hip joint mobility and decreasing pain through a variety of techniques (Appendix A). Home and clinic therapeutic exercise programs focused on increasing lower extremity and lumbopelvic mobility, neuromuscular control, biomechanics, strength, flexibility, and stabilization (Appendix B). HipTrac was initiated at home, after the fourth visit, to be used between visits and after discharge for pain control and to supplement, reinforce, and further improve the hip mobility gains that he achieved with his clinical treatment (Appendix C – protocol).

Travis' CCFI score increased from 80% (intake) to 94% (discharge); this met the MCID of 11 points. Travis' VAS decreased from 3.7 (intake score) to 1 (discharge score); this met the MCID criteria of 1.37 cm. His perceived global rate of change was 5/7 at discharge. Between intake and discharge from physical therapy, Travis' ROM retest scores for his left hip increased by 27° for flexion and 14° for internal rotation (Table 2). Travis' left hip abduction manual muscle test score at discharge was 4+/5 as compared to 4/5 at intake. In addition, Travis was able to perform 3 sets of 10 functional single leg squats and single leg dead lifts with proper technique and no pain over a 1/10 at discharge.

Near the end of Travis' physical therapy program, he reported that he had participated in a painfree 62-mile bike ride. He also stated he was very happy to not only delay his total hip replacement but participate in more activities with less pain. He was able to return to surfing with some symptoms and could ride his bike daily for commuting without aggravating his hip. Against the advice of his medical team, he also returned to running 4 to 5 miles on trails 3 times per week with pain below a 2/10. Because of his interest in regular participation in the high-level activities of surfing, running, and performance cycling, Travis reports that he has good days and days with some soreness. However, he now has improved mobility and strength in addition to pain management strategies to cope with any flare-ups. He reports that he can use the HipTrac and home exercise program to quickly decrease pain from increased activity and maintain hip mobility. He reported that he would not have been able to return to any of these activities or delay hip surgery for the past two years if he had not used the HipTrac regularly at home.

DISCUSSION

Providing individually dosed and impairment-specific manual therapy, therapeutic exercise, a home exercise program, and use of traction using the HipTrac independently at home between visits and after discharge increased the quality of life for these two patients. Hip traction has long been established as an effective therapy for patients with hip OA.[1] The most effective form of long-axis traction is when the distraction force is progressed.[12] The HipTrac allows the patient to receive prolonged and progressed distraction forces in the clinic and at home.

We have described a multi-modal rehabilitation program that produced subjective and objective results for these two patients. Our results are consistent with other authors[9,11,12,14,17] who have reported benefits from manual therapy, exercise therapy, and a reinforcing home program. However, our findings are not supported by the work of Bennell et al.[18] Differences between our case series and the Bennell et al[18] study may be related to the following: (1) the dosage of manual therapy and therapeutic exercise provided; (2) the impairment-specific manual therapy techniques and therapeutic exercises provided to each individual patient or

Table 2. Travis' Hip Range of Motion over 15 Visits in a 5.5-month Period

	Intake		Discharge	
Hip ROM (deg)	Right	Left	Right	Left
Flexion (supine knee flexed)	115	85	120	112
Extension (prone, knee extended)	22	20	23	20
Abduction (supine)	35	40	40	45
Internal rotation (90° flexion)	28	0	27	14
External Rotation (90° flexion)	40	50	45	51

lack thereof and, (3) the activity level of the patients.

Regarding dosage, the authors of this paper spent more time with the patients than did Bennell et al.[18] The authors believe that when treating such a complicated and varying pathology, a meaningful dose of manual therapy and therapeutic exercise cannot be properly applied in only 30 minutes and only one time per week. Some individuals may only need 30 minutes while others may require up to 60 minutes per session, with sessions being 1 to 2 times per week for 4 to 6 weeks initially.

Regarding the manual therapy and exercise approach, the authors's program was individualized for each patient whereas that of Bennell et al[18] used a semi-standardized approach to treatment. Random allocation of subjects into treatment and control groups is a very important component of a well-done study, as was the case with the Bennell et al[18] work. However, treatment for hip OA may need to be very specific to the individual's impairments, and providers may need to take special care to non-randomly categorize patients into the proper treatment protocol in order to show success. For example, clinical reasoning would discourage placing a patient with very good ROM into a manual therapy-emphasized category to increase ROM, just as we would not expect to place a patient with severe capsular restrictions into an exercise-only category. Treatment emphasis and categorization should depend on that individual's impairments.

In addition, all of the Bennell et al[18] subjects received only 2 to 3 different joint mobilization techniques: long-axis distraction in clinic and lateral distraction and/or inferior glide in hip flexion. Only 22% of the subjects in their active group also received joint mobilization in anterior glides for hip extension and external rotation, and 16% received posterior glides for internal rotation. It is well established that hip extension, internal rotation, and external rotation can be greatly limited with hip OA and are critical to specifically target in treatment when these limitations exist. In our case series, our two subjects received 8 different joint mobilization techniques, as needed, rather than only 2 to 5 techniques to specifically target each individual's impairments.

Also, Bennell et al[18] excluded patients under 50 years old as well as patients who could walk continuously for more than 30 minutes daily and those who participated in regular structured exercise more than once weekly. By excluding these individuals, Bennell et al[18] may only be studying individuals who are unmotivated to exercise/improve, who are in too much pain or dysfunction to exercise, or who are fear-based individuals avoiding exercise. There is also a growing number of individuals younger than 50 years old that may benefit from treatment for hip OA earlier in the disease cycle. We believe that all individuals of all ages along the continuum of mild, moderate, and severe OA who are active and inactive more accurately represent those who need and may seek treatment for hip OA prior to becoming surgical candidates.

Evidence-informed practice takes into account what has been published in the literature, the experience of the clinician, and the goals of the patient. Consequently, success may need to be individually defined. There is no cure for hip OA and therefore providers cannot rid these patients of OA. The goals for most patients are to more comfortably avoid or delay surgery, improve mobility, decrease risk for co-morbidities due to inactivity related to their disease, decrease pain, and increase overall quality of life to engage in all of their social, occupational, and leisure activities. For some patients, making a change from a 7/10 pain level and no participation in a regular exercise regimen to a 3/10 pain level with consistent participation in an exercise regimen could equate to 100% success. For others, success could be to delay their hip replacement by 6 months for personal scheduling reasons while not having increased risk for hypertension or loss of blood glucose control due to inactivity. However, for all patients, we should not underestimate the significance of assisting them to become more active for at least 30 minutes per day to decrease the risk for heart disease, stroke, cancer, diabetes, depression, and other co-morbidities related to inactivity. Total hip replacement is the gold standard of care once conservative measures have been exhausted and it is well documented that these individuals do very well after surgery in terms of functionality and quality of life. However, surgery is expensive, carries its own risks associated with being under general anesthesia, and will usually need to be repeated 15 to 20 years later on the same hip. From the point of view of the patient as well as that of the federal and private health care system, it is in the best interest to more comfortably delay this surgery as long as possible to decrease the overall health care utilization related to chronic pain and inactivity while improving the quality of the life for each individual.

We would like to emphasize the importance of evidence-based treatments including clinic and home manual therapy, therapeutic exercise, and patient education that can help each individual meet his or her specific goals. In this process we hope to discover which manual therapy techniques and therapeutic exercises, as well as which dosages of each, can help improve outcomes for individuals along the entire progressive continuum of hip OA and other hip joint pathologies.

Our two patients had joint mobility restrictions, muscle length deficits, muscle strength limitations, and insufficient muscle endurance/coordination at intake. The two patients were gradually progressed to higher levels of clinical manual therapy, traction at home via HipTrac, therapeutic exercise, and soft-tissue stretch-and-release techniques such that the rehabilitation remained challenging. Our case study added home manual therapy, in the form of long-axis traction with HipTrac, as an additional benefit for the patients between visits and after discharge.

One potential challenge with using HipTrac is that it may be cost-prohibitive for some patients. According to their website, cost to rent is $125 per month and the cost to purchase is $895. Additionally, since this is a new device, there is no literature on standard-

ized protocols for use and progression. These two patients were not required to follow any strict protocol. They were simply educated in loose-packed and close-packed positions and were encouraged to progress towards close-packed as quickly as was comfortable. In addition, they were encouraged to discover a particular position, intensity, and dosage that produced personal results for them in the form of decreased pain, increased mobility, and improved functionality during activities of daily living.

A limitation of any case series is that causality cannot be inferred from the data, especially with only two subjects and no control group. However, the findings can be used to inform clinical practice. Future studies will need a more robust experimental design and the addition of a control group. These authors would like to see further studies on the effectiveness of this device. Studies could specifically address reductions in medication usage, increases in activity level, decreases in pain scores, increases in ROM, and increases in functional indices among patients with hip OA. The unique role of this device in independent home programs including therapeutic exercise and home manual therapy needs further study.

CONCLUSION

We have shown that providing manual therapy, exercise therapy, a home program, and home long-axis hip traction with the HipTrac provided clinically important improvements in pain and function for our two patients with OA of the hip. While not definitive, we also documented objective and subjective feedback indicating that the use of continuous and progressive hip traction can play a valuable role in improving mobility and function while relieving pain in patients who have hip OA.

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Appendix A. Manual Therapy Techniques

Clinic Joint and Soft Tissue Mobilization

Long-axis distraction was performed at grade IV and High velocity low-amplitude thrust (HVLAT), while all other techniques were grades III-IV. Time spent on mobilizations varied with each individual. During the first 4 to 6 weeks, at least 30 to 40 minutes of each session was spent solely on joint and soft tissue mobilization while 15 to 20 minutes was spent on exercise instruction/education. After the 6th week, mobilization continued as needed with an emphasis placed on spending more time instructing the patients in advancing independent home exercise work. Proper technique was always evaluated at each session. Patients were encouraged to spend their time at home performing their stretches and exercises while taking full advantage of their clinical time obtaining manual therapy.

Long-Axis Hip Traction (Grades IV and HVLAT)

Sidelying Long-Axis Traction in Abduction with Inferior/Medial Glide (two people)

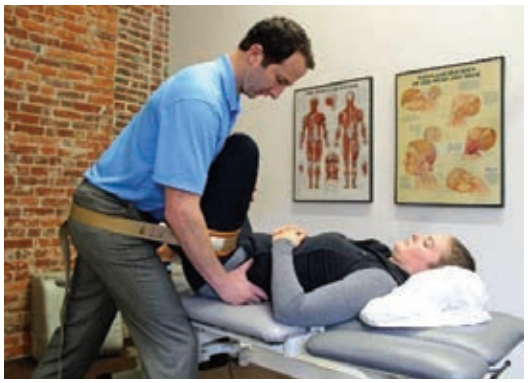
Lateral Distraction in Neutral (45° and 90° of hip flexion)

Lateral Distraction in External Rotation

Lateral Distraction in Internal Rotation

Prone Anterior Glide in Extension

(Continued on page 18)



Inferior Glide

Prone Anterior Glide in FABER (flexion, abduction, external rotation position)

Posterior Glide

Home Joint and Soft Tissue Mobilization
See Appendix C for HipTrac protocol

HipTrac – Long-Axis Hip Traction Unit used for home use.

Soft-tissue release using a foam roller or ball was performed 4 to 7 days per week for 90 seconds minimum, but no more than 5 minutes per body part

Psoas Release Using Different Balls

Gluteal/Deep Hip Rotators Release Level I with Foam Roller

Gluteal/Deep Hip Rotators Release Level II with Roller

Gluteal/Deep Hip Rotator Release Level II with Ball

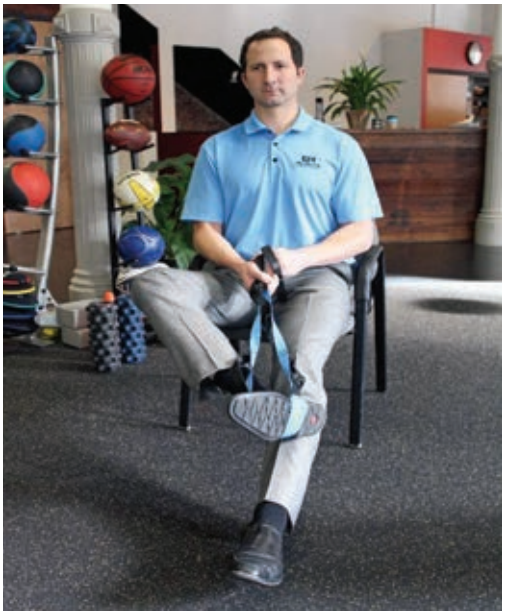
Appendix B. Therapeutic Exercises

Hip Capsular and Soft-Tissue Stretching/Positioning

Below are examples of therapeutic exercises and movements/positions that the two patients did in the clinic and at home. Because the patients had capsular restrictions, they did not initially report that they felt stretch in the muscles. During this phase, we still asked them to move into the positions but to keep pain levels below a 2-3/10 on their scale. As manual therapy accumulated to improve capsular mobility, the goal was for the patients' sensation to evolve from joint/capsular pain/restriction to more of a muscular stretch. The goal was not to stretch aggressively to lengthen muscles (especially in the presence of certain labral tears and the absence of osteoarthritis) but rather to achieve quadrants and positions that were important for activities of daily living and normal human mechanics. The patients were encouraged to "snack/graze" on these movements 3 to 6 times per day for 15 to 30 seconds each, 6 to 7 days per week. The patients were encouraged to perform any other traditional stretches that they liked to perform including quads, hamstrings, gastrocnemius/soleus, iliotibial band, etc.

Hip Opening/Adductor Stretch

Extension Movement/Hip Flexor Stretch



Assisted Seated External Rotation Cross-Over Phase I

Assisted Seated External Rotation Cross-Over – Phase II

Hip Internal Rotation Movement/Stretch of Left Hip

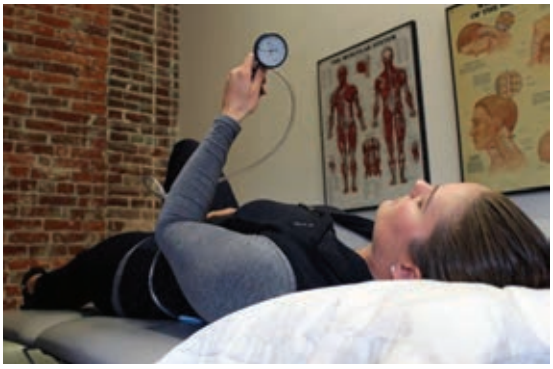
(Continued on page 20)

Appendix B. Therapeutic Exercises *(Continued from page 19)*

Strengthening and Biomechanical Re-education Exercises

These exercises were divided into 3 main categories and were performed by the patients during rehabilitation and after discharge from physical therapy: (1) sequencing/coordination; (2) lumbopelvic/hip floor core, and (3) weight-bearing functional strengthening. The goal was not simply to be strong, but to be "smart and strong." The emphasis was more on neuromuscular control and coordination, building towards this "smart-and-strong" foundation for more mobility without compensation. Some of these exercises can be in different categories depending on instruction and the goal of their performance. There are hundreds of other exercises that can be used in each category limited only by the provider's creativity and clinical reasoning. We chose this group of exercises to help transition from nonweight bearing to functional weight bearing while also working on muscle groups at the hip and around the hip. Pain levels again were encouraged to stay below 2-3/10 on their pain scale.

Phase I: Sequencing and Coordination (2-3 sets of 5-10 reps 4-5 days per week for weeks 1-3)



Pressure Biofeedback in Lumbopelvic Coordination and Control of Lower Extremities

Clam Shell with Lumbopelvic Coordination and Co-recruitment of Transversus Diaphragm Abdominis, Breathing, Multifidi, and Pelvic Floor

Supine Lumbopelvic Control with Opposite Arm and Leg Lifts

Phase II: Lumbopelvic/Hip floor Core (2-3 sets of 10 every other day for 1 week). Continue with phase I but reduce to a 5-minute warm-up prior to initiating phase II exercises in weeks 2-8.

Resisted Clam Shell with Reverse Clam Shell

Double and Single Leg Bridge

(Continued on page 21)

Side Plank I: With Emphasis on Posterior Pelvic Tilt and Push of Lower Knee into Ground for Enhanced Gluteal Contraction

Side Plank II: Same as Version I Adding Repeated Abductions of Top Leg Fully Locked into Extension at Knee, Ankle Dorsiflexed, and Hip in Neutral Rotation

Forward Plank I, II – I: Static Holds and II. Abduction Toe Taps with Neutral Lumbopelvic Region

Quadruped Opposite Arm and Leg (bird dogs) Neutral Lumbopelvic Region

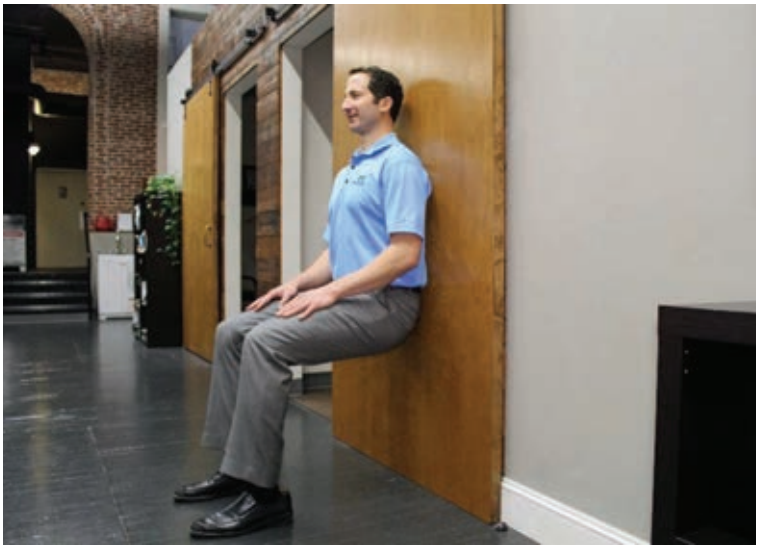
Phase III: Functional Weight-bearing Strengthening (2-3 sets of 10 reps every other day). Continue with phase II every other day 2-3 sets of 10. Discontinue phase I. Phase III is initiated in weeks 6+ ongoing in a progressive manner over time.

Assisted Single Leg Dead Lift (well-controlled neutral pelvis, neutral hip; avoid any femoral adduction/internal rotation of WB LE)

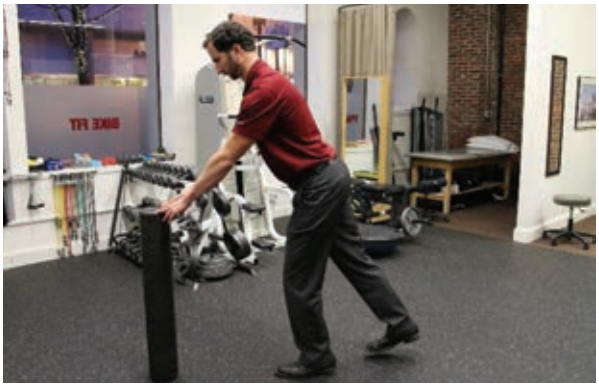
Single Leg Dead Lift with Kettle Bell (same biomechanical rules as per assisted)

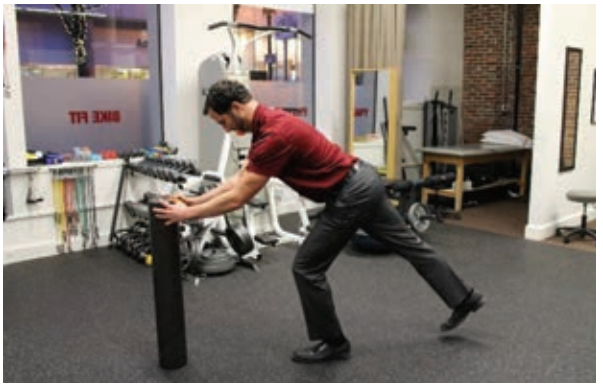
(Continued on page 22)

Monster Walking (no femoral internal rotation during lateral movements)



Quad Emphasis Partial Wall Squat (without femoral internal rotation)





Assisted Single Leg Functional Squat with Gluteal Emphasis – Start and End Positions
NWB LE stays extended long while WB LE moves into traditional squat; patella is behind the toes and over 2nd/3rd ray with weight equal through metatarsal heads and calcaneus. First metatarsal head stays on the ground and LEs each stay in their sagittal position without any movement into frontal or transverse planes.

Miscellaneous:
Cardiovascular exercise - The patients were also encouraged to perform any cardiovascular exercise, such as a stationary bike, that did not increase their pain levels past 2-3/10. They were encouraged to participate 4-6 days per week starting at 10 minutes and working up to 30-45 minutes per session.

These two patients started with their individualized physical therapy treatment. As they improved and were able to keep pain levels low and/or manage their pain with HipTrac, they were encouraged to add other activities such as yoga, hiking, and other personal hobbies/exercises of their choosing to their daily routine.

Appendix C. HipTrac Protocol

These two patients' HipTrac protocol was based on subjective reports, clinical reasoning, and individual clinical presentation. The HipTrac can perform traction in flexion from 0-30°, any degree of abduction available and any degree of rotation available. Our initial goal was pain relief. Consequently, the patients were instructed to perform in as close to the loose-packed position as possible (30° of flexion, 30° of abduction while relaxing their LE into as much naturally available external rotation as possible). As the patients improved with overall treatment, pain was reduced and tolerance was increased, they were encouraged to move towards less flexion/relative extension while maintaining abduction and naturally available ER. In the end, we encouraged the patients to "discover" in which angles/positions they obtained the greatest relief. Theoretically, if we wanted more capsular mobilization, we would encourage positions closer to close-packed and if we wanted more pain relief, we might move to more loose-packed positions. Patients with hip OA often do not follow one set of strict guidelines so we encouraged them to discover their most pain-relieving and capsular-mobilizing positions for the purpose of this case series.

Day 1-7: 1-minute holds under traction at 20-30 PSI, 5-10 second release halfway. Repeat 6-8 times.

Day 8-14: Begin to increase to 1 to 3 minute holds at 30-50 PSI, 5 to 10 second release halfway, Repeat for a total of 12-15 minutes of traction time; patients chose the duty cycle based on comfort for that session.

Day 14+: 1 to 5 minute holds. Patients progressed gradually over time to as high of PSI (40+) as they deemed comfortable for a total of 15-20 minutes of traction time, with 5- to 10- second release halfway. Patients chose the duty cycle based on comfort for that session.

Jill and Travis were initially instructed to use the HipTrac more frequently to assist with pain relief, 1-3 times per day. As time went on, they were encouraged to use it regularly in the presence or absence of pain to maintain consistent capsular mobilization and also at their discretion when any flare-ups occurred from harder physical days at work or home as needed. They both admitted that they felt they did not need to use it as often as time went on as there was an accumulation effect that occurred overall. When they first used it, pain relief only lasted minutes or while on it. As they progressed, relief began to last longer and up to days after use so they were able to reduce their use to 2-4 times per week, rather than 10-20 times per week. We encouraged Jill and Travis to find their optimum position, amount of time, and traction force when using the HipTrac.

2017 Annual Orthopaedic Section Meeting

Hyatt Regency Mission Bay Spa & Marina | San Diego, CA

Please join us in San Diego, California, at the beautiful Hyatt Regency Mission Bay Spa and Marina for the 5th Annual Orthopaedic Section Meeting April 20 - 22, 2017. This meeting is designed to allow physical therapists and physical therapist assistants an opportunity to learn from and engage with experts in the field and the leadership of the Orthopaedic Section.

The meeting begins Thursday evening with a keynote address followed by an enjoyable reception. The focus of the next 2 days will be on current topics related to the knee, foot, ankle, and shoulder regions. Each day begins with a general session attended by all participants followed by smaller concurrent breakout sessions. Each of the speakers in the general session will lead a breakout session intended to allow case-based, advanced application and hands-on experiences related to the topics presented earlier.

Regarding the lower extremity, you will learn about current evidence, examination, and treatment of articular cartilage lesions of the knee, forefoot pain, flat foot deformity, posterior tibialis, and Achilles tendinopathy. A special emphasis will be placed on the implication of these pain problems for walking and running. Regarding the shoulder, you will learn about current evidence, examination, classification, and treatment for a variety of disorders described in the Shoulder Pain Clinical Practice Guidelines and return-to-sport rehabilitation following a shoulder injury.

Finally, a new "Rise and Learn" optional session will be offered during breakfast. Using total knee arthroplasty rehabilitation as a model, the speakers will highlight key elements in a care process improvement project designed to improve outcomes for patients.

Program Information

Thursday, April 20, 2017

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

Seeking Didactic Learning Resources for your Orthopaedic Residency/Fellowship Program? The Section's "Curriculum Package" "Could be the Answer!"
Speakers: Kathryn R. Cieslak, PT, MS, DSc, OCS; Libby Bergman, PT, DPT, OCS, FAAOMPT, MTC

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

Process of Care and Clinical Outcomes Data to Improve Decision Making, Quality and Value
Speaker: James J. Irrgang, PT, PhD, ATC, FAPTA

Friday, April 21, 2017

Friday Schedule: 8:00AM – 4:30PM

General Session: 8:00AM – 10:30AM

Knee, Foot, and Ankle: Treating Walkers, Runners and Athletes that Need to Run
Speakers: Kornelia Kulig, PT, PhD, FAPTA; Mark Paterno, PT, PhD, BA, SCS; Stephen Paulseth, PT, DPT, SCS, ATC; Susan Sigward, PT, PhD, ATC

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 given on a first-come, first-serve basis.

Breakout Session 1:
Young Runners and Older Walkers with Ankle and Foot Pain
Speaker: Kornelia Kulig, PT, PhD, FAPTA

Breakout Session 2:
Lesion Specific Modified Rehabilitation - How Knee Articular Cartilage Injury can Inform Your Practice
Speaker: Mark Paterno, PT, PhD, BA, SCS

Breakout Session 3:
Advanced Interventions Focused on Treating Foot and Ankle Gait Impairments
Speaker: Stephen Paulseth, PT, DPT, SCS, ATC

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Breakout Session 4:
Early Rehabilitation Following Anterior Cruciate Ligament Reconstruction: Are We Doing Enough?
Speaker: Susan Sigward, PT, PhD, ATC

Saturday, April 22, 2017

Saturday Schedule: 7:00AM – 4:30PM

"Rise-and-Learn" *Optional* Session
7:00AM – 7:45AM
Day to Day Data - What Role can it Play in Practice Change!
Speakers: Gerard Brennan, PT, PhD; Tara Jo Manal, PT, DPT, OCS, SCS, FAPTA

General Session: 8:00AM – 10:30 AM
Shoulder Pain Clinical Practice Guidelines and Treatment: Surgery First and Rehabilitation Controversies?
Speakers: Jeff Houck, PT, PhD; Lori Michener, PT, PhD, ATC, SCS, FAPTA; Amee Seitz, PT, PhD, DPT, OCS; Charles Thigpen, PT, PhD, ATC

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 given on a first-come, first-serve basis.

Breakout Session 5:
Practice Linking Video-based Motion Analysis with Clinical Cases of Injured Runners
Speaker: Jeff Houck, PT, PhD

Breakout Session 6:
Differential Diagnosis and Special Tests for Diagnosing Shoulder Pain
Speaker: Lori Michener, PT, PhD, ATC, SCS, FAPTA

Breakout Session 7:
Manual Therapy for Pain and Limited Motion: Non-surgical and Post-surgical Considerations and Techniques for Rotator Cuff Related Disorders and Instability
Speaker: Amee Seitz, PT, PhD, DPT, OCS

Breakout Session 8:
Functional Exercise Progression and Criterion Based Return To Sport for the Athletic Shoulder
Speaker: Charles Thigpen, PT, PhD, ATC

Adoption of Clinical Prediction Rules and Manipulation after CEU Training by Physical Therapists: An Observational Study

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Note: The views expressed in this manuscript are those of the authors and do not reflect the official policy or position of the Department of the Army, Department of Defense, or the US Government.

ABSTRACT

Background: Researchers have shown that self-reported use rates of manipulation are lower among physical therapy students when their clinical instructors display limited use of such techniques. This lack of adoption of newly learned skills into practice after training is referred to as the training transfer problem. **Purpose:** The purpose of this report is two-fold: (1) promote awareness of the training transfer problem, and (2) observe behavior changes using a pre/post course engagement strategy to adopting LMCPR (lumbopelvic manipulation clinical prediction rule) and LM by physical therapists. **Study Description:** The authors held 8 continuing education units (CEU) training programs at various times and geographic locations in the United States. Ten participants, all outpatient orthopaedic physical therapists, completed the entire 12-week study period that involved tracking their adoption of the training program. **Outcomes:** By 12 weeks post-course, 8 of the 10 participants reported routinely using LMCPR and 9 of the 10 reported routinely using LM when strongly indicated. **Discussion and Conclusion:** This study demonstrated a high level of adoption of LMCPR and LM of the 10 physical therapists included in the study by 12 weeks after attending the training program. Most importantly, this study identified facilitating factors for adopting LMCPR and LM included training design, trainee characteristics, and work environmental factors.

Key Words: continuing education, training transfer, lumbopelvic manipulation

BACKGROUND AND PURPOSE

In a 2009 survey, 95% of all physical therapy student respondents indicated that their program provided them academic training in manipulation.[1] However, recent studies also indicate use of manipulation during clinical affiliations was lower than what would be expected given this high level of academic training.[1,2] One explanation is low use rates of manipulation among clinical instructors (ie, clinical educators).[1-3] The logic being if clinical instructors (CI) are not performing manipulation, then these clinical educators would be less likely to encourage its use or model it for their students.[2] Some support for this conjecture exists with researchers finding a relationship between the level of use of manipulation by the physical therapy student during the clinical affiliation and the clinical instructor's use of manipulation.[1,2]

Consistent with this argument, some educators and researchers have suggested that an effective way to increase adoption of manipulation, and other evidence-based practices, is to insure that they are being used and modeled by the clinical educators.[1,4,5] Unfortunately, researchers have found low use rates of manipulation, and other evidence-based practices, among physical therapists (including clinical educators) despite increased training (ie, continued education unit [CEUs]) on these topics.[1-3,6-13] On the surface this low adoption of evidence-based practice after training may be surprising. However, this is reflective of what is commonly referred to as the training transfer problem.[14]

In this study, LMCPR (lumbopelvic manipulation clinical prediction rule) refers to the clinical prediction rule (CPR) for using lumbopelvic manipulation which has been shown to be an effective decision tool for identifying patients that are likely to have success with lumbopelvic manipulation.[15,16] This CPR consists of 5 predictive criteria: Fear Avoidance Belief Questionnaire Work (FABQW) subscale score < 19, at least one hip with prone passive range of motion (ROM) > 35°, at least one lumbar spinal segment with hypomobility with spring testing, no symptoms distal to the knee, and duration of symptoms < 16 days.[16] This LMCPR indicates when 3 of the criteria are present, the patient has a 68% chance of a success, and 95% chance of success given 4 of 5 criteria.[16]

The purpose of this report is 2-fold: (1) promote awareness of the training transfer problem, and (2) observe behavior changes using a pre/post course engagement strategy for adopting the LMCPR and LM by physical therapists.

Training Transfer Problem

In an ideal world, professionals would attend a training event on some evidence-based topic, and if they felt it would help their practice (or if mandated by their organization), they would return to work and implement their newly gained knowledge, skills, and attitude as behavior changes. Unfortunately, much research has shown that this ideal scenario is not so common.[14,17,18] This lack of complete training transfer to practice is considered by many as a training transfer problem.[14] Researchers have found that transfer rates in a variety of industries and organizations are initially higher immediately after training, and then may decline up to one year post-training.[18]

This variability in training transfer also seems to be present in health care training.[17-21] For example, Davis et al[17] looked at the impact of 14 randomized controlled trials of primarily physician-focused professional development events between the years of 1993 to 1999. They reported that 0% of purely didactic lecture-based, 67% of interactive (ie, learning activities designed to

enhance participation), and 71% of mixed (ie, didactic combined with interactive) training interventions resulted in at least one targeted changed physician behavior at variable time frames after training. When looking at the intensity of the training events, single event training sessions (range of 2 to 6 hours) had a 28% occurrence of change in physician performance compared to 89% for multiple sessions (at least 2 separate training events with a range of 2 to 48 total hours).[17]

In addition, Willett et al[13] found that after training physical therapists on lumbopelvic manipulation the proportion of physical therapists preferring to use manipulation as an intervention significantly increased from 3% pre-course to 25% at 6 weeks post-course. However, by 6 months post-course, the proportion preferring manipulation as an intervention decreased to 11%.[13]

Training Transfer Solutions

Research of training transfer in various settings, including health care, suggests training programs will more likely lead to adoption of new skills into practice when facilitating factors related to training design, trainee characteristics, and the work environment are maximized and barriers are minimized.[16-18,22] Some examples of common facilitating factors are providing clear learning goals, practice and feedback, and theoretical principles. Trainee characteristics that seem to be facilitators of adoption include high self-efficacy, perceived usefulness of the new skill, and a trainee's commitment to his or her organization. Work environment facilitating factors include peer and supervisor support, reminders, and having an opportunity to perform the newly learned skills.[18,21-31] Some of the common major barriers to adoption include the lack of the above stated facilitating training design and trainee characteristics, and the lack of the following work environment factors: time, peer support, and practice or use of new skills.[26,27,31,32]

Despite such research findings being useful in suggesting areas to focus on to improve adoption, Blume et al[23] stated that the "roughly equivalent predictive power of several individual and situational predictors reflects the reality that there are no magic bullets for leveraging transfer."(p1096) Even though a single "magic bullet" training intervention does not exist, Robertson et al[33] found that interventions' "effectiveness improved as more educational strategies were employed."(p152) For example, adoption success following a CEU type training program was much more likely when an event was multi-component (eg, many interventions vs. only one intervention), consisted of interactive learning activities (eg, mix of hands-on, case-based, discussions), included reference learning materials or enabling factors (eg, job aides, algorithms, patient-handout materials), and was spread out over time, or sequenced.[17,24,25,34]

In addition, research in physical therapy for classification-based systems (ie, CPRs) and manipulation and non-manipulation treatments for the neck have shown promising results for using post-training support. For example, Brennan et al[34] and Cleland et al[35] both found improved patient outcomes from physical therapists who, following face-to-face training, received post-training support in the form of ongoing small-group training sessions (with the original instructors), and one-on-one worksite consultations with the original instructors. Such post-training support provided feedback over time to the clinicians, and impacted clinical outcomes, possibly by increasing adoption of the new skills into practice.[35]

Finally, qualitative research on physical therapists suggests the importance of hands-on lab-based training events for learning new clinical psychomotor skills (eg, LM). Rappolt and Tassone[27] wrote, "Many participants indicated they needed some form of participatory learning, either hands-on workshops or practice sessions with colleagues, before they felt confident enough to apply new knowledge or a skill to practice." The desire for face-to-face hands-on practice was also supported by Salbach et al,[28] who found guidance and feedback from an expert was highly valued.

Study Intervention

Based on the training transfer literature, the investigators designed a multi-component CEU training program on the topic of low back pain (LBP) and CPRs (ie, lumbopelvic manipulation, lumbar stabilization, and lumbar directional specific exercise). This intervention provided the investigators the opportunity to study the participant's adoption process and identify the specific facilitators and barriers related to the adoption of LMCPR and LM following training.

The multi-component CEU training program used was designed to leverage many of the common adoption facilitators, and provide a pragmatic approach that the investigators felt would be technically, logistically, and financially feasible to implement for most CEU providers. This intervention included 3 phases sequenced over time consisting of pre-course, course, and post-course activities.

The pre-course learning activities included reading the American Physical Therapy Association (APTA) white paper on manipulation one week prior to the course, and reviewing an online course support website (eg, reviewing the blog and discussion board). The course activities included a one-day 8-hour long face-to-face course. This included 5 hours of lecture on theory, practical application, practice using/grading the MODI and FABQ measurement tools, use of a CPR algorithm on paper cases, and review of other job aides (eg, customized evaluation form with integrated CPR criteria). In addition, this course included 3 hours of hands-on lab time allowing trainees the opportunity to practice skills related to lumbar CPRs and related treatments (eg, LM). The day-long course ended with a 15 minute group discussion/interaction on the topic of training transfer, where trainees were asked to work with other trainees (eg, attending co-workers) and discuss barriers to adoption they may encounter when back on the job, and to establish a personal/clinic adoption plan. Finally, post-course activities included using job aides (eg, CPR algorithm), receiving a weekly blog email reminder, reading a weekly blog posting by the lead investigator/instructor on the topic of LMCPR and LM, and accessing the online post-training support system as desired (ie, a simple password protected website that provided a blog, discussion board, and resource documents for download such as the course lecture, outcome measure forms, and related articles). One additional post-course intervention was the instructor "following-up" with the participants after the course to see how their adoption was going. While this was an activity related to the study data collection process, it was also used as an intervention to influence adoption. The iterative development of this multi-component intervention is described in more detail elsewhere.[36]

OBSERVATION DESCRIPTION

During the study period from September 2012 to March 2013 the investigators conducted 8 identical one-day (8 hour) face-to-face CEU training courses, including the pre-course activities (1 week prior to the course), and the post-course activities up to 12 weeks after the course. Based on convenience for the investigators these courses were held in various locations across the country (see Table 1). At the end of each face-to-face course, all course attendees that met the inclusion criteria were asked to participate in

the study (sample of convenience). Inclusion criteria for this study included licensed physical therapists that currently evaluate and treat LBP patients on a weekly basis, who volunteer to participate in the study, and who sign the informed consent form.

As Table 1 shows, 22 of 48 (46%) attendees agreed to participate in this study. Ten participants completed the entire 12-week study period, thus becoming the cases for this observational report. This study consisted of the participants completing a self-reported behavior questionnaire (Appendix A) immediately after the course, and then essentially the same questionnaire at 6 and 12 weeks post-course (Appendix B). In addition, 2 phone interviews were conducted soon after receiving the 6- and 12-week questionnaires in order to probe and explore questionnaire responses. These interviews (and open ended questionnaire data) were open coded, and organized by theme.

All 10 case participants were currently working as orthopaedic outpatient physical therapists and saw LBP patients on a weekly basis (see Table 2). Sixty percent served as clinical instructors over the last year, and 50% had attended this course with one or more co-workers. Most described the common LBP patient population as chronic and older age. Only two reported seeing more than half of their LBP patients with less than 16 days of symptoms (ie, 1 of the 5 LMCPR criteria indicating LM).

Table 3 shows that prior to this multicomponent training program 40% had prior training in LMCPR, yet only 20% were currently routinely using LMCPR as a clinical decision tool. In addition, Table 3 shows that 70% of the participants had prior training on LM, but only 20% were currently routinely using LM as a treatment intervention for their LBP patients when strongly indicated (eg, when 4 of 5 LMCPR criteria were present).

OUTCOMES

Table 3 shows the self-reported routine use of LMCPR and LM at 12 weeks post-course. Note that only participants 1 and 4 did not adopt routine use of LMCPR. Specifically, at 12 weeks participants 1 and 4 both reported measuring the number of LMCPR criteria present at initial evaluation only 30% of the time. Also, neither used the FABQ instrument. Regarding LM, participant 1 was the only participant to not adopt routine use of LM when strongly indicated, stating she did not use LM even once on a patient during the study period.

DISCUSSION AND CONCLUSION

This study found that despite prior training on LMCPR and LM, only 2 participants (2 and 8) had managed to fully adopt these tools into their practice before attending this study training course, evidence of a training transfer problem. It is interesting to note of the 7 study participants that had training in either LMCPR or LM prior to the course, 6 received their training in physical therapy school, and only 2 (participants 2 and 8) had CIs that were actively using LM, and encouraged the use of LMCPR and LM by their physical therapist students. Participant 2 directly attributed his adoption of LMCPR and LM to his clinical affiliation experience. Participant 8 also indicated that he adopted these skills during his clinical affiliation, stating in his 6-week phone interview,

> "I had a real good clinical instructor in my 1st true outpatient rotation, who kept up with the research and seeing the research. So, we practiced this stuff daily while I was a student. We were practicing, if not on patients, then at least on each other, and talking about what the research says and kind of talking about the types of manipulations throughout the entire spine. So, once I got done with that rotation it just kept following with me."

On the other hand, Participant 1 explained her lack of initial adoption of LMCPR and LM after physical therapy school training was due to not having a CI who used these tools. She stated in her 6-week phone interview,

> "…I think because maybe my clinicals, I really only had one outpatient clinical and they were...so far out of the box…and when you do the actual internships the hands-on training with patients, I think that is where you really develop your evaluation skills, theory, and diagnostic skills, so I think for me that's probably why I did not carry it over so much from school."

Table 1. Course Location and Study Recruitment

Course Date	8-hour day-long training course location	Number of physical therapy attendees	Initial number of study participants	Number of study participants completing 12 week study
22-Sep-12	Mid-Atlantic US	2	1	1
13-Oct-12	Mid-West US	9	5	3
20-Oct-12	South East US	4	3	3
3-Nov-12	South Central US	10	5	2
10-Nov-12	South Central US	5	4	0
1-Dec-12	South Central US	2	1	0
15-Dec-12	Mid-Atlantic US	4	2	1
19-Jan-13	South West US	12	1	0
				10
Column Frequency Count	8	48	22	

Table 2. Participant's Demographics

Participant	Age	# years as physical therapist	# years working outpatient orthopedic setting	Served as a Clinical Instructor in the last year	Attended this course with direct co-worker	Pre-course # LBP visits per week	% of LBP patients at evaluation with less than 16 days of symptoms ("acute")
1	26	3	3	Yes	No	10	0
2	33	8	8	No	Yes	22.5	12.5
3	32	6	6	Yes	Yes	6.5	5
4	37	13	6	Yes	Yes	10	5
5	30	5	5	No	Yes	6	1
6	26	.5	.5	No	Yes	10	0
7	31	6	6	Yes	No	2	0
8	29	3	3	Yes	No	35	50
9	49	16	3	No	No	8	75
10	37	12	12	Yes	No	20	16
Mean	33	7	5	60%	50%	13	16%

Abbreviation: LBP, low back pain

Table 3. Self-reported LMCPR and LM Behaviors

Participant	Previous LMCPR Training	Pre-course LMCPR Routine Use	12 weeks Post-course LMCPR Routine Use	Previous LM Training	Pre-course LM Routine Use	12 weeks post-course LM Routine Use
1	Yes	No	No	Yes	No	No
2	No	No	Yes	Yes	No	Yes
3	Yes	Yes	Yes	Yes	Yes	Yes
4	No	No	No	No	No	Yes
5	Yes	No	Yes	Yes	No	Yes
6	No	No	Yes	Yes	No	Yes
7	No	No	Yes	No	No	Yes
8	Yes	Yes	Yes	Yes	Yes	Yes
9	No	No	Yes	Yes	No	Yes
10	No	No	Yes	No	No	Yes
% of "Yes"	40	20	80	70	20	90

Abbreviations: LMCPR, lumbopelvic manipulation clinical prediction rule; LM, lumbopelvic manipulation

These views are consistent with recent evidence that if a CI uses manipulation, then the student is more likely to use the skill (80% when indicated), and likewise, if a CI rarely/never uses manipulation, students were much less likely to use manipulation (7%).[1]

Facilitating Factors to Adoption

There were many facilitating factors that helped the adoption of LMCPR and LM as reported by the participants throughout the 12 week post-course study period. These factors were categorized into training design, trainee characteristics, and work environment, and are described elsewhere with supporting quotes and detailed explanation and analysis.[36]

The study participants indicated that certain training design features of the multi-component intervention facilitated their adoption process. In particular, the pre-course activity of reading the APTA white paper on manipulation reportedly decreased apprehension of using LM, and increased pre-course motivation to adopt LM.

In addition, several course related activities were reported as facilitating adoption of LMCPR and LM. These included the hands-on lab time, reviewing reference/job aide material in class, practice using the CPR algorithm using cases, lectures (focus on evidence supporting the tools), and the training transfer discussion/group interaction. Regarding the training transfer discussion, while training transfer researchers have suggested that establishing implementation

plans are helpful in the adoption process, no course attendee indicated that they had ever attended a physical therapy CEU course before where training transfer was discussed so openly and was a focused activity.[31] Many attendees commented on the value of this part of the course in their adoption efforts. These comments included descriptions that this activity helped facilitate their thinking about adoption, adjusted their expectations about the difficulties in adopting, and served as a personal challenge that motivated them to make extra efforts to adopt LMCPR and LM. The 6-week interview response by Participant 5 illustrates the first comment about facilitating thinking and reflection on the topic of adoption:

> "It (training transfer discussion/ group interaction component) forced you to think right then, when I get back to the clinic what is going to happen, instead of…you know, what are we going to need to do to incorporate this…because a lot of times at the end of a day, or at the end of a course, you are already brain dead, and you leave there and that is the last thing on your mind….then when you start work the next day, and you just pick up with that patient and keep going and that's when it gets forgotten about. That's definitely a huge part of what everyone needs in order to start incorporating it into their clinic, to make them think…it forces you to think, "how would we realistically adopt this, what would we need to do to the way things are going now." I think we discussed [in the small group discussion activity] the paperwork, and the things we needed to change, and we made notes right then instead of waiting to when you return to work and you are busy. It forces you to take time to stop and write down what needs to take place. That's why I liked it."

Finally, the post-course training design components that were reported as facilitating adoption included the blog, having a job aide (ie, CPR algorithm), and being followed-up on by the course instructor. The blog, and the blog related weekly reminder email, seemed to be valued for increasing knowledge (a form of sequenced or extended learning after the course) by continuing after the course to introduce additional information related to the course topics, and for serving as a reminder to use the newly learned skills. Furthermore, the CPR algorithm served as a reminder of the criteria, and helped to organize clinical data. Finally, follow-up by the instructor (dual hatted as the primary researcher) via phone interviews and questionnaires were reported as being helpful in stimulating reflection on the course content and the adoption process, and provided opportunities for the participants to ask questions and have a conversation about the course topics with the lead instructor.

In addition to the training design, there were several major factors that participants indicated helped them adopt LMCPR and LM that were related to trainee characteristics (to include trainee decisions). These were the participants using and/or practicing the new skills after the course, feeling accountable to adopt/use the new tools, and LMCPR and LM being consistent with personal current practice.

Finally, the last facilitating factors were related to the participant's work environment. These included making systematic/ formal process changes (eg, integrating the MODI and FABQ into the patient check-in process), attending training with at least one co-worker, and co-workers using or trying to adopt LMCPR and LM. Other key work environment facilitators included success with trial, having opportunities to use, and the skills being consistent with clinic norms and standards.

Barriers to Adoption

The barriers to adoption of LMCPR and LM were categorized as trainee characteristics and work environmental factors. The most frequently described trainee characteristic barrier was the use of screening criteria. Many of the participants did not simply measure all 5 LMCPR criteria on every low back pain patient to decide who would need LM. Instead, they used their own biases, or screening criteria, to decide on whom to try out the LMCPR and LM. If a patient first met his or her personal, often subconscious, screening criteria (eg, too large, too much pain, symptoms below the knee, perceived secondary gain or odd behaviors), then parts or all of the LMCPR and/or LM would not be used on the patient. As a result of this screening process, participants felt safer and more comfortable in trying out the new tools, but the secondary impact of this decision was it contributed to early and inconsistent use of the tools. This in turn reduced their opportunities to use these innovations, which then became a barrier to adoption.

Other important trainee characteristics serving as barriers to adoption included low confidence, LM being considered too aggressive for certain patients, choosing to only use part of the LMCPR criteria to qualify patients (eg, only 5 of the 10 participants adopted using the FABQ on a routine basis), choosing to use LM less frequently if only 3 of 5 LMCPR criteria are present rather than 4 or more, fear of hurting the patient, not feeling accountable to adopt LMCPR and LM, fear of being sued, and fear of losing credibility with a patient if not successful with treatment attempt.

The most frequently cited work environment related barrier to adoption of LMCPR and LM was having perceived limited opportunities to use LMCPR and/or LM. As previously mentioned the use of screening criteria played a role in this perception. In addition, only 2 out of the 10 study participants saw patients with less than 16 days of acute LBP on a frequent basis (see Table 2). As a result, so many felt their typical chronic LBP patients were not appropriate for LM. Other common work environment barriers included having limited time, which resulted in limited practice and limited integration of the new skills into their practice behaviors/processes, having no co-workers using the skills, and the perception that LMCPR and LM are not the clinic norm/ standard.

All participants had a mixture of facilitating factors and barriers that applied to their adoption process. However, in most cases the barriers were not enough to prevent adoption. The one exception was participant 1. In her process of adoption of LMCPR and LM, she paints the picture of a trial period, where she worked in isolation (ie, no apparent direct influence or support to adopt or not adopt by co-workers, supervisors, and fellow course attendees) as she used the LMCPR and LM (only practicing on a co-worker 3 times in 12 weeks) to see if it would work for her patients. She stated she did not feel accountable to anyone to change her practice after the course.

Participant 1 also indicated having co-workers that use manipulation would have "definitely" improved her adoption of manipulation, since "you could get their feedback on your technique and you could have a patient right after, use the technique, and have good carryover." Additionally, she suggested that not having co-workers that used manipulation served as a barrier for her to adopt this new treatment given her low confidence in using manipulation, since doing something different than the norm could be questioned.

This study provided insights into what factors influence the adoption of LMCPR and LM into practice. These factors can be used to better design future CEU training programs in order to maximize the facilitating factors and minimize the barriers to adoption. This may increase adoption rates of LMCPR and LM, leading to increased use of both tools by physical therapists (including clinical educators).

Limitation and Future Research

In addition to the normal limitations of a case study design (eg, lack of generalizability), 3 additional validity threats to this study were the use of self-reported behavior, the short-term nature of the study (12 weeks), and the Hawthorne effect.[37] While it is true self-reported behaviors may not be accurate, Curry and Purkis[38] concluded that "the self-report procedure is sufficiently valid to be recommended as a routine evaluation mechanism in CME courses."(p583) In addition, recent researchers looking at manipulation use have relied on self-reported behaviors.[2,13] Finally, triangulation between questionnaire and interview responses on the same topic, and between multiple participants from the same clinic, as well as probing follow-up interview questions on self-reported behavior mitigated this validity threat.

Another threat to validity is the participant's reported behavior changes are only valid for the 12-week study period. It is entirely possible and likely (according to training transfer research) that self-reported adoption levels at 12 weeks will continue to change over time.[18] Furthermore, adoption over the first 12 weeks may reflect more of the trial rate of LMCPR and LM, rather than a permanent adoption rate. However, with that said, for most of the participants that trial period (ie, figuring out if LMCPR and LM should be adopted) seemed to take place during the first 6 weeks of the post-course period. In addition, all participants that had adopted LMCPR and LM by 12 weeks indicated that they intended to continue using these tools in the future.

One final validity threat to consider is the researcher's influence on adoption. It can be argued that the researcher following the behavior changes over 12 weeks influenced the behavior of the participants (a form of the Hawthorne effect).[37] Clearly the participants indicated this was the case, suggesting they felt accountable to the instructor/researcher to try out the newly learned skills. However, since the researchers considered this follow-up/data collection process as part of the intervention, this influence was monitored and purposely exploited as a means of increasing adoption. Putting the Hawthorne effect to use has been described by other researchers.[37]

Finally, future areas for research could be conducting surveys to establish baseline use of certain evidence-based practices (eg, LMCPR and LM) among clinical educators, as well as the general physical therapy population. Also, future studies on training transfer should ideally follow behaviors up to 1 year after training. Such research might include randomized control trials using some or all of this studies intervention components that were reported as training design facilitating factors. Finally, more research needs to look at the impact of using screening criteria during the adoption process, and ways to mitigate this behavior.

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Appendix A. Physical Therapy Training Course

Post-Course Baseline

Name:
Today's Date:

Purpose: The purpose of this questionnaire is to determine your perception of, intention to use, and use of the lumbopelvic manipulation Clinical Prediction Rule (CPR) and its related components (eg, measuring Modified Oswestry Disability Index (MODI), Fear Avoidance Belief Questionnaire (FABQ), and performing a lumbopelvic manipulation).

The term mechanical low back pain (MLBP) in this questionnaire refers to anyone with mechanical non-specific low back pain with or without associated lower extremity pain (without neurological findings such as myotomal weakness, diminished reflexes, dermatomal altered sensation, or red flags such as ataxic gait, changes in bowel/bladder, or saddle anesthesia).

For this questionnaire, the term "lumbopelvic manipulation" is defined as any high velocity, low amplitude therapeutic movement at end range of motion directed to the lumbar spine and/or SI joints.This is also commonly known as spinal manipulation, or a grade V mobilization.

1. Prior to this course, have you ever been trained on using the lumbopelvic manipulation CPR? (if Yes, please explain when, how, and the number of hours of training)
   ____ YES:_____
   ____ NO
2. Prior to this course, have you ever been trained on performing a lumbopelvic manipulation of any kind? (if YES, please explain when, how, and the number of hours of training)
   ___YES:_____
   ___NO:
3. How many outpatient visits (ie, evaluations, treatments, follow-up) do you currently have per week with patients with mechanical low back pain?_____
4. How many times per week do you currently perform a lumbopelvic manipulation to patients with mechanical low back pain?_____
5. Did you attend today's course with any co-workers? (if so, please provide the name of your co-worker)
   ___YES ____NO
6. How frequently do your current co-workers use the lumbopelvic manipulation clinical prediction rule when evaluating MLBP patients (circle one)?
   Never (1) Rarely (2) Sometimes (3) Frequently (4) All the time (5)
7. How frequently do your current co-workers use lumbopelvic manipulations as a treatment for MLBP patients (circle one)?
   Never (1) Rarely (2) Sometimes (3) Frequently (4) All the time (5)
8. What % of the time do you <u>currently</u> do the following with your mechanical low back pain patients: (put a **% of the time** that you do this next to each item below. For example, if you measure and score MODI for mechanical low back pain patients only half the time, then put a "**50%**" next to "MODI measured and scored at each initial evaluation and follow-up visit" below):
   a.____MODI measured and scored at each initial evaluation and follow-up visit
   b.____FABQ Work measured and scored at the initial evaluation
   c.____Bilateral prone hip internal rotation is measured at the initial evaluation
   d.____Lumbar spinal segments are classified as hyper or hypomobile at the initial evaluation
   e.____Pain is determined as above or below the knee at the initial evaluation
   f.____Number of days of current low back pain episode is determined at the initial evaluation
   g.____Determine how many of the 5 CPR criteria are present at the initial evaluation
   h.____Determine if any contraindications to lumbopelvic manipulation are present
   i.____Lumbopelvic manipulation is performed if 3 or more of the 5 CPR criteria are present
   j.____Lumbopelvic manipulation is performed if 4 or more of the 5 CPR criteria are present
9. Indicate your agreement with the following statements regarding the lumbopelvic manipulation CPR (circle your answer):
   a. I intend to use the lumbopelvic manipulation CPR in my practice.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   b. I am confident in my ability to use the lumbopelvic manipulation CPR.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   c. I have opportunities to use the lumbopelvic manipulation CPR on my patients.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   d. I feel using the lumbopelvic manipulation CPR provides advantages over my current clinical decision making.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   e. I feel using the lumbopelvic manipulation CPR is compatible with my current clinical decision making methods and beliefs.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   f. I feel the lumbopelvic manipulation CPR is complex and difficult to use.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   g. I feel I can easily try out using the lumbopelvic manipulation CPR with my MLBP patients.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
10. Indicate your agreement with the following statements regarding lumbopelvic manipulations (circle your answer):
   a. I intend to use lumbopelvic manipulations as a treatment in my practice.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   b. I am confident in my ability to use lumbopelvic manipulations.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   c. The risk of me injuring a patient while using a lumbopelvic manipulation is low.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   d. The risk of me being sued for using a lumbopelvic manipulation is higher than other treatments I typically use.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   e. I have opportunities to use lumbopelvic manipulations on my patients.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   f. I feel using lumbopelvic manipulations provide advantages over my current treatment methods.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   g. I feel using lumbopelvic manipulations are compatible with my current treatment methods and beliefs.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   h. I feel lumbopelvic manipulations are complex and difficult to use.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   i. I feel I can easily try out using lumbopelvic manipulations on my MLBP patients.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)

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Appendix A. Physical Therapy Training Course *(Continued from page 33)*

11. What did you learn from this course that you will use directly in your practice? Please indicate why:_____
_____
_____
_____

12. What did you learn from this course that you will NOT use in your practice? Please indicate why:_____
_____
_____
_____

13. Demographics/Background (write in answer):

    a. Age:_____

    b. Gender:_____

    c. Year graduated from Physical Therapy school:_____

    d. Highest level of Physical Therapy education (circle one): Bachelors, Masters (MPT), Doctorate (DPT), tDPT

    e. Highest academic degree obtained (eg, MPT, PhD): _____

    f. List any specialty certifications (eg, OCS, CSCS, Cert MDT, COMT, etc.): _____

    g. Did you graduate from a physical therapy Residency or Fellowship program (if so, please indicate which one and the year graduated)?
    _____

    h. In the last year have you been a clinical instructor?
    ____YES ____NO

    i. How many years of outpatient orthopedic based physical therapy experience do you have?_____

Appendix B. Physical Therapy Training Course

Post-Course Follow-up

Name:
Today's Date:

Purpose: The purpose of this questionnaire is to determine your perception of, intention to use, and use of the lumbopelvic manipulation Clinical Prediction Rule (CPR) and its related components (eg, measuring Modified Oswestry Disability Index (MODI), Fear Avoidance Belief Questionnaire (FABQ), and performing a lumbopelvic manipulation).

The term mechanical low back pain (MLBP) in this questionnaire refers to anyone with mechanical non-specific low back pain with or without associated lower extremity pain (without neurological findings such as myotomal weakness, diminished reflexes, dermatomal altered sensation, or red flags such as ataxic gait, changes in bowel/bladder, or saddle anesthesia).

For this questionnaire, the term "lumbopelvic manipulation" is defined as any high velocity, low amplitude therapeutic movement at end range of motion directed to the lumbar spine and/or SI joints. This is also commonly known as spinal manipulation, or a grade V mobilization.

1. How many outpatient visits (ie, evaluations, treatments, follow-up) do you currently have per week with patients with mechanical low back pain? _____

2. How many times per week do you currently perform a lumbopelvic manipulation to patients with mechanical low back pain?_____

3. How frequently do your current co-workers use the lumbopelvic manipulation clinical prediction rule when evaluating MLBP patients (bold type answer below)?
   Never (1) Rarely (2) Sometimes (3) Frequently (4) All the time (5)

4. How frequently do your current co-workers use lumbopelvic manipulations as a treatment for MLBP patients (bold type answer below)?
   Never (1) Rarely (2) Sometimes (3) Frequently (4) All the time (5)

5. What % of the time do you currently do the following with your mechanical low back pain patients: (put a **% of the time** that you do this next to each item below. For example, if you measure and score MODI for mechanical low back pain patients only half the time, then put a "**50%**" next to "MODI measured and scored at each initial evaluation and follow-up visit" below):
   a.____MODI measured and scored at each initial evaluation and follow-up visit
   b.____FABQ Work measured and scored at the initial evaluation
   c.____Bilateral prone hip internal rotation is measured at the initial evaluation
   d.____Lumbar spinal segments are classified as hyper or hypomobile at the initial evaluation
   e.____Pain is determined as above or below the knee at the initial evaluation
   f.____Number of days of current low back pain episode is determined at the initial evaluation

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Appendix B. Physical Therapy Training Course *(Continued from page 34)*

g.____Determine how many of the 5 CPR criteria are present at the initial evaluation
h.____Determine if any contraindications to lumbopelvic manipulation are present
i.____Lumbopelvic manipulation is performed if 3 or more of the 5 CPR criteria are present
j.____Lumbopelvic manipulation is performed if 4 or more of the 5 CPR criteria are present

6. Indicate your agreement with the following statements regarding the lumbopelvic manipulation CPR (bold type answer below):
   a. I intend to use the lumbopelvic manipulation CPR in my practice.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   b. I am confident in my ability to use the lumbopelvic manipulation CPR.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   c. I have opportunities to use the lumbopelvic manipulation CPR on my patients.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   d. I feel using the lumbopelvic manipulation CPR provides advantages over my current clinical decision making.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   e. I feel using the lumbopelvic manipulation CPR is compatible with my current clinical decision making methods and beliefs.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   f. I feel the lumbopelvic manipulation CPR is complex and difficult to use.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   g. I feel I can easily try out using the lumbopelvic manipulation CPR with my MLBP patients.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   f. I feel the lumbopelvic manipulation CPR is complex and difficult to use.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   g. I feel I can easily try out using the lumbopelvic manipulation CPR with my MLBP patients.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)

7. Indicate your agreement with the following statements regarding lumbopelvic manipulations (bold type answer below):
   a. I intend to use lumbopelvic manipulations as a treatment in my practice.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   b. I am confident in my ability to use lumbopelvic manipulations.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   c. The risk of me injuring a patient while using a lumbopelvic manipulation is low.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   d. The risk of me being sued for using a lumbopelvic manipulation is higher than other treatments I typically use.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   e. I have opportunities to use lumbopelvic manipulations on my patients.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   f. I feel using lumbopelvic manipulations provide advantages over my current treatment methods.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   g. I feel using lumbopelvic manipulations are compatible with my current treatment methods and beliefs.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   h. I feel lumbopelvic manipulations are complex and difficult to use.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)
   i. I feel I can easily try out using lumbopelvic manipulations on my MLBP patients.
      1 (strongly disagree) 2 (disagree) 3 (unsure) 4 (agree) 5 (strongly agree)

8. What factors seemed to help you in the process of adopting the lumbopelvic manipulation CPR into your practice?

_____
_____
_____
_____
_____
_____
_____

9. What factors seemed to help you in the process of adopting lumbopelvic manipulations into your practice?

_____
_____
_____
_____
_____
_____
_____

10. What difficulties/barriers did you experience in the process of adopting the lumbopelvic manipulation CPR into your practice?

_____
_____
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_____

11. What difficulties/barriers did you experience in the process of adopting lumbopelvic manipulations into your practice?

_____
_____
_____
_____
_____
_____
_____

Exercise for Posttraumatic Stress Disorder: Systematic Review and Critical Synthesis of the Literature

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ABSTRACT

Purpose: Posttraumatic stress disorder (PTSD) is a type of anxiety disorder that can be seen in individuals who sustain major biological stresses, including military veterans. Physical activity has been linked to improve psychological well-being. Therefore, the purpose of this literature review is to examine the effects of exercise on symptoms and functioning associated with PTSD in military veterans. **Method:** A systematic literature search was conducted to identify primary research articles that were then graded based on their strength and level of evidence according to Centre for Evidence-based Medicine. Due to low quality of evidence, heterogeneous outcomes measures, and incongruent study designs a critical synthesis of the literature was conducted. **Results:** Eight primary research articles were found that documented potential effects of exercise on PTSD (range of evidence grades: 2B-4). Outcomes measures often included responses to surveys and to exercise training. Direct evidence for clinical effects was sparse. **Conclusion:** Available evidence suggests that exercise may be a promising type of therapy to address symptoms and functioning. Physical therapists may consider prescribing aerobic exercise for individuals with PTSD. Specifically as part of an overall intervention strategy involving multi-disciplinary teams. This recommendation is not yet confirmed from the available research, and additional clinical studies are necessary.

Key Words: physical therapy, physical activity

BACKGROUND

Posttraumatic stress disorder (PTSD) is a chronic, debilitating anxiety disorder characterized by a psychological response triggered by exposure to an intense traumatic experience usually abnormal to daily human experiences.[1-5] Posttraumatic stress disorder can occur at any age and currently affects 8% of the United States population, 7.7 million who are 18 years of age and older.[5,6] The highest rates of PTSD can be found among individuals who have been raped, people who have experienced military combat and captivity, and survivors of ethnically or politically motivated internment and genocide.[5] Posttraumatic stress disorder is twice as likely to occur in women than in men and is often associated with other medical and psychological disorders that can result in poor physical health.[1,6,7,8]

Precipitating events for PTSD include a direct experience of trauma, or being a witness to or vicariously learning about a traumatic event. Some of the more common direct traumatic events include military combat, violent personal assault, being kidnapped, being taken hostage, being involved in a terrorist attack, torture, incarceration as a prisoner of war, experiencing a natural (eg, earthquake, tsunami, hurricane, etc) or manmade (eg, nuclear blasts, explosions, blackouts, etc) disaster, severe automobile accidents, or being diagnosed with a life-threatening illness. Witnessed experiences include observing serious injury or unnatural death of another person due to violent assault, accident, war, or disaster, or unexpectedly observing a dead body or body parts. Posttraumatic stress disorder brought on by learning about traumatic events from others include stories of violent personal assault, serious accidents, or serious injuries experienced by a family member or close friend or learning that one's child has a life threatening disease.

The American Psychiatric Association created 6 diagnostic criteria that guide the clinical diagnosis of PTSD (Box).[5] In PTSD, an unusually strong distressing event can create recollections that are intrusive to normal functioning, as well as stress responses that are out of scale compared to the level necessary for a situation. Stressors that can induce PTSD are overwhelming to the individual, and often occur in response to events that create the unusual distress.[5,9] These stressors can create intrusive recollections, in which the individual re-lives the stressful experience. Stress responses can also induce avoidance or numbing to dangerous stimuli and/or hyper-arousal in response to benign stimuli.

To be diagnosed with PTSD, a specific set of clinical features needs to be present for a defined period of time. For a diagnosis of acute PTSD, the symptoms must be present for less than 3 months after the stressor. Chronic PTSD is defined as symptoms being present for 3 months or longer. Posttraumatic stress disorder can also be delayed, where 6 months has to pass between the stressor and onset of the symptoms. Symptoms of PTSD have been reported to resolve in 3 months in about half of the cases; however, symptoms can be present longer than 12 months in persistent cases.[5] Symptoms of PTSD generally include the following: impaired affect modulation, self-destructive, and impulsive behavior; dissociative symptoms; somatic complaints; feelings of ineffectiveness, shame, despair, or hopelessness; social withdrawal; paranoia; impaired relationships with others; and personality changes.[5]

Stress, coping, and adaptation are a part of the human experience. However, abnormalities in stress responses are documented to exist in individuals with PTSD. Individuals with PTSD appear to have a sympathetic nervous system (SNS) that has adapted to dealing with permanent stress. Additionally, these individuals have elevated levels and activity of corticotropin releasing factor, increased lymphocyte glucocorticoid receptor levels, and a suppression of glucocorticoid dexamethasone levels. Fear conditioning, an adaptive mechanism where humans learn to remember information about a threat in order to promote survival, is more sensitive in these individuals. Individuals with PTSD will display sudden elevations in cardiovascular and/or respiratory reactions, as well as other SNS activity driven responses, immediately after exposure to stimuli related to trauma. Indeed, individuals with PTSD have an abnormal startle reflex that includes a shorter latency period, increased amplitude,

Box. Diagnostic Statistical Manual IV (DSM-IV-TR) Criteria for Posttraumatic Stress Disorder[5]

To meet the diagnostic criteria for PTSD, an individual must meet the following essential features:

Criterion A- must have been exposed to a traumatic event where both of the following occurred:
- A1- person experienced, witnessed, or vicariously learned of an event that involved actual or threatened death or serious injury to oneself or others.
- A2- having a response involving intense fear, helplessness, or horror.

Criterion B- persistently re-experiencing at least one of the following:
- B1- recurrent and intrusive distressing recollections of the event including images, thoughts, or perception
- B2- recurrent distressing dreams of event
- B3- acting or feeling as if the traumatic event were recurring, includes sense of "flash backs," reliving the experience, illusions, hallucinations; can occur on awakening or when intoxicated
- B4- intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event
- B5- physiologic reactivity upon exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event (anniversaries of the traumatic event; examples include cold, snowy weather or uniformed guards for survivors of death camps in cold climates; hot, humid weather for combat veterans of the South Pacific; entering any elevator for a woman who was raped in an elevator)

Criterion C- persistent avoidance of stimuli associated with the trauma as well as numbing as specified by at least three of the following:
- C1- efforts to avoid thoughts, feelings, or conversations associated with the trauma
- C2- efforts to avoid activities, places, or people that arouse recollections of the trauma
- C3- inability to recall an important aspect of the trauma
- C4- markedly diminished interest or participation in significant activities, "psychic numbing" or "emotional anesthesia"
- C5- feeling of detachment or estrangement from others
- C6- restricted range of affect (unable to have loving feelings)
- C7-sense of foreshortened future (not expecting to have a career, marriage, children, or a normal life span)

Criterion D- Persistent symptoms of increasing arousal and include two of the following:
- D1- difficulty falling or staying asleep
- D2- irritability of outburst of anger
- D3- difficulty concentrating
- D4- hyper-vigilance
- D5- exaggerated startle response

Criterion E- noting if the duration of the disturbance in each of the symptoms in criterions B, C, and D is more than one month.

Criterion F- notes whether the disturbances significantly impair social, occupational, or other important areas of functioning.

Specifiers- may be used to specify onset and duration of symptoms
- Acute- symptoms less than 3 months
- Chronic- symptoms 3 months or longer
- Delayed onset- 6 months have passed between traumatic event and onset of symptoms

resistance to normal habituation, and a loss of normal inhibitory modulation of this reflex.[10]

Presently, there is no definitive treatment for PTSD. Treatment options generally include pharmacotherapy and/or psychotherapy, the former being associated with side effects while both are associated with poor long-term effectiveness.[2,9,11] There are two medications approved by the Food and Drug Administration to treat PTSD, Zoloft (sertraline) and Paxil (paroxetine). Both drugs are antidepressants that are prescribed to control PTSD symptoms. The most common side effects of these drugs include headache, nausea, sleeplessness or drowsiness, agitation, and sexual problems.[12] Psychotherapy involves talking with a professional therapist who attempts to teach the patient about the original trauma that causes PTSD symptoms and working with the patient to understand feelings about the event. Relaxation and anger management skills are also often worked on to improve daily functioning.

Indirect evidence suggests that the increased arousal response in individuals with PTSD may be reduced through the use of chronic exercise.[1,2,13-15] Consistent physical activity has been associated with improved psychological well-being, improved physical health and life satisfaction, and improved cognitive functioning.[2,16-17] In general, exercise improves mood and increases quality of sleep.[6,11] Exercise has also been shown to increase β-endorphins which are linked to mood state changes and "exercise induced euphoria," altered pain perception, and decreases in numerous stress hormones such as growth hormone, adrenocorticotropic hormone, prolactin, catecholamines, and cortisol.[16,17] It is unclear how effective exercise is in alleviating the symptoms associated with PTSD. Thus, the purpose of this literature review is to assess the effectiveness of exercise on individuals with PTSD through examination of the current literature. If exercise is an effective treatment for PTSD, physical therapists may play a prominent role as part of an interdisciplinary team who treat soldiers and veterans through exercise prescription.

METHODS

A literature search for the effects of exercise on PTSD among male veterans was performed in the following databases: Academic Search Complete, PubMed, CINAHL, SPORTDiscus, PEDro, and PsycInfo (Table 1). The search was conducted on April 2, 2014. *Posttraumatic stress disorder, exercise,* and *adult* were entered as general search

Table 1. Literature Search: Evidence Related to the Effects of Exercise on Posttraumatic Stress Disorder

	Academic Search Complete	PubMed	PEDro	CINAHL	SPORT-Discus	PsycINFO
Articles available for review	33	78	12	15	13	
de Assis et al[2]		X				
LeardMann et al[15]	X					
Libby et al[1]						X
Manger & Motta[4]		X				X
Otter & Currie[3]	X	X				X
Rutter et al[16]						X
Sealey[17]					X	
Zen et al[7]	X	X				

terms in all of the databases. No limitations on year of publication or type of publication were applied. Search terms were chosen with the intention of returning as many results as possible. To be included in this literature review, articles needed to be primary research studies published in peer-reviewed journals, written in English, and had to involve exercise and PTSD. Articles that included participants younger than 18 years of age were excluded. Articles that included adult male and female participants, with or without veteran status, were included. A single reviewer screened the titles and abstracts of all search results and selected articles to be reviewed. References from the selected articles were also consulted.

Each of the articles selected were classified using Centre for Evidence-Based Medicine to establish the strength of their evidence (Table 2).[18] A designated number and letter were used indicating the strongest and weakest levels of evidence, 1A to 5 respectively. Nine studies were found that met the above criteria. Two of the studies were rated at level 2B, 6 studies at level 3B, and one study at level 4. Each study was then examined in terms of patient population, interventions used, outcome measures, and significant results.

RESULTS

Of the 8 studies found that met the above criteria, only one directly examined the effects of exercise on PTSD. The 7 remaining studies attempt to investigate associations between exercise and PTSD. Five of the 8 studies were cross sectional surveys, one was a cohort study, one was a pilot study, and one was a focus group (Table 3).

Physical Activity Frequency and PTSD

De Assis et al[2] conducted a retrospective cohort study that investigated the effect of PTSD diagnosis on physical activity habits of individuals with PTSD and also compared physical activity levels of individuals with PTSD to levels in a community sample. Fifty individuals (34 female, 16 males) between the ages of 15 and 68 years who were diagnosed with PTSD using the Clinician Administered Post-traumatic Stress Disorder Scale (CAPS) participated in the study. Primary outcome measures included a 25-item physical and leisure time activity questionnaire, which was used to measure self-reported physical activity habits in each cohort. Subjects were classified as either "active" or "inactive" based on interpreting the questionnaire results with respect to the American College of Sports Medicine (ACSM) physical activity guidelines. According to ACSM guidelines, active individuals included those who exercise at least 150 minutes per week at an adequate intensity; inadequately active individuals exercise less than 150 minutes per week; and sedentary individuals do not exercise at all.[19] Approximately 54% of the comparison cohort met the "active" criteria. Of the individuals with PTSD, 26% met the active criteria before their diagnosis, while only 14% met the active criteria after their diagnosis. A uniform decrease in the frequency of a wide variety of physical and social activities was reported by the PTSD group. These data suggest that individuals with PTSD have lower levels of participation in physical activities both before and after a PTSD diagnosis. Physical activity habit items in the questionnaire included self-reported shopping, walking, driving, social contact with friends, and participation in religious society. No objective verification of the questionnaire data was available, which was an important limitation of the study. Nevertheless, this research suggests that the diagnosis of PTSD may be related to a decrease in physical activity levels, which suggest the possible importance of interventions to increase activity levels in individuals with PTSD.

A cross sectional study conducted by Zen et al[7] assessed whether individuals with PTSD are at a higher risk for cardiovascular disease (CVD). Of 1,022 prospective men and women with CVD, only 95 (9%) were found to have PTSD according to the Computerized Diagnostic Interview Schedule for DSM-IV. The primary outcome measure included self-report questionnaires, which assessed physical activity, medication adherence, and smoking history. In terms of physical activity, authors investigated overall activity, specific types of exercise, and what participants would rate their physical activity levels compared to others of the same age and sex category. To determine overall activity, individuals were asked how often in the last month they performed 15 to 20 minutes of exercise. To examine specific types of exercise, participants were asked how often in the last month they engaged in 15 to 20 minutes of light, moderate, or heavy exercise. When asked to compare themselves to others of the same age and sex participants could rate themselves as less active, somewhat active,

about the same, somewhat more active, or much more active. Participants with and without PTSD were compared to determine baseline differences using t tests for continuous variables and chi-square tests for dichotomous variables. Multivariate logistic regression models were also used to determine the association of PTSD with physical activity, medication adherence, and current smoking. In terms of overall exercise, light exercise, and level of exercise compared to others, participants with PTSD were more likely to be categorized as inactive. Authors also found that participants with PTSD were more likely to rate themselves as much less active or somewhat less active compared to those without PTSD. The researchers concluded that participants with CVD and PTSD are more likely to report physical inactivity. The results of this study need to be taken lightly due to the lack of objective measures using self-report surveys, the inability to rule out the likelihood of PTSD and other health behaviors being coincidental, and not being able to determine the independent effects of PTSD and depression. However since poor health behaviors are associated with individuals with PTSD, a physical therapist may encourage individuals to improve their physical activity levels to combat PTSD, and in turn, prevent CVD.

Rutter et al[13] performed a cross sectional survey to assess PTSD symptoms, depressive symptoms, exercise, and health in college students. Participants included 200 undergraduate students (125 females) between the ages of 18 to 23 years. The primary outcome measures included the Traumatic Life Events Questionnaire (TLEQ), PTSD Checklist Civilian Version (PCL), Beck Depression Inventory (BDI), Health Risk Appraisal (HRA), Cohen-Hoberman Inventory of Physical Symptoms (CHIPS), and the Short Form Health Survey (SF-36). The TLEQ is a 24 item self-report questionnaire that inquires about 22 types of potentially traumatic events. The PCL is also a self-report measure used to assess symptoms of PTSD while the BDI is a 21-item self-report instrument used to assess symptoms of depression. The HRA is a 50-item questionnaire that is used to assess the degree of involvement in physical exercise. The CHIPS is a 33-item self-report assessment that was used to measure physical health symptoms using a 5-point scale. Symptoms in the CHIPS questionnaire were divided into negative health symptoms that were defined as general health complaints such as headaches or back pain, and functional health outcomes that were defined as the extent to which health problems limit activity. The SF-36 is a 36-item questionnaire that was used to measure health related quality of life. According to a bivariate analysis, PTSD and depressive symptoms were related to decreased involvement in exercise as well as poorer health status. A multivariate linear regression analysis indicated that PTSD and depressive symptoms each significantly correlated with negative health symptoms and functional health. The authors also tested the hypothesis that the relationships between PTSD and depressive symptoms with negative health symptoms would be mediated by exercise by creating a path model analysis, although the magnitudes of correlation coefficients were modest. Findings from this correlational study suggest that health and functional effects of PTSD might be mitigated by physical activity. These preliminary observations should be confirmed by future studies that are designed to establish causative relationships between PTSD symptoms, health effects, and exercise interventions provided by physical therapists.

Table 2. Centre for Evidence-Based Medicine Evidence Hierarchy

Level of Evidence	Description
1A	Systematic review of randomized controlled trials
1B	Individual randomized controlled trials
1C	All or none case series
2A	Systematic review cohort studies
2B	Individual cohort study
2C	Outcomes research
3A	Systematic review of case controlled studies
3B	Individual case-controlled study
4	Case series
5	Expert opinion

Exercise as an Intervention in PTSD

In a pilot study, Sealey[14] examined the effects of acute bouts of exercise on post-exercise mood responses in Vietnam veterans. Participants included 32 individuals who presented with a high prevalence of chronic diseases and conditions, with 63% of individuals having PTSD and/or depression. Individuals were divided into 3 groups that each performed one session of differing exercise protocols. Group 1 included 10 individuals who completed lower body vibration exercises and upper-body resistance training for 20 to 30 minutes. Group 2 included 11 individuals who performed lower-body vibration, upper body resistance training, and aerobic exercise for 40 to 60 minutes. Group 3 included 11 individuals who performed full body resistance and aerobic exercise for 40 to 60 minutes. The primary outcome measure was the Subjective Exercise Experience Scale (SEES) that was completed by all participants immediately before and 5 minutes after the single bout of exercise. The SEES is a 12-item instrument used to examine positive well-being, psychological distress, and fatigue. Their results indicated a statistically significant difference between pretest scores and posttest scores in terms of positive well-being and psychological distress. After an acute bout of exercise, 72% of participants reported improved positive well-being and 47% of participants reported less psychological distress. These data indicate that an acute bout of exercise increased the perception of positive well-being in all groups but gave no indication how this single bout of exercise would affect symptoms of PTSD. Notably, the proportion of subjects with PTSD was not reported in for each group. However, since positive mood responses were present at the beginning of an acute bout of exercise, physical therapists might prescribe exercise to elicit that acute positive response.

Libby et al[1] performed a cross sectional survey to investigate the use and effectiveness of complementary and alternative medicine (CAM) therapies as a form of treatment for PTSD. Participants included 599 individuals with PTSD who were 18 years and older (461 females; 138 males) and met Diagnostic and Statistical Manual IV (DSM-IV) criteria for PTSD. The primary outcome measure was the Collaborative Psychiatric Epidemiology Surveys (CPES), which included an accumulation of data from the National Comorbid-

Table 3. Evidence Summary Table: Effect of Exercise on Symptoms and Function in Individuals with Posttraumatic Stress Disorder

Study	Type of Study	Sackett Level of Evidence[15]	Conditions	Patient Population	Important Outcome Measures	Important Results
de Assis et al[2]	Cross sectional survey research	3B	none	50 Brazilian participants diagnosed with PTSD. 34 females. Mean age of 37.	Structured clinical interview, Clinician Administered PTSD Scale, Beck Depression Inventory, Beck Anxiety Inventory	Patients with PTSD have low levels of participation in physical activities as measured by the structured clinical interview.
LeardMann et al[15]	Cross sectional survey research	3B	none	38,883 participants who were United States military service members.	Millennium Cohort questionnaires, PTSD Checklist Civilian Version	Participating in physical activity, especially vigorous activity is associated with decreased likelihood of developing PTSD symptoms in veterans as measured by the Millennium Cohort questionnaires.
Libby et al[1]	Cross sectional survey research	3B	none	599 participants with PTSD, 73.4% women, between the ages of 25-44.	Collaborative Psychiatric Epidemiology Surveys, National Comorbidity Survey-Replication, National Latino and Asian American Survey, National Survey of American Life	The most frequently used complementary and alternative therapy used to treat PTSD was mind body treatments which included exercise as measured by multiple surveys.
Manger & Motta[4]	Cohort study	2B	Warm up for 10 min (5 min of bicycling and 5 min of stretching), walk or jog on treadmill at moderate intensity for 30 min, then cool down for 10 min; 2-3x/ week for 10 weeks with a minimum of 12 sessions.	9 participants with PTSD. Mean age of 48.1.	Posttraumatic Diagnostic Scale, Clinician Administered PTSD Scale for DSM-IV: Current and Lifetime Diagnostic Version (CAPS), State-Trait Anxiety Inventory (STAI-T), Beck Depression Scale (BDI)	After aerobic exercise training participants were able to show improvements in CAPS, PDS, STAI-T, and BDI scores implicating aerobic exercise may be an effective intervention for PTSD.
Otter & Currie[3]	Cohort study (focus group methodology)	4	Aerobic exercise class program for 40 weeks. Class consisted of low to moderate intensity exercise to music involving a 5 min warm up, 30-40 min cardiovascular callisthenic type movements and activities, 10 min muscular strength and endurance training, and a cool down incorporating flexibility and stretching.	14 participants who were Vietnam veterans.	Focus groups conducted at weeks 10, 25, and 40	Following a physical activity program veterans were able to benefit psychologically and physically based on subjective experiences.

(Continued on page 41)

Table 3. Evidence Summary Table: Effect of Exercise on Symptoms and Function in Individuals with Posttraumatic Stress Disorder *(Continued from page 40)*

Study	Type of Study	Sackett Level of Evidence[15]	Conditions	Patient Population	Important Outcome Measures	Important Results
Rutter et al[13]	Cross sectional survey research	3B	none	200 undergraduate students, ages 18-23, 125 females	Traumatic Life Events Questionnaire, PTSD Checklist Civilian Version, Beck Depression Inventory-II, HRA, Short Form Health Survey	PTSD is associated with lower levels of physical activity and thus more susceptible to negative physical and functional health outcomes as measured by the HRA and CHIPS.
Sealey[14]	Cohort study	3B	Group 1- lower body vibration exercises and upper body resistance for 20-30 minutes Group 2- lower body vibration exercises, upper body resistance, and aerobic exercise for 40-60 minutes Group 3- full body resistance and aerobic exercise for 40-60 minutes.	32 participants who were Vietnam veterans. 63% had PTSD and/or depression. Mean age is 62	Subjective Exercise Experience Scale (positive well-being, psychological distress, fatigue)	Exercise had a positive effect on veterans as measured by the Subjective Exercise Experience Scale.
Zen et al[7]	Cross sectional survey research	3B	none	95 participants with PTSD and cardiovascular disease (CVD)	Computerized Diagnostic Interview Schedule for DSM-IV, self-report questionnaire (overall activity, types of activity, self-perception of activity level compared to others)	Participants with CVD and PTSD are more likely to report physical inactivity.

Abbreviations: DSM-IV, Diagnostic and Statistical Manual; min, minutes; PTSD, posttraumatic stress disorder, HRA, Health Risk Appraisal; CHIPS, Cohen-Hoberman Inventory of Physical Symptoms

ity Survey Replication, the National Latino and Asian American Survey, and the National Survey of American Life. The CPES was used to determine the types of CAM therapy used in the cohort. Types of CAM therapy included mind body treatments, biologically based treatments, manipulative body based therapies, alternative medicine systems, and other practices. Of the participants, 203 used CAM therapies. The most frequently used CAM therapy was mind-body treatment, which included exercise, and was used by 16% of participants. These participants claimed that mind-body treatment including exercise was an effective way to address symptoms associated with PTSD. It is important to note that neither the type nor amount of exercise was discussed in this study. Further limitation in this study included the lack of objective measures to assess the symptoms of PTSD and the effectiveness of the CAM therapy. Nevertheless, the favorable experience of subjects in this study suggests that physical therapists may consider exercise-based treatments for individuals with PTSD.

Using focus groups, Otter and Currie[3] also evaluated Vietnam veterans' experiences during a 40-week exercise program. Participants included 14 male veterans, 5 who reported being diagnosed with PTSD prior to the study and 9 claiming to have experienced at least one symptom of PTSD at the time of the study. Individuals participated in a 40-week supervised aerobic exercise program that included low to moderate intensity exercises while listening to music. Exercise sessions were held twice per week for an hour and included a 5-minute warm up; 30 to 40 minute cardiovascular callisthenic type movements and activities; 10 minutes of muscular strength, endurance, and resistance exercises such as crunches and push-ups; and a cool down period involving flexibility and stretching exercises. Information was obtained from a focus group interviews at intervention weeks 10, 25, and 40 to discuss opinions, attitudes, issues, and experiences important to the individuals. Researchers then categorized their qualitative findings in terms of work and lifestyle; motivation; anger levels and psychological changes; daily

habits, resilience, and energy levels; and social support. Participants reported positive changes in daily activity, energy, and lifestyle. They also described improved health experiences, including an increase in the ease and rate of recovery from performing daily activities, increased manageability of performing daily tasks, as well as an increase in mobility. The individuals also noted positive changes in eating habits, exercise duration and frequency, social interaction, and medication intake as they perceived a sense of control caused by exercise. They reported increased participation in physical activities outside of the program such as walking and swimming. The researchers concluded that an exercise program catered towards veterans built self-confidence, created friendships, and enhanced personal well-being. Information gathered from this study suggests that exercise may help veterans, many whom may have PTSD.

In a cohort study, Manger and Motta[4] examined the impact of an exercise program on PTSD, anxiety, and depression. Participants included 9 individuals between the ages of 18 and 65 years who scored at least 20 on the CAPS (indicating mild PTSD) and participated in no regular physical activity during the month prior to the study. Primary outcome measures included the CAPS, Posttraumatic Diagnostic Scale (PDS), State-Trait Anxiety Inventory (STAI-S and STAI-T), and BDI. The PDS is a 49-item self-report scale that measures symptoms associated with PTSD, while the STAI-S and STAI-T uses a 4 point scale to evaluate the state and trait of anxiety, respectively. Data from these measures were taken twice prior to the exercise intervention to establish a baseline, after the intervention, and at one month follow-up. Participants were instructed to exercise 12 times throughout the study, 2 to 3 times per week for 10 weeks. A detailed manual provided to the participants and YMCA supervising staff members instructed participants to warm-up (5 minutes of bicycling and 5 minutes of stretching) for 10 minutes, then walk or jog on a treadmill at a moderate intensity (60%-80% of max heart rate) for 30 minutes, followed by a 10-minute cool down. At baseline, 6 participants met the criteria for PTSD (67%) while at the postintervention time period, 2 participants met the criteria for PTSD (22%); after the 1-month follow-up, 4 participants met the criteria for PTSD (44%). At postintervention and 1-month follow-up, significant reductions were noted in symptoms of PTSD, depression, and trait anxiety. However, state anxiety remained unchanged during the study. The authors concluded that aerobic exercise was an effective intervention for PTSD. However, the small sample size and lack of a control group were important limitations in this study, because a strongly reactive subgroup may have skewed the data. Although this preliminary study is encouraging, future larger-scale and randomized studies seem necessary to establish the specific effects of aerobic exercise and refine dosage parameters.

Exercise in the Primary Prevention of PTSD

One study looked into the potential effect of premorbid self-reported physical activities on the risk of developing PTSD following exposure to trauma. In a cross sectional survey, LeardMann et al[15] analyzed the relationship between physical activity level and PTSD symptoms in a military cohort. The sample consisted of 38,883 randomly selected individuals (8,665 females; 30,218 males) that was divided among individuals with PTSD (n=1,401) and individuals without PTSD (n=37,482) using the PTSD Checklist Civilian Version. Baseline data was gathered through the Millennium Cohort questionnaires that were administered in 2001. For this study, the primary outcome measure was follow-up questionnaires completed every 3 years concerning physical and mental health, deployment, occupational exposures, and other health outcomes and exposures. Based on the individuals' responses, they were categorized as "very active," "active," "slightly active," "inactive," or "unable to perform physical activity." At the end of the 2006 study, 1,060 individuals in the previously non-disabled group reported new onset symptoms of PTSD. In the PTSD group, 820 individuals had resolved symptoms whereas 581 individuals still had persistent symptoms of PTSD. Overall among both cohorts, individuals who presented with PTSD at follow-up (n=1,641) were less physically active than individuals without PTSD (n=36,422). Individuals who participated in vigorous physical activity, which was described as exercise or work that causes heavy sweating or large increases in breathing or heart rate (eg, running), had reduced odds of developing new onset PTSD symptoms following combat exposure compared to sedentary subjects. Conversely, individuals who reported being physically unable to engage in continuous physical exercise had a significantly increased risk of new onset PTSD following combat exposure. Interestingly, however, strength training was not similarly associated with decreased odds of developing PTSD symptoms. Thus, the effects of exercise may not generalize across all modes. These data suggest that participating in physical activity, specifically including aerobic exercise, is associated with reduced odds of developing new onset PTSD after exposure to a traumatic event. These findings suggest that vigorous aerobic activity may serve a protective effect against the development of PTSD following exposure to trauma.

DISCUSSION

The 8 studies presented in this paper examined the potential relationship between exercise and PTSD. Research on the subject is still developing, as there are sparse amounts of studies that use exercise as a direct intervention to examine its effects on PTSD. However, the results from these current studies show promising outcomes for exercise as a form of treatment for PTSD. Six studies[1,2,7,13-15] investigated the association between exercise and PTSD. Of the 6 studies, 4 showed a relationship between decreased physical activity levels and individuals with PTSD. The remaining two studies[1,15] examined the effectiveness of exercise as an intervention for individuals, many who had PTSD. Additionally, one study[15] found that an acute bout of exercise increased the perception of positive well-being in the veterans in this study, many who had PTSD. Although the overall data supported the use of exercise as an effective intervention for individuals with PTSD, further research is needed to determine direct and long-term effects of exercise on this population. One study[3] evaluated personal experiences during an exercise program. Their qualitative finding suggested that an exercise program tailored to veterans built self-confidence, created friendships, and enhanced personal well-being. Because this study did not contain any quantifiable data, further research is needed to confidently support the effectiveness of exercise on PTSD. One study[4] with a higher level of evidence assessed the effects of exercise on individuals with PTSD using a direct intervention. Results indicated significant reductions in symptoms of PTSD at postintervention and 1-month follow-up, which validated the impact of exercise on individuals with PTSD. The authors of this study concluded aerobic exercise may be an effective treatment for PTSD.

CONCLUSION

The purpose of this literature review was to evaluate the current literature on the effects of exercise on PTSD. Research analysis provided evidence in support of poorer health outcomes being related to a decrease in physical activity in individuals with PTSD. Overall, it may be concluded that exercise may be beneficial and may have the potential to be an effective intervention in treating adults with PTSD. Although focus has been placed on PTSD's effects on health outcomes, little research is available on direct interventions such as exercise as an effective treatment method for PTSD. Stronger study designs are needed to determine the effects of exercise on PTSD that include randomized controlled trials and adhere to ACSM guidelines. Clinicians may consider aerobic exercise as an effective intervention; however, further research should be done on different types of exercise as well as dosage that may be beneficial in treating PTSD.

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Addressing Yellow Flags in the Care of a Patient with Chronic Neck Pain: A Case Report

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ABSTRACT

Background and Purpose: In many instances, chronic pain cannot be fully explained using a conventional biomedical model. In this case report, we illustrate the combined use of orthopaedic and psychologically informed physical therapy for the treatment of chronic neck pain. **Description:** We describe the care of an 84-year-old male patient with a complaint of chronic neck pain with recent exacerbation. The initial onset of symptoms was one year prior to the examination but had substantially worsened in the last 3 months. Standard orthopaedic physical therapy management was complemented with a psychologically informed approach. **Outcomes:** After 9 visits, the patient reported significant improvement in pain and function and returned to his previous level of activity. This improvement was maintained 3 months after discharge. **Conclusion:** The application of the biopsychosocial model of care with special attention to yellow flags was successfully used for treatment of chronic neck pain.

Key Words: fear-avoidance, neuroplasticity, pain education, sensitization

BACKGROUND AND PURPOSE

It is estimated that 1 in 3 Americans suffer from chronic pain.[1] The yearly health care cost and lost productivity secondary to pain-related disability is $600 billion.[2] Unlike acute pain, chronic pain does not serve a useful biological, protective purpose. On the contrary, it often limits our capacity for physical activity and participation in social undertakings.[3] Treatment for chronic pain is beginning to see a shift from an emphasis on medications (opioids, antidepressants, and anticonvulsants) to a more comprehensive and multidisciplinary approach.[4] The focus is more on the whole person and less on the physical body structures. Recommendations include physical activity, a healthy diet, quality sleep, and seeking social support.[5] Health care professionals, including physical therapists, use a variety of approaches to stimulate cognitive and behavioral changes with the goal of restructuring the patient's experience of pain. Redirecting the patient's attention toward completion of functional tasks rather than pain abolishment becomes one of the main goals of these newer approaches.[6] This is a challenging proposition if the patient has developed well-established negative thoughts associated with previously painful activities. In addition to negative thoughts, patients manifest other modifiable psychological risk factors, or yellow flags, in the form of fear of movement, unhelpful beliefs about recovery, and anxiety.[7] Yellow flags were developed, as part of the Flag System, to help clinicians identify psychological and social risk factors interfering with a person's rehabilitation.[8] The adoption of the Flag System is part of a global shift from the biomedical model to the biopsychosocial model. This new model acknowledges tissue damage or disease as an essential component, while also highlighting the more complex social and psychological reality experienced by patients. The biopsychosocial model has changed the patient-clinician interaction by allowing a more holistic approach to health care.

Several psychological models explain the possible mechanisms behind the cognitions and behaviors recognized as yellow flags. Examples of these models are the Fear-avoidance, Misdirected Problem-Solving, and the Self-Efficacy Models.[9] Fear-avoidance is one of the most influential models with a large number of studies supporting its assumptions. This model attempts to explain the role of fear in pain-related disability associated with musculoskeletal conditions. In recent years, the fear-avoidance model has undergone several modifications; incorporating the findings of new research.[10] A key component of the model is its proposed explanation of how a person "learns" to be afraid of pain through interoceptive or proprioceptive stimuli. Several possible learning pathways are explained by Vlaeyen et al,[11] using the concept of Pavlovian conditioning. These concepts describe how pain transitions from being an unconditioned stimulus to a conditioned stimulus, which then elicits a conditioned response in the form of fear. More than explaining the acquisition of a fear response, these models have clinical implications in many areas of patient-management, including explanations of how to screen and examine patients and also how to treat them. A thorough interview and use of self-administered outcome tools can identify those patients in whom pain-related fear and avoidance behaviors are present. The Fear-Avoidance Beliefs Questionnaire (FABQ) and the Örebro Musculoskeletal Screening Questionnaire (ÖMSQ) are two examples of frequently used self-administered outcome tools.[12,13] The FABQ score has been identified by different clinical prediction rules as one of various criteria associated with treatment success in patients with neck pain and low back pain.[14-16]

Once a patient has been identified as having pain-related fear and avoidance behaviors, this information should be used in planning further assessment and treatment. Treatment is varied, but most contemporary approaches involve some form of learning, either *formal learning, associative learning or motor learning*, with the goal of promoting positive neuroplastic changes.[17-19] This approach is substantiated by findings in previous research, which shows structural and functional cortical changes in patients with chronic musculoskeletal disorders like patellofemoral pain syndrome, osteoarthritis, and rotator cuff pathology.[20] These patients show altered neural transmission and processing in the primary motor cortex and primary somatosensory cortex, which has been associated with disturbances in pressure pain thresholds, tactile acuity, and motor control.[20] *Formal learning* as a form of treatment has been adopted by Lorimer Moseley and others who postulate that learning about pain neurophysiology can decrease pain and improve function in people with chronic pain.[21,22] These education sessions explain nociceptive input processing through the nervous system and how a person with chronic pain perceives this information. The approach relies on identifying misguided beliefs and behaviors people exhibit regarding an injury. The notion that "pain means I am harming my body by performing this task" is challenged and replaced by "it hurts but I understand the mechanism, therefore, I believe I'm

safe." *Associative learning* involves the extinction of pain-related fear of movement by the introduction of "inhibitory responses." An inhibitory response (no fear of movement) will compete with, and eventually replace the original response (fear of movement). Graded exposure through motor imagery can be used as an initial strategy since the patient's visualization of the task is non-threatening. Motor imagery implies that the individual imagines the performance of a given action. This exercise is meant to bridge the gap between visualization and execution of a task with the ultimate goal of forming new non-threatening associations that can be subsequently generalized across time and contexts.[23] Neuroplastic changes can also be achieved with novel *motor-skill learning*.[19] Novel motor skills learning in a patient with neck pain can be achieved by performing tasks like deep neck flexor endurance training since this is an atypical motion and the exercise's level of skill requires the patient's attention.

Given the importance of the learning process in the treatment of chronic musculoskeletal pain; identifying patients who will likely benefit from such an approach is critical. A determination of a patient's ability to respond to a learning-dependent treatment approach seems feasible when considering intrinsic characteristics that are believed to influence learning capability, such as personality, intelligence, and age. This case report will describe the implementation of a bottom-up and top-down approach to facilitate the rehabilitation of a psychiatrist with chronic neck pain. The bottom-up component consisted of evidence-based orthopaedic manual therapy and exercises, while the top-down component used a learning-based treatment approach with the goal of cortical reorganization.

CASE DESCRIPTION

History

The patient is an 84-year-old male who works as a licensed psychiatrist. He is 167 cm tall and weighs 72.6 kg (body mass index, 25.8 kg/m^2). At the time of his initial examination, the primary complaint was neck pain that had started one year prior and had gradually worsened over the last 3 months. He did not recall a specific injury and stated that his symptoms appeared gradually over time. Until recently, he had not sought treatment, except using acetaminophen when his symptoms were particularly bothersome. Relevant past medical history includes ventricular tachycardia, hypothyroidism, osteoporosis, and osteoarthritis on several axial and appendicular joints. For the last 9 years, he has had an implantable cardioverter defibrillator (ICD) controlling the ventricular tachycardia. He reported no current cardiovascular symptoms.

Three weeks prior to his initial examination, the patient consulted a neurosurgeon who diagnosed him with left C5-6 radiculopathy and administered a trans-foraminal, fluoroscopy-guided, steroid injection at the involved segment. The injection provided mild relief of symptoms. Subsequently, a physiatrist at our institution referred him to physical therapy to address body mechanics and musculoskeletal impairments. During the subjective portion of the initial examination, he described his main complaint as an intermittent sharp, stabbing pain located on the left side of the upper thoracic spine, surrounding the superior and medial borders of the left scapula. Pain intensity at rest was 5 out of 10 on the Numeric Pain Rating Scale (where 0 indicates no pain and 10 indicates the worst pain imaginable). This increased to 7 out of 10 when reading, driving, dressing/undressing, and sleeping on his right side.[24] Figure 1 depicts the location of pain.

The score of the FABQ was 24/24 on the physical activity scale, and 3/42 on the work scale. The score on his physical activity scale suggests high levels of movement-related fear. The Neck Disability Index (NDI) score was 35/50.[25] This score is interpreted as severe perceived neck disability.

During the examination, several evidence-based yellow flags were identified.[7] He mentioned that his pain had recently increased to a level that had "forced him to stay home." He missed 2 weeks of work and avoided personal and telephone contact with friends and family. When asked why he isolated himself during that period of time, he replied, "Pain had me in a very bad mood, and I did not want to bore people with my problems." Table 1 includes a list of yellow flags identified during the interview.

Systems Review

The patient was given a medical screening questionnaire intended to identify signs and symptoms suggestive of serious pathology of the cervico-thoracic spine, including fractures, infection, vertebrobasilar insufficiency, ligamentous instability, and malignancy. Symptoms suggestive of malignancy, such as unremitting night pain, fever, unin-

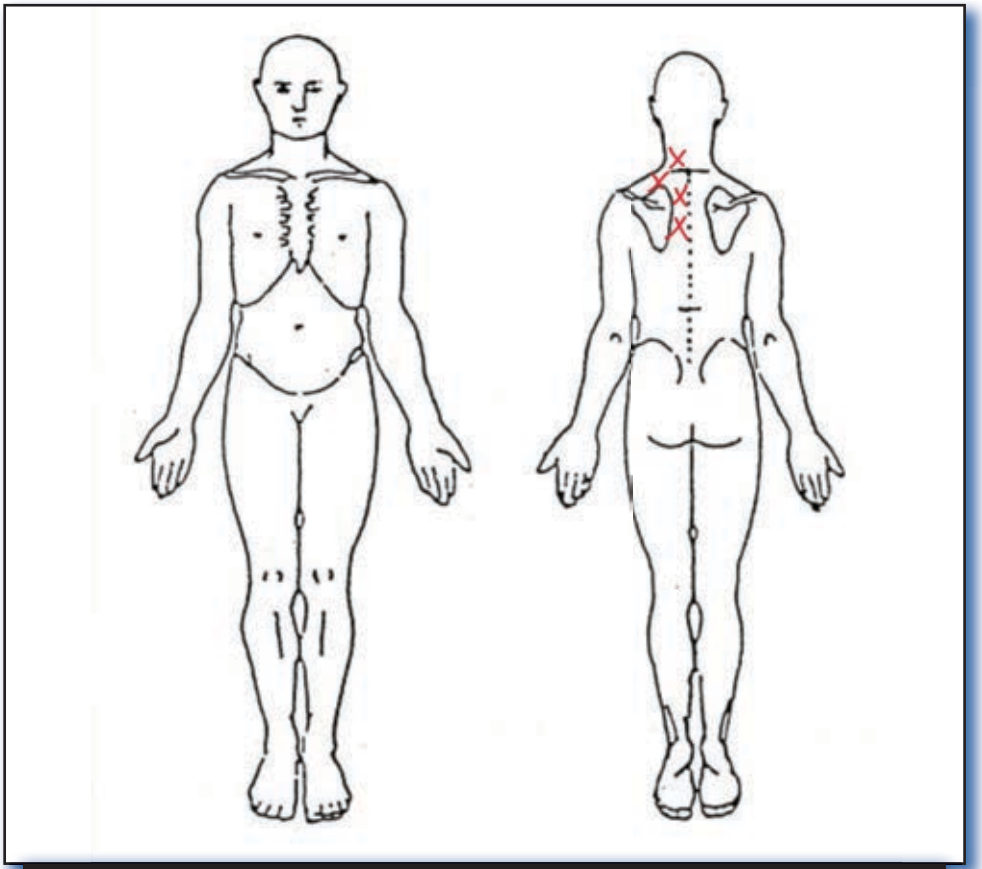

Figure 1. Pain location identified during the initial visit.

tended weight loss, or history of cancer were not present.[26] He denied symptoms of cervical spine instability such as locking/catching, neck pain, and/or headaches worsened by sustained weight bearing postures and relieved by nonweight bearing postures.[27] There were no symptoms of vertebrobasilar insufficiency described as blurred vision, dysarthria/dysphagia, drop attacks, vomiting, lightheadedness, disorientation, tinnitus, or orofacial paresthesias.[28] He denied symptoms of spinal cord compromise like ataxia or changes in bowel and bladder function.[28] He also denied recent trauma or falls. Due to his history of cardiovascular disease, he was given the National Stroke Association's Stroke Risk Scorecard; he scored "low risk" of having a stroke.[29] The patient's goals after treatment were to feel well enough to continue working part-time, sleep without being woken up by pain, and be able to drive comfortably.

Clinical Impression 1

The patient's history was not suggestive of serious pathology. Intermittent cervicothoracic pain, episodic in duration, reproduced and relieved by movement and positions, is suggestive of musculoskeletal pain. The location of the patient's pain (superior and medial borders of the scapula) correlates with the radicular referred pain pattern reported by Mizutamari et al[30] as originating from an insult to the dorsal rami of segments C5 and C6 nerve roots.[30] The pain location also correlates with the pattern of pain originating from the C7-T1 and T1-2 zygapophyseal joints, as described by Fukui S et al.[31] A biomechanical examination of the cervical and thoracic spine was deemed necessary in order to clearly understand the origin of the nociceptive input. Due to the likelihood of this patient benefiting from cervico-thoracic joint mobilizations or manipulations and the inherent risk on these techniques, we considered performing a screening for cervical arterial dysfunction and craniovertebral ligamentous instability as described in the literature.[32-34] In addition to the bio-medical findings, the presence of multiple yellow flags places this patient at high risk of disability and pain chronicity, making him an interesting subject for this case report.

EXAMINATION

The postural examination revealed an increased thoracic kyphotic curve with bilaterally protracted scapulae. The patient carries his head anterior to the body's center of gravity with concurrent cranio-cervical hyperextension and lower cervical flexion. We observed normal chest expansion and respiration rate. Inspection of the upper extremities did not reveal significant muscular atrophy. Assessment of cervical spine active range of motion (ROM), using an inclinometer, was limited and painful in flexion (25°), extension (25°), and especially in right side bending (5°).[35] During active ROM testing, the patient was asked, "Is this your typical pain?", to which he responded, "yes." The rest of the cervical spine ROM examination was limited but painless (left side bending: 30°, right rotation: 65°, left rotation: 70°). Thoracic active ROM was significantly restricted but painfree, into flexion (30°) and extension (15°). To test thoracic flexion and extension spine active ROM, we placed one inclinometer on the cervico-thoracic junction and a second one at the thoraco-lumbar junction. The difference between the two readings was considered to be his thoracic flexion and extension active ROM.[35]

A neurological examination of the upper quarter was performed. Light touch was intact throughout the bilateral upper extremity dermatomes. Deep tendon reflexes (DTR) exam showed bilateral brisk response on the triceps (+2) and the brachioradialis (+2), but diminished response on the left biceps (+1).[36] Myotome testing revealed fatiguing weakness of the left wrist extensors and left elbow flexors, which are innervated by the C5-6-7 spinal nerves, C6 being the common innervation for both motions.[37] During the Neck Flexor Muscle Endurance Test, he was able to hold the position for 17 seconds.[38] The test was terminated because of muscular fatigue and mild pain. Since cervical spine active ROM reproduced the patient's symptoms, a biomechanical examination of the cervical spine was deemed appropriate and yielded the following results.[39] The alar and transverse ligament laxity tests were negative.[32] The sternocleidomastoid, scalene, and short craniovertebral extensor muscles were hypertonic and tender to palpation but did not reproduce the patient's symptoms. The craniocervical and cervicothoracic junctions had restricted accessory motion into flexion, on the right side when compared to the left side. Examination of the mid-cervical spine revealed pain with C5-6 intervertebral motion, which was alleviated by guided manual accessory motion of the right C5 inferior articular facet into flexion (arthrokinematic opening) during cervical spine flexion active ROM, and into extension (arthrokinematic closing) during cervical spine right side bending active ROM. Neither the Distraction test or the Spurling's test altered the patient's symptoms and were considered negative.[40] The Upper Limb Tension Test (ULTT) with bias for the median nerve was positive on the left side.[40] Cervical arterial function testing and results are summarized in Table 2.

Table 1. Yellow Flags Identified at the Initial Visit

Risk Factor	Patient Verbalization
Passive Coping Mechanism	"The only thing that made it better was the injections."
Pain Catastrophizing	"Feels like it will never end."
Kinesiophobia	"I do not move that way because it makes things worse."
Hypervigilance	"The only thing I can talk about is my pain."

Clinical Impression 2 (Evaluation of Examination Findings)

Based on the information obtained from the subjective and objective examinations, sinister pathology as a source of the patient's pain can be considered unlikely. The patient's primary complaint can be best described as somatic referred pain, with mild neurological involvement as evidenced by fatigable weakness of the left C6 myotome and diminished left biceps DTR. What makes this case particularly interesting are the patient's behaviors, beliefs, and coping strategies, the yellow flags. He verbally and physically expressed fear of movement and pain catastrophizing in addition to other findings consistent with a person who has developed negative thoughts and beliefs about pain. He was a good candidate for supervised physical therapy and was expected to respond well to a psychologically informed orthopaedic approach.

INTERVENTION

The patient received 9 supervised physical therapy visits in a one-month period. The treatment focused on addressing both the bottom-up nociceptive input and the top-down modulation of pain, with a strong focus on the cognitive and behavioral aspects of treatment. A summary of the intervention provided on each visit is presented on Table 3.

Bottom-Up Intervention

Initially, orthopaedic manual therapy techniques were used to normalize motion at the craniocervical and cervicothoracic junctions. Soft tissue mobilization techniques were used to regain normal length of several of the region's phasic muscles (scalene, sternocleidomastoid, and short cranio-vertebral extensors). Next, we used passive physiological (PPIVMS) and passive accessory intervertebral motions (PAIVMS) as described by Geoff Maitland et al[41] to decrease nociceptive input and normalize motion at the hypomobile zygapophyseal joints. Passive joint mobilizations were followed by neuromuscular re-education using muscle energy techniques as described by Leon Chaitow.[42] Manual therapy interventions were performed with minimal force and avoiding end range cervical movements as recommended by the Orthopaedic Section Clinical Practice Guideline for mechanical neck pain.[43] Cardiovascular exercise on a treadmill was used for 2 reasons: (1) improving cardiovascular endurance and function, and (2) increasing the secretion of endorphins as part of a graded activity program.[44,45] The opioid-like effects of endorphins can generate a feeling of well-being and inhibits transmission of pain signals.[46] A gradual increase of activity reinforces healthy behaviors and shifts the patient's focus from pain relief to the achievement of functional tasks. Our patient increased treadmill-walking time from 5 minutes to 15 minutes over a period of 4 weeks. We frequently monitored vital signs during treadmill-walking to ensure heart rhythm and blood pressure remained within safe parameters. Deep neck flexor musculature (longus capitis and longus colli) endurance training was performed by instructing the patient to do craniocervical flexion while lifting the head up from a supine and also a prone position, as described by Ylinen et al.[47] Additionally, postural re-education exercises were used to improve the static and dynamic positioning of the cervico-thoracic spine and scapulae.

Top-Down Intervention

Several approaches to re-conceptualize pain were used. Self-efficacy concepts were introduced early on, with the purpose of providing a sense of control and promoting active coping skills.[48] He learned how to avoid and self-manage pain "flare-ups," by performing simple exercises like shoulder circles. On the second visit, we explained current evidence about nociception, neuroplasticity, and sensitization. Additionally, he was given the "Explain Pain" book by Mosley and Butler.[17] Graded exposure and graded motor imagery techniques were used to address the patient's fear of moving the cervical spine, specifically in right side-bending.[49] He performed active ROM exercises only to a non-threatening, painfree range. This exercise was performed using the image of a clock, instead of his head, while instructing the patient to "turn the clock from 12:00 towards 1:00" when doing right side bending active ROM. He gradually progressed to move the clock "towards 2:00," and then "towards 3:00" until the ROM was symmetrical with the contralateral side. A similar image was used for cervical rotation, flexion, and extension. The image of a clock provides an external focus of attention, which de-emphasizes the body movement and brings the patient's attention to the accomplishment of a task.

Breathing exercises were introduced with the purpose of decreasing the stress associated with chronic pain and promoting mindfulness.[50] The patient was guided through diaphragmatic breathing with a slow and deep pattern. During the exercise, the patient was encouraged to let go of negative ideas associated with his pain and observe his body in a new light. Acknowledging the patient's understanding of the body and mind, as part of his psychiatry training, it was deemed appropriate and beneficial to have an open discussion about the yellow flags previously observed. The Fear-avoidance Model was discussed as it relates to biological and cognitive-behavioral processes.[51] The conversation focused on the progression of symptoms from the moment he first perceived acute neck pain one year prior, to the current state where his nervous system had become sensitized and he had adopted a maladaptive pain personality. We also discussed the role of catastrophizing as a risk factor for pain chronicity and disability and the different ways negative beliefs and thoughts can be challenged and replaced by positive ones.

OUTCOMES

The patient's goals were to feel well enough to continue working part-time, to sleep without being woken up by pain, and to drive comfortably. At discharge, he reported reaching all of his goals. He was sleeping 6 to 7 hours a night without use of a sleeping aid. He could perform light to moderate physical activities on a daily basis, and was not taking medication for pain control. He returned to work part-time and had no difficulty performing his typical duties. At the discharge visit, he was still complaining of mild pain on the superior aspect of the left scapula, which worsened with prolonged sitting. Average pain was rated as 1/10, on a 0 to 10 scale, with extended periods of time when he reported "not being aware of the pain." He understood that mild neck pain was expected at times and he should not be concerned by it.

Outcome measure tools were answered at baseline, discharge (4 weeks), and 3 months after discharge. From baseline to discharge, change of the FABQ physical activity subscale score reached the minimal detectable change (MDC) of 8 points as reported in subjects with pelvic pain and upper extremity

Table 2. Cervical Arterial System Screening

Test	Result
Body Mass Index	25.8 kg/m^2 (over weight)
Pulse	70 bpm
Neurological Exam	No signs of upper motor neuron lesion
Functional Positional Provocation	No signs of vertebrobasilar insufficiency during combined neck extension and rotation active range of motion
Eye Exam	Symmetrical appearance, no signs of Horner's Syndrome
Blood Pressure	130/90 mmHg
Abbreviations: kg/m^2, kilograms by square meter; bpm, beats per minute	

Table 3. Intervention Provided on Each Visit

Visit #	Therapeutic Exercises	Manual Treatment	Psychologically-Informed Treatment	Cardiovascular Training	Pain Medication Dosing and Frequency
1 Examination			Discussion about active coping mechanisms and "self-efficacy"		Acetaminophen 325 mg oral tablet 3 x day
2	Scapular retraction, chin tuck	STM of SCM and sub-occipital short cranio-vertebral extensor muscles	"Explain Pain" book[14] was provided and a summary of the content was explained	Treadmill 5 min	Acetaminophen 325 mg oral tablet 2 x day
3	Craniocervical flexion endurance training in supine and prone	STM of suboccipital short cranio-vertebral extensor muscles	Diaphragmatic breathing	Treadmill 5 min	Acetaminophen 325 mg oral tablet 2 x day
4	Pectoral muscles stretch with door frame	STM of scalenes, PAIVMS directed at bilateral C1-2 and PPIVMS directed at right C5-6	Conversation about fear and kinesiophobia	Treadmill 10 min	Acetaminophen 325 mg oral tablet 1 x day
5	Elastic band triceps pull down with sustained scapular depression	PAIVMS directed at C1-2 and C7-T1-2, PPIVMS directed at C5-6	Graded exposure, graded imagery (visualization and graded progression towards feared / painful movement)	Treadmill 10 min	No pain medication for last 48 hrs.
6	Horizontal rowing with elastic band (targeting middle trapezius muscle)	PPIVMS at C5-6	Conversation about pain catastrophizing	Treadmill 10 min	No pain medication
7	Diagonal rowing with elastic band (targeting lower trapezius muscle)	PAIVMS C5-6	Progressive muscle relaxation (selectively tensing - relaxing major muscle groups of the upper and lower quadrants)	Treadmill 15 min	No pain medication
8	Thoracic extension/ rotation active ROM in sitting	None	Graded integration of cervico-thoracic and shoulders active ROM	Treadmill 15 min	No pain medication
9 Discharge	Upper traps, scalenes stretch	None	Review of active pain management strategies	None	No pain medication

Abbreviations: STM, soft-tissue mobilization; SCM, sternocleidomastoid muscle; PAIVMS, passive accessory intervertebral movements; PPIVMS, passive physiological intervertebral movements; ROM, range of motion

pain.[52-53] The MDC is defined as the minimum change that falls outside the measurement error in the score of an instrument. The score change also satisfied the minimally clinically important difference (MCID) of 25%, reported in subjects with pelvic pain.[53] The MCID is defined as the smallest score difference that signifies an important rather than trivial difference in the patient's condition. Neither MCID nor MDC have been reported in the literature for a population similar to the subject in this case report. The FABQ physical activity subscale continued to improve from discharge to the 3-month follow-up (additional 16 point change). The patient also showed a significant change in perceived neck disability as captured by the NDI. At the initial visit, he perceived being severely disabled (35/50). One month later, he perceived mild disability (2/50). At the 3-month follow-up appointment, he perceived no disability (0/50). Changes in the NDI satisfied both the MDC and MCID for the outcome measure tool. Table 4 includes a summary of outcome measure scores captured at the initial visit, discharge visit, and at the 3-month follow-up.

The patient also experienced impairment changes including cervico-thoracic active ROM, deep neck flexor muscle endurance, and flexibility of anterior chest wall musculature. The Deep Neck Flexor Endurance test increased from 17 seconds at baseline to 30 seconds at discharge. Granting there was a 13-second improvement between baseline and discharge, the 30-second hold time did not reach the normative mean endurance hold time for healthy males of 38.9 ± 20.1 as reported by Domenech et al.[54] At discharge,

Table 4. Outcome Measures at Baseline, Discharge, and 3-Month Follow-up

Patient - Reported Outcome Measure	Initial Examination	Discharge Visit	Three-Month Follow Up
Numeric Pain Rating Scale	7/10	1/10	0/10
Fear-Avoidance Beliefs Questionnaire	Physical Activity Subscale: 24/24 Work Subscale: 3/42	Physical Activity Subscale: 16/24 Work Subscale: 0/42	Physical Activity Subscale: 0/24 Work Subscale: 0/42
Neck Disability Index	71%	4%	0%
Global Rating of Change	-	A great deal better (+6)	A very great deal better (+7)

the patient reported feeling "a great deal better" on the Global Rating of Change scale. The scale's validity has been criticized with the argument that a patient's recollection of previous health may be poor, making it difficult to determine if there has been improvement or deterioration over a period of time. Despite the possibility of poor recollection, this tool can provide useful information about general perception of improvement and patient satisfaction.

DISCUSSION

The patient described in this case report experienced neck pain for 12 months before being referred to our physical therapy clinic. During that period of time, he developed maladaptive pain management strategies that were provoked, in part, by pain-related fear. He believed that rest would allow the injured tissue an opportunity to heal. Rest had been a successful pain management approach in the past, and he learned to use it as a dependable first line of treatment for all future pain. This learning process promoted decreased activity and avoidance of the tasks previously recognized as painful. His beliefs and behaviors were consistent with the ones described in the Fear-avoidance Model. Paradoxically, these behaviors result in a transition toward pain chronicity instead of symptom reduction. In addition to fear, our patient also experienced emotions like anger, confusion, and helplessness. We believe these emotions were triggered by the inability to take control of his symptoms, leading to a self-imposed, 2-week period of isolation from work, friends, and family. This process occurred despite the patient's training as a medical doctor specializing in mental disorders. On the other hand, his medical and psychological knowledge likely served as a strong base for the initiation of a sound approach to rehabilitation. The physical therapy treatment was designed to de-construct the pain experience into these categories: primary nociception, sensitization (central, spinal or peripheral), emotions, behaviors, expectations, and goals. The various treatment components were intended to address those categories in an effective and efficient manner. During the biomechanical examination we identified capsular restrictions at several spinal segments, which created a new axis of motion. This new axis of motion caused pain at the left C5-6 segment, especially during contralateral side bending and flexion ROM. Primary nociception was believed to originate at this segment. These restrictions were addressed using manual therapy techniques. The use of such techniques had the potential to cause dependence on "passive treatment," but this approach was chosen because of the importance of eliminating the nociceptive input originating at those spinal segments. By addressing the nociceptive input, we were able to decrease anxiety and fear of movement. To avoid dependence on the passive treatment, the patient was concurrently encouraged to perform non-threatening cervico-thoracic spine and upper extremity motions introduced in a graded manner. Pain sensitization with resultant hyperalgesia and allodynia were thought to be present. With the introduction of current pain neuroscience evidence, the ground was set for what would become the formal educational component of our patient's treatment, which was intended to modify his expectations and goals. The general message was that the initial examination pain rating of 7 out of 10 was not a true representation of the state of the cervical spine structures but rather a decision his brain had made about perceived danger.[55] Changing this perception could diminish the intensity of emotions linked to the pain experience (anxiety, anger, fear, etc) and allow the initiation of an active pain coping strategy. Activity would no longer be interpreted as a threat, but as a way of returning the body to a healthy state.[7] In an effort to avoid flare-ups, gradual integration of meaningful activity was used in every session with special attention to the exercises' intensity and volume. The nature of flare-ups was explained to the patient with the expectation that they could occur during and/or after the treatment and were not an indication of danger or damage.

LIMITATIONS & FUTURE IMPLICATIONS

By employing a bottom-up and top-down approach to this patient's problem, the goal was to address pain chronicity with a multi-faceted approach. Given the nature of a case report, one cannot infer cause and effect between treatment and outcomes. It is possible that his improvement could have been the results of a spontaneous resolution of symptoms or the result of treatment received prior to physical therapy. However, the chronic nature of his symptoms and the steady change seen over a short time period suggests that our treatment contributed to his functional improvement. Further research could investigate how factors like personality, intelligence, and age affect a person's ability to benefit from treatments focusing on formal, associative, or motor learning.

CONCLUSION

Yellow flags become obstacles to improvement and the behaviors associated with them can intrinsically worsen the experience of pain. These patients typically have a poor prognosis unless the yellow flag components are addressed in an effective manner. Treatment was designed to address the patient's problem using a bottom-up (modification of input) and top-down (modification of output) approach. The author of this case study strongly believes the patient's previous knowledge about physical and mental health provided a strong foundation, which allowed him to easily comprehend and apply the concepts being presented.

ACKNOWLEDGEMENT

The author would like to thank Emily Altman PT, DPT, CHT, OCS, CLT, for her guidance and support with this article.

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Effective Worksite Strategies and Interventions to Increase Physical Activity in Sedentary Workforce Populations: The Role of Physical Therapists

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ABSTRACT

Background: The increase in physical inactivity and sedentary lifestyles has been associated with the rise of two major preventable health concerns: non-communicable diseases and musculoskeletal disorders. The financial burden to employers attributed to these preventable health concerns continues to escalate. **Purpose:** To identify, evaluate, and summarize the role of physical therapists in worksite strategies, delivery systems, and interventions to improve the health of sedentary workforce populations. **Methods:** A literature search of 5 electronic databases including EBSCO, Cochrane, Pubmed, OVID, and Google Scholar was performed along with reviewing the reference lists of relevant articles. **Results:** Twenty-nine articles were included identifying effective strategies, delivery systems, and interventions. **Clinical Relevance:** This review will identify effective worksite intervention programs based on evidence in the literature. **Conclusion:** Implementing effective worksite health promotion strategies, delivery systems, and interventions with the use of onsite physical therapists can increase employee health by increasing employee physical activity and decreasing their sedentary time. This investment results in reduced health care costs, and improved productivity.

Key Words: independent modifiable risk factors, musculoskeletal disorders, non-communicable diseases, occupational health

BACKGROUND

Currently, the United States population is in the midst of an epidemic impacting the societal health of the nation and increasing the economic burden. Over the past 50 years, increasingly sedentary lifestyles have resulted in major public health concerns with a large portion of our workforce unhealthy and less productive.[1-3] Approximately 69 million workers report missed days due to illness each year, reducing our economic output by $260 billion per year.[4] Two major preventable public health concerns include non-communicable diseases and musculoskeletal disorders.[2,3,5-7]

Non-communicable diseases (NCDs), which can take years to develop, become lifelong, chronic diseases; Type II diabetes; and some cancers. Every year, non-communicable diseases account for approximately 60% of mortality and a large portion of morbidity, leading to a decreased quality of life.[8,9] In 2009, the average medical costs per year for an individual without chronic diseases was $1,884; for those with chronic diseases, excluding heart disease, was $6,448, and for those with heart disease was $7,026.[10] In 2011, the cost to employers for every short-term disability claim for acute coronary syndrome cost nearly $8,000 and each long-term claim cost more than $52,000.[11] The National Business Group identified the mean overall cost of an initial heart attack to be about $1 million and the average cost of a less severe heart attack to be about $760,000.[12]

Musculoskeletal disorders (MSDs) are injuries affecting the body's musculoskeletal system and they increase with age. Musculoskeletal disorders account for 42% to 58% of all work-related injuries and illnesses, with back injuries being most prevalent, accounting for 42% of all injuries and illnesses.[13] Musculoskeletal disorders also have a high price tag. In 2008, MSDs cost an estimated $510 billion in direct costs and $339 billion in indirect costs.[7] Overall, health care costs increase by 50% due to MSDs.[14] Additionally, over 50% of those with MSDs also have NCDs or other risk factors.[1,15] Non-communicable diseases and MSDs have an enormous impact on our nation's economy and productivity as well as individual families.

The literature provides underlying evidence of the role individual modifiable risk factors (IMRFs) play in both NCDs and MSDs. The health of individual workers is often quantified by the number of risk factors one has or does not have for both NCDs and MSDs. Many of these risk factors overlap. The increase in the number of health risk factors directly relates to a decrease in employee productivity and an increase in absenteeism.[16,17] The 6 most common IMRFs that increase the prevalence of NCDs include high blood pressure, tobacco use, elevated glucose levels, physical inactivity, obesity, and elevated cholesterol levels.[8,18] The 4 most common IMRFs that increase the prevalence of MSDs include smoking, high body mass index, high psychosocial work demands, and the presence of co-morbidities, including NCDs.[19] Given these risk factors, two major components that may have the greatest impact on the prevention of NCDs and MSDs are increasing physical activity and decreasing sedentary behaviors.[20]

A new strategy must be implemented to decrease the prevalence of these preventable diseases and disorders and improve overall health and productivity. The 2011 National Health and Prevention Strategy stated by the Surgeon General is to "move the nation away from a health care system focused on sickness and disease to one focused on wellness and prevention."[21] Strategies and interventions must be applied at the national, state, and city levels, within the health care industry, at worksites, and for the individual.[22] The worksite has become a common choice for the implementation of broad-scale health promotion programs for several reasons. Sixty percent of people between 18 and 65 years of age are employed full-time, making the workplace a strategic location for health promotion activities for workers because it provides access to a large percentage of the population for an average of 8 hours per day.[13] Companies have a vested interest in keeping their workforce healthy and health care costs contained.[22] Additionally, there continues to be an increase in required prolonged sitting as a major portion of many job tasks.[23] Only 48% of people in the United States reach the recommended guidelines for physical activity.[24-26]

PURPOSE

The purpose of this article is to provide a review of the literature summarizing the

best-evidence strategies, delivery systems, and interventions for the prevention and management of IMRFs along with drawing conclusions and making recommendations. This information will serve to guide the physical therapist who is practicing in the area of occupational health so they can lower the incidence of NCDs and MSDs in a sedentary workforce. In this article, "strategies" will apply to the WAY a particular intervention is presented (eg, cognitive or behavioral presentation of the individual or work place, adult learning styles, etc). "Delivery systems" will deal with HOW the particular intervention is presented (eg, face-to-face, online). "Interventions" relates to WHAT is being done with the WAY and HOW it is presented.

METHODS

Five electronic search databases were used to search the literature: EBSCO, Cochrane, PubMed, OVID, and Google Scholar. The search was divided into 3 parts with the main search terms being: (1) non-communicable diseases, (2) musculoskeletal disorders, and (3) physical therapy. Combinations of the various terms below were included with each main search term. The additional terms included "occupational health," "occupational intervention," "worksite," "systematic review," "randomized controlled trial," "prevention," "sedentary populations," "sedentary behaviors," "independent modifiable risk factors," "adults," "interventions," "effective," and "physical activity." The reference lists of relevant articles were also reviewed to identify additional publications not identified in the formal search strategy.

Articles were included in this search if they: (1) examined the effectiveness of strategies and interventions for sedentary populations that could be implemented at the worksite in the prevention and management of IMRF through the increase of physical activity and the decrease in sedentary behaviors, (2) used some form of outcome measures including health risk assessments, biometric measurements, self-efficacy, tracking of physical and sedentary activity, productivity, and absenteeism and presenteeism, (3) were published in peer-reviewed journals, and (4) printed in English. Articles were excluded if populations tested were not sedentary or if interventions were not able to be implemented within the workforce.

RESULTS

Twenty-nine articles were included in this review. These articles consisted of 9 randomized controlled trials, 7 systematic reviews, 6 systematic reviews with meta-analyses, 1 meta-analysis, 2 quasi-experimental designed trials, 2 literature reviews, 1 review of prospective studies, and 1 review of empirical data. The articles included a great deal of heterogeneity between studies, indicating a need for more high quality randomized controlled trials to be performed.

STRATEGIES

To determine the most effective interventions, the organization's culture and readiness to change must first be analyzed, followed by a determination of the overall strategies that best fit the organization. From a review of the literature, strategies that were deemed more effective involved the use of multi-modal or comprehensive rather than a single component intervention, behavioral change versus cognitive interventions, and targeting specific groups versus the whole workforce.[27] Anger et al[28] evaluated the effectiveness of "Total Worker Health" interventions and determined "the number of risk factors that are changed in combination show effective simultaneous interventions or synergy in interventions that change multiple behaviors. This strategy appears to be more effective and efficient than focusing on one intervention and one outcome in a serial fashion." Musich et al[29] evaluated the "Well at Dell Health Management Program" and determined a well-designed and well-managed comprehensive worksite health promotion program can produce significant health risk improvement. Due to the complexity of keeping a workforce healthy, it is necessary to provide multiple interventions to improve the various aspects of IMRFs to reduce and manage MSDs and NCDs.[30]

In a review article of the International Olympic Committee Consensus Statement, it was determined the core component of all clinical programs for the prevention and management of chronic disease is behavioral change.[31] Furthermore, in a meta-analysis, Conn et al[32] determined behavioral interventions were a more effective strategy to increase physical activity among healthy adults than cognitive interventions. Unfortunately, these behavioral modifications have not been implemented effectively to decrease these preventable disorders.[31,33] Matheson et al[31] states "interventions that are designed from a content perspective are more likely to fail and need to be directed by how people behave." Behavioral-based strategies proven more effective in improving physical activity behavior include feedback, goal setting, consequences, self-monitoring, and cuing.[32] A component that has been effective in promoting behavioral change is determining one's self-efficacy and readiness to change.[34] Ashford et al[34] concluded the best ways to improve self-efficacy and promote increased physical activity include feedback on past or others performance and vicarious experience. Verbal persuasion, graded mastery, and barrier identification were determined to have a negative impact on improving self-efficacy.

Another proven effective strategy involves reviewing individual employee data and identifying those who have IMRFs.[28] A health risk assessment, work ability, self-efficacy, readiness to change questionnaires, biometric measurements, a cardiovascular fitness assessment, and muscular strength and functional assessments are outcome measures used for gathering data. This can provide insight into the lifestyle choices of workers, identify present risk factors, and assist the developers and distributors of health promotion programs to implement targeted interventions for specific workers at different levels of readiness.[31] The strategy to identify targeted interventions should also take into account the feasibility of interventions, while being respectful and responsive to an individual's preferences, needs, and values. This will assist individuals in becoming more actively engaged in improving his or her own health by participating in and using the interventions provided.[31,35] Once the strategies are in place, determining the delivery systems of these targeted interventions can be selected and implemented.

DELIVERY OF INTERVENTIONS

A literature review shows the delivery of interventions by professional staff with ongoing support, face-to-face delivery, and the inclusion of online tools to be effective. Foster et al[36] determined a mixture of professional guidance and self-direction with on-going professional support leads to meaningful change including increased physical activity. Conn et al[32] determined that delivering the interventions face-to-face showed a larger effect size when compared to the delivery of interventions by phone or mail. To et al[37] found 6 of the 7 interventions that used online tools to increase physical activity were effective. These online tools consisted of the distribution of information and strategies, tailored messages according to identified needs, motivational messages, behavioral counseling, access to tracking, and walking routes. A randomized controlled trial by Hurling et al[38] found online and mobile phone technology to be effective in increas-

ing physical activity through an automated physical activity program.

In contrast, Slootmaker et al[39] found a 3-month online personal physical activity monitor and web-based tailored advice to be ineffective in increasing physical activity in healthy adults. They postulated this may be due to offering minimal intervention to adults already meeting physical activity guidelines and 39% of the participants finding the online advice unappealing. There was a positive effect in increased awareness of meeting physical activity guidelines in an overweight subgroup. Tailoring the intervention to the employees' needs should be carefully considered. The combination of the delivery of interventions by professional staff with ongoing support, face-to-face meetings, and online tools demonstrated an overall positive effect on increasing physical activity in the workplace.

INTERVENTIONS

The interventions for this review will be placed in 2 categories: (1) increasing physical activity (including cardiovascular health and muscular strength) and (2) decreasing sedentary behaviors. Interventions within each category often treat both MSDs and NCDs. Nutrition is also a key factor but is beyond the scope of this literature review.

There are a large number of systematic reviews and meta-analyses that have studied the effectiveness of worksite interventions. However, due to heterogeneity of populations and interventions among studies, there are concerns with external validity. Nonetheless, identifying effective interventions that have provided at least a minimal to moderate effect will be discussed.

Physical Activity

Weiler et al[20] recently wrote, "Physical activity (including aerobic and musculoskeletal fitness) is a potentially inexpensive treatment for physical inactivity that has demonstrated benefits on 39 diseases or health conditions." In 2008, the US government established guidelines regarding the minimum amount of physical activity considered healthy and will promote disease prevention. The current minimum guideline is 150 minutes of moderate or 75 minutes of vigorous-intensity aerobic physical activity per week and muscle strengthening 2 times or more per week.[24] The Centers for Disease Control and Prevention (CDC) assessed only 48% of people reach the recommended guidelines for physical activity.[25]

Proper et al[40] determined implementing worksite physical activity programs increased the level of physical activity and decreased MSDs. A Cochrane review concluded, "interventions designed to increase physical activity can lead to moderate short and mid-term increases in self-reported physical activity and measured cardio-respiratory fitness."[36] A systematic review by Malik et al[41] found a significant increase in physical activity at the workplace in 4 of 6 randomized controlled trials. The interventions included workplace walking programs and mandatory physical activity interventions. A specific physical activity intervention was determined to have a higher probability of success than an intervention of counseling and support or health promotion messages.

Interventions used to promote physical activity and decrease MSDs and NCDs can be generalized into 2 categories: structured (continuous) and lifestyle (accumulating). Structured exercise is planned, organized, and uses repetitive bodily movement to improve or maintain one or more components of physical fitness.[42] It occurs at a certain time for a specific duration and is often of higher intensity. Unstructured or lifestyle physical activity is not planned and occurs during the day through lifestyle activities. Both structured exercise and lifestyle activity are beneficial in improving physical activity, cardiorespiratory fitness, and blood pressure.[43,44] To reach the 52% who are not achieving the recommended physical activity guidelines each week, both types of physical activity will need to be used, depending on the target group and objective.[25]

For employees with MSDs of neck and shoulder pain, several studies evaluated the effectiveness of different types of exercise or physical activity within the workplace. It was determined the intervention groups who received specific resistance training, general fitness, or general physical activity had a significant decrease in neck and shoulder symptoms when compared to control groups who received general health information.[45-48] Specific resistance training at work was completed 3 times per week for 20 minutes using dumbbells focused on the shoulder and static exercises for the neck. General fitness included structured exercise meeting the CDC's physical activity guidelines each week, excluding the upper body. All-around physical activity included increasing lifestyle activity such as walking at work and/or home. All 3 groups received professional support but not constant supervision. In regards to the need for regular supervision during structured exercises to reduce neck and shoulder pain in office workers, Gram et al[48] found well-performed instruction and initial supervision to be effective without the need for regular supervision.

Two studies determined specific resistance training provided greater relief from neck and shoulder symptoms when compared to general fitness and lifestyle activity.[45,47] In a review of prospective studies, it was concluded specific resistance training decreased neck and shoulder symptoms when compared to general resistance, physical exercise, stretching, and movement awareness but determined using workplace exercise as a primary prevention of MSDs showed minimal effect.[49] Anderson et al[46] and Lowe and Dick[49] concluded those individuals who were asymptomatic at baseline showed a decreased prevalence of MSDs from the specific resistance training intervention when compared to general physical activity.

In a randomized controlled cross-over trial, Sjogren et al[50] determined a small but statistically significant decrease in low back pain with light resistance exercise of 5 minutes per day while at work. In a systematic review, Bell and Burnett[51] assessed methodological quality of 15 papers (10 randomized controlled trials and 5 clinical controlled trials) using the Cochrane Back Review group criteria and the CONSORT (Consolidated Standards of Reporting Trials) statement. Four of the 15 included studies were rated as high quality, but the remaining studies were judged to be of low quality with methodological limitations, including problems with randomization, blinding, compliance reporting, and follow-up. They concluded there was some evidence exercise reduces the severity of low back pain and activity interference caused by low back pain.[51] However, several factors, including the design of the majority of the studies, the heterogeneity of populations and interventions, and the lack of reporting on effect sizes and subgroup types, made it difficult to draw conclusions about the efficacy of workplace exercise interventions in preventing low back pain.[51] These studies indicate physical activity interventions may decrease the incidence of MSDs, but more research is needed to determine the best intervention approach in the primary prevention of MSDs.

Physical inactivity is one of the IMRFs leading to an increased prevalence of NCDs and MSDs.[8,18,19] In a randomized controlled trial comparing lifestyle and structured interventions, both had significant and comparable improvements in physical activity and cardiorespiratory fitness from baseline

to 24 months.[44] These changes in lifestyle behaviors were able to be maintained by a large percentage of those who participated in the trials with long-term results.[52,53] The intervention goals include physical activity reaches or surpasses the CDC's guidelines for disease prevention, including 150 minutes per week of moderate intensity exercise or activity and strength training of major muscle groups 2 times per week.[24] Promoting interventions such as walking as opposed to other forms of physical activity were more effective.[54] In the systematic review by To et al[37] the 7 studies assessing the effectiveness of pedometer use to increase physical activity resulted in increased steps. Abraham and Graham-Rowe[54] determined individually tailored interventions were not more effective in regards to increasing physical activity than walking programs. As indicated by Foster et al[36] receiving initial instruction by a professional combined with self-direction and ongoing support has led to more consistent effect estimates and improvement in physical activity.

The duration of an intervention impacts the outcome. To et al[37] concluded interventions with a duration of 6 months or less were more effective than those longer than 6 months. Additionally, interventions that included social and environmental applications, such as maps with routes and distances, staircase promotion, and walking circuits, helped to increase physical activity.[37]

Decrease in Sedentary Behavior

Total and prolonged sedentary time are independent risk factors for harmful health outcomes regardless of physical activity.[55,56] Individuals in more sedentary occupations will benefit from interventions that will assist in reducing or limiting the prolonged unbroken bouts of sedentary time. Neuhaus et al[57] assessed activity-permissive workstations and determined they are an effective intervention. These interventions included fixed standing desks, adjustable height work stations, treadmill desks, cycle ergometers, and pedal devices that can be used while working at one's desk. Using activity-permissive workstations led to a reduction of 77 minutes per 8-hour workday in sedentary time. A significant effect was found in 11 out of 14 comparisons with an average reduction of 90 minutes per 8-hour workday in workplace sedentary time. Other outcomes also included decreased waist circumference and improved psychological well-being. There were no significant changes in work performance outcomes. The treadmill desk was the workstation showing the greatest negative impact on work performance. This was assessed within one to two days after initiation. More research is needed to determine if familiarization can occur and improve work-related outcomes. Studies have found that manual height-adjustable desk mount and the height-adjustable desks to be a nonsignificant factor for decreasing sedentary behaviors.[58] Alkhajah et al[59] evaluated the efficacy of using sit-stand workstations and found a reduced sitting time of 143 minutes per day (95% CI -184, -102) with effects being maintained at 3 months.

In a meta-analysis by Martin et al[60] it was determined sedentary behavioral interventions can reduce overall sedentary time by -22 to -34 minutes per day (95% CI –35.[81] to –8.88, p = 0.001). Moderate to high-quality evidence on the efficacy of lifestyle interventions for reducing sedentary behavior suggests this may be a promising approach. Interventions focusing on sedentary behavior only resulted in the greatest reduction in sedentary time (42 minutes per day). There is also evidence to support the need for specific interventions such as accelerometers and sit-to-stand desks to reduce sedentary behavior in order to generate clinically meaningful reductions in sedentary time. Prince et al[61] identified a 91 minute per day reduction in sedentary time that maintained short-term results. Also, sedentary behavioral interventions that included education on the benefits of decreasing leisure time sitting may contribute to decreasing a risk factor for obesity independent of occupational sitting.[56]

Short "booster" breaks or group exercises of 10- to 15-minute durations implemented at work have been shown to decrease sedentary time and increase physical activity.[62] Reducing sedentary time is significant as determined by Buman et al[63] who showed for every 30 minutes of sedentary behavior that were reallocated to moderate-vigorous physical activity, there was a 2% to 25% improvement in risk.

THE ROLE OF PHYSICAL THERAPISTS

Physical therapists already participate in injury prevention and management through interventions such as ergonomic assessment, functional testing, and job modifications.[13] They also have the skill set to help bridge the gap between knowledge and practical application related to the prevention and management of IMRF to decrease MSDs and NCDs in the workplace. The World Confederation for Physical Therapy, in its position statement on exercise, states, "As experts in movement and exercise and with a thorough knowledge of risk factors and pathology and their effects on all systems, physical therapists are the ideal professionals to promote, guide, prescribe and manage exercise activities and efforts."[64] With the increase in MSDs and NCDs and their related costs, moving beyond traditional interventions to consulting and working in a health promotional role is essential. Onsite access by ideal professionals, such as physical therapists, provides early intervention, links interventions directly to the risk factors, including job demands, and decreases time away from work. This proximity of the occupational health physical therapist to the worker can improve integrated care and improve worker self-management for overall health and disability prevention.[13,65] Physical therapists practicing in the area of health promotion provide benefit to the companies through decreased health care costs and increased worker productivity.[66] Providing onsite consulting, education, assessment, and training can improve integrated care and worker self-management with early interventions.

DISCUSSION

This literature review determined evidence-based worksite health promotion and management of IMRF can be effective in reducing MSDs and NCDs in sedentary workforce populations. Once the organizational culture is identified, strategies can then be determined to best fit the organization. Strategies deemed more effective include comprehensive programs focusing on multiple interventions and implementing interventions focusing on behavioral changes, such as feedback on past or others performance, goal setting, consequences, self-monitoring, and cuing.[27] This also includes determining a worker's self-efficacy and readiness to change.[34] Additional strategies include targeting specific groups determined by identifying risk factors and applying specific interventions that are appropriate.[27,31] The delivery of these interventions should include a combination of systems such as online tools for general education, environmental communications, and initial face-to-face contact. Providing professional instruction for the implementation of these interventions with ongoing support appears more effective.[36]

Once the delivery system has been determined, the interventions focusing on physical activity and sedentary behavior can be implemented. The promotion of physical activity can be increased through the use of both structured and lifestyle activity compo-

nents. Overall, the use of specific resistance training and all-around physical activity are effective in decreasing musculoskeletal neck, shoulder, and back pain with specific resistance training proving to be more effective.[45,47,50,51] Furthermore, using a combination of structured (continuous) exercise and lifestyle (accumulating) physical activity can help the workforce reach recommended physical activity levels.

Interventions used to decrease sedentary behavior need to be incorporated within the company's organizational framework. Activity-permissive workstations, sit-stand workstations, and establishing activity-based, 10-minute breaks occurring every 2 to 3 hours with the necessary cuing, having standing meetings, environmental cues, and activity-based gatherings may all be used to help decrease sedentary time.[57,58] This is one area where a paradigm shift must be made to incorporate new ways of thinking to benefit employees by decreasing sedentary time and increasing work performance.

A weakness in determining the effectiveness of worksite health promotion and injury prevention programs is often determined by the quantifying of the absence of symptoms or signs, which is difficult. Additionally, much of the research is based on studies with a great deal of heterogeneity, indicating a need for improved research in this area. Given the unique skill set of physical therapists, they are in a position to significantly contribute to the management and prevention of NCDs and MSDs, as well as the literature in this area.

Due to the increasing incidence of NCDs and MSDs directly related to physical inactivity and sedentary behaviors, more research will be needed to help create more effective strategies, delivery systems, and interventions for worksite health promotion programs within sedentary occupations.

CONCLUSION

Implementing worksite health promotion strategies, delivery systems, and interventions can create a positive effect on improving employee health and decreasing IMRFs by increased physical activity and decreased sedentary behaviors. This investment can be cost-effective, reduce health care costs, and improve productivity with the use of onsite professionals such as physical therapists.

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Wooden Book Reviews

Rita Shapiro, PT, MA, DPT
Book Review Editor

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

Dutton's Orthopaedic Examination, Evaluation, and Intervention, 4th Edition, McGraw-Hill Education, 2016, $151
ISBN: 9781259583100, 1672 pages, Hard Cover

Editor: Dutton, Mark, PT

Description: This is the fourth edition of a book that presents a comprehensive, systematic, and evidence-based approach to the examination of and interventions for orthopedic patients. The previous edition was published in 2012. **Purpose:** The author states that this edition updates the information and the bibliography and reorganizes various chapters. This is an important objective: as the evidence continues to evolve, it is important to stay as current as possible. **Audience:** The book is geared for both students and clinicians, which is appropriate. The material covered is valuable for practitioners who interact with patients with orthopedic concerns. Mr. Dutton is both a clinician and an adjunct professor at Duquesne University. **Features:** This book covers the examination and treatment for the extremities, spine, and temporomandibular regions. There is also a chapter dedicated to the vertebral artery. The section on anatomy covers the behavior of various connective tissues, which is clinically applicable. Other sections deal with patient management, imaging, and pharmacology, as well as manual techniques and neurodynamic evaluation and treatment, while four sections focus on improving muscle performance, mobility,

neuromuscular control, and cardiovascular endurance. A whole chapter deals with special populations including the pediatric, pregnant, and geriatric, as well as those involved in various specific sports. The tables and photos are clear and of high quality. The algorithms are easy to follow and not so convoluted that they intimidate readers. Clinical pearls appear throughout, emphasizing pertinent key clinical points or highlights of evidence that make this book much more applicable. **Assessment:** This book is both well written and comprehensive, but that is not its greatest strength. Its strength lies in its clinical relevance. Every aspect is related to its clinical importance and improving patient care is the focus.

Jeff B. Yaver, PT
Kaiser Permanente

Physical Therapy: Treatment of Common Orthopedic Conditions, Jaypee Brothers, 2016, $81
ISBN: 9789352501670, 454 pages, Soft Cover

Editor: Baheti, Neeraj D, PT, DPT, OCS, CSCS; Jamati, Moira K, PT, MSPT, ATC, CSCS

Description: This book covers 16 orthopedic conditions commonly seen by physical therapists, presented by 16 different practitioners of physical and occupational therapy from the U.S. and New Zealand. Each chapter provides an in-depth analysis of the clinical presentation, clinical examination, and evidence-based physical therapy treatment of the condition, generously supplemented by illustrations of anatomy and photographs of patient examination techniques, manual therapy techniques, and exercise programs. **Purpose:** The purpose is to create a resource for practicing clinicians for best practice and evidence-based interventions for common musculoskeletal disorders. This book is needed because it provides a concise source of ideas for effective diagnosis and treatment for clinicians who often do not have time to search for the latest evidence for disorders commonly seen in their practices. The book meets the objectives. **Audience:** The intended audience is "practicing clinicians," particularly physical therapists. The authors of each chapter focus on the examination and treatment of musculoskeletal conditions by physical therapists. The chapter authors appear to be credible authorities in their subject areas. **Content/Features:** This book covers the relevant anatomy, clinical presentation, clinical examination, differential diagnosis, physical therapy interventions, and some alternative and surgical interventions for 16 different musculoskeletal conditions. Most of the chapters are extensively referenced to support the content of the chapter. Sensitivity and specificity are included for most clinical diagnostic tests ("special tests"). Chapters on upper extremity and lower extremity are particularly well done and include many photos of exercise programs, some of which are unique and innovative. Several chapters contain extensive tables for differential diagnosis, rehabilitation based on phases of healing or recovery, and exercise progression. The photos of exercises are very helpful for illustrating correct exercise techniques, but some of the photos are blurry and there are a few errors in captioning. The book describes most of the exercises presented in the photos, but the exercise techniques shown in some photos are unclear and an explanation in the text is lacking. Chapter 6, on cervical sprain and strain, does not meet the level of quality of the other 15 chapters. Several patient exam techniques described in this chapter are obscure (i.e. doorbell sign test and coin test) and are not referenced. Interventions such as "hourly exercises described by Dennis Morgan" are unclear and not referenced. **Assessment/Comparison:** This is a valuable source of evidence-based patient examination and intervention for 16 common musculoskeletal conditions. I am not aware of a comparable publication that provides practicing clinicians with the clinically relevant guidelines and ideas for effective outcomes for their patients with these conditions.

Thomas Nolan, Jr., DPT, MS
Stockton University

Functional Anatomy for Physical Therapists, Thieme Medical Publishers, Inc., 2016, $109.99
ISBN: 9783131768612, 578 pages, Hard Cover

Author: Hochschild, Jutta

Description: This book highlights anatomy relevant to the practice of physical therapy while describing other topics such as palpation and kinesiology and providing clinical pearls. **Purpose:** The book serves as a supplement to classic anatomy textbooks. In addition to covering anatomical structure, it includes information on palpation and discussions of relevant function and pathology that affect structure and function. Describing anatomical structures and implications for function and rehabilitation is pertinent to the education of physical therapists. The author has succeeded in accomplishing this goal. Audience: The primary audience is physical therapy students, but the book also presents clinical pearls for practicing physical therapists. This is a good reference for anyone looking to delve deeper into the study of anatomy and human movement. The author has taught anatomy for more than 25 years, and the book reflects the author's vast experience. **Content/Features:** The book's presentation of anatomy is relevant primarily to the practice of orthopedic physical therapy. Ten chapters cover the spine and extremities. Each chapter discusses a different spinal or extremity joint complex and includes palpation landmarks, imaging views, pathology, clinical tips, bony and joint surfaces, muscles, ligaments, and nerves. The inclusion of imaging is helpful for clinicians, although the figures are illustrations. Real images would have been a nice addition. Also, innervation for muscles is not consistently included, and this information would further provide clinical relevance. **Assessment/Comparison:** This book is helpful to student physical therapists as it juxtaposes anatomy with information about kinesiology, function, and pathology relevant to rehabilitation. For clinicians looking to study anatomy more deeply or solve clinical problems, this can be a useful adjunct to the traditional anatomy books such as Netter's *Atlas of Human Anatomy*, 6th edition (Elsevier, 2014). It is not as comprehensive at displaying anatomical views and describing layers, but it displays the anatomy alongside descriptions of movement, clinical pearls, and pathology. Overall, it is a good quality book that lives up to its title.

Monique Serpas, PT, DPT, OCS
Touro Infirmary

OCCUPATIONAL HEALTH

SPECIAL INTEREST GROUP

We hope to see you in San Antonio during APTA Combined Sections Meeting February 15-18. The **Work Rehabilitation Clinical Practice Guideline** will be introduced at the OHSIG Meeting on Friday, February 17 at 7:00 a.m, along with the plan for implementation of educational opportunities surrounding this specialty practice. Come and participate in the meeting to help us plan, become educated, and share with your colleagues.

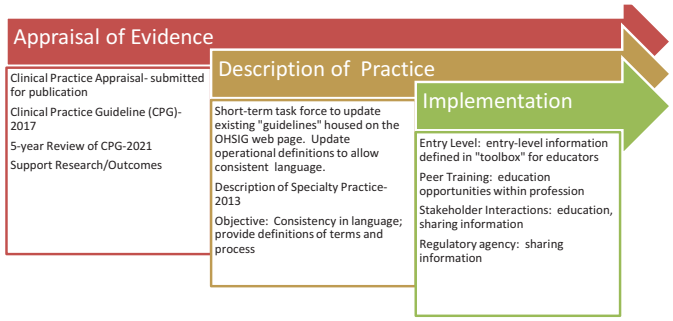
- **OHSIG Meeting: Work Rehabilitation Clinical Practice Guideline**
  Friday, February 17, 2017, 7:00 a.m. - 7:45 a.m.
  Location: Henry B. Gonzalez Convention Center,
  Room: Stars at Night Ballroom 4
- **Evolving Paradigms in Psychosocial Management of Debilitating Chronic Conditions**
  Friday, February 17, 2017, 8:00 a.m. - 10:00 a.m.
  Location: Henry B. Gonzalez Convention Center
  Room: Stars at Night Ballroom 4

We are excited to co-host Michael Sullivan, PhD, originator of Progressive Goal Attainment Program (PGAP) for this session. Rehabilitation as a health discipline evolved in the early 1900s, originally to deal with injured soldiers returning from combat. Vestiges of the protective and palliative orientations of early rehabilitation models continue to influence current clinical practice patterns for individuals suffering from pain conditions. Examination of the techniques included within these pain management approaches reveals an overrepresentation of passive and palliative techniques. Examination of the repertoire of private sector services offered to individuals with debilitating pain conditions reveals increased use of risk-targeted activity reintegration approaches. Increasingly, return to work is considered to be a central goal of intervention. This session will compare and contrast how traditional, conceptual models and market pressures influence the orientation of pain management interventions, as well as the desired outcomes of pain management interventions. This presentation will also address how the superior performance of risk-targeted activity reintegration interventions invites reconsideration of some of the assumptions that have guided the development of traditional approaches to pain management.

OHSIG Strategic Plan Related to Definition and Validation of Practice

A big thank you goes to Herb Doerr, John Lowe and participants for a successful course. Herb Doerr, owner of HHD- Eagle Physical Therapy Solutions and John Lowe, onsite and implementation specialist for WorkWell Prevention and Health presented a successful one day course in Chicago. These experts shared their experience and knowledge with participants in building a successful occupational health practice.

Highlights from the National Ergonomics Conference and ErgoExpo, November 15-18, 2016



Attendance exceeded 1500, with 59 sessions to choose from over 2½ days. The ErgoExpo hosts 135 vendors, the majority involving office work products including leaning, kneeling, rocking and reclining chairs, and numerous sit-stand desk surfaces.

"Legal Considerations of Pre-work Screening" was presented by fellow physical therapist Drew Bossen, Executive Vice President of Atlas Injury Prevention Solutions; Albert Lee, employment and Labor Law Attorney; and Mary Kate Teske, Director of Human Resources, Prompt Ambulance Service. They reviewed the importance of providing a safe, defensible screening process. These are a few of the points that the team shared. Validation of the screening tool is critical suggesting that current associates, employed in the position for testing, participate in validating the accuracy of the screening tool. Advertise the test parameters prior to completion. Good practice is to share the content of the screen with the candidate prior to completion. Separate the "test for the test" (ie, blood pressure) from the Pre-work Screen, keeping any protected health information separate. Warn applicants not to furnish any genetic information on questionnaires or verbally. Any medical exam is not permissible prior to job offer. Mimic work by the accurate sequence of screen items. Revalidate the screen, which includes only those tasks that must be completed to get the job done, at least every 2 years or upon a change in job.

Kathryn Meeks, PT, DPT, CAE, and Suzanne Patenaude, PT, MA, CIE, presented information regarding the top reasons for musculoskeletal disorders (MSDs) in a manufacturing workplace and keys to successful outcomes. After identifying the top 6 most common injuries and risk factors, they presented ideas on work rotation, job enlargement, and work-rest cycles.

Dr. Lynn McAtamney, PhD, CPE, APAM, presented a keynote presentation titled "From RULA to Resilience – The Interaction of Mental and Physical Risks in the Worker." She began her career in physiotherapy and is now director of research and ergonomics with Australian based ATUNE Health Centres. She is well known for publishing the Rapid Upper Limb Assessment (RULA), a survey method for the investigation of upper limb disorders, published in *Applied Ergonomics* in 1993 and Rapid Entire Body Assessment (REBA) in 2000.

In her keynote introduction Dr. McAtamney states, "In many ways, ergonomists are detectives, applying scientific

assessment tools to complex human interactions within the person's work environment to reveal the causes of and solutions to problems. Assessment tools such as the Rapid Upper Limb Assessment (RULA) and the Rapid Entire Body Assessment (REBA) were developed to enable risk assessments of the posture, force and movements occurring. However, there is more to consider beyond the physical work, such as the interaction of employees' skills and needs, what they do, and the environment in which they work."

Some preliminary findings of her current study indicate that tasks requiring higher cognitive demand leads to lower reported discomfort. She brings up newer ways of thinking how work is done to include activity based work. She has been involved in a project termed future ways of working (FWOW) using participative ergonomics to design and utilize space for work.

In his concluding remarks, Alan Hedge, professor of ergonomics at Cornell University reminded the audience that effective, specifically chosen tools (a chair, desk, cognitive intervention, etc) are like medicine. Choosing the right treatment or product for the individual can lead to effective management of work place injury.

Another take away message focused on productivity and quality as being the primary goals for every company. As a consultant, with any intervention that we suggest or implement, the goal remains to improve the productivity of the workers and quality of the product. Many tools for measuring work exist. Check out the electronic form to identify Threshold Limit Value (TLV) with directions for use with American Conference of Government Industrial Hygienists. Watch for a revised NIOSH lift equation and revised strain index published in the journals, *Human Factors* and in *Ergonomics*.

PTA Educational Pathways in Orthopaedic Physical Therapy Begins at AOM 2016

Jason Oliver, PTA
McLeod, Trahan, & Sheffield Physical Therapy Services, Breaux Bridge, LA

The 2016 4th Annual Orthopaedic Section Meeting (AOM) was the first meeting that provided both physical therapist (PT) and physical therapist assistant (PTA) course objectives. While this is not uncommon in many continuing education course offerings, this represents the beginning of an evolving mission of the PTA Education Interest Group (EIG) of the Orthopaedic Section. Part of the mission of the PTA EIG is to enhance the Section's goal of providing *exceptional educational content for continuing competence in Orthopaedic Physical Therapy*. For PTAs working in an orthopaedic setting, it is important to note that the structure of APTA's PTA Advanced Proficiency Pathway (APP) in orthopaedic physical therapy has been guided by the Orthopaedic Section. By surveying the Section membership, orthopaedic PT expectations for the proficient orthopaedic PTA were extracted from the data. Therefore, is reasonable to have the Section PT membership provide input into what is expected of their support staff. Also a high standard of quality for this educational pathway can be achieved through AOM programming.

Promoting excellence in orthopaedic physical therapy will require elevating continuing competence standards for PTAs. Through the use of PT/PTA teams, we now have the opportunity at AOM for a valuable balance of didactic and hands-on team learning experiences to meet those needs. The excellent programming provided by the Orthopaedic Section should be the obvious source for PTAs seeking to gain advanced proficiency. As the PTA EIG Chair, I hope to serve as the link between Section leadership and PTA members in order to insure proper course structure for the PTA registrant. Through our work with APTA, future AOM programming and the APTA APP in orthopaedic physical therapy, we will be supporting the academic and clinical rigor necessary for PTAs to fulfill advanced proficiency in orthopaedic physical therapy. I urge PT and PTA members to use this opportunity to not only take advantage of the quality programming offered at the AOM, but also provide needed input to meet the needs your orthopaedic PT/PTA team. Please contact me with any questions regarding PTA attendance at the 2017 Annual Orthopaedic Section Meeting. I can be reached at lsu73lsu73@yahoo.com. I hope to see more PTAs at the 2017 meeting in San Diego!

PERFORMING ARTS

SPECIAL INTEREST GROUP

President's Letter

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

CSM **February 15-18, 2017**
San Antonio, TX

CSM 2017 is around the corner. We hope to see you there! There are several noteworthy PASIG events at this year's conference. The PASIG Membership Meeting will be on Thursday, February 16th, at 7 a.m. in the Henry B. Gonzalez Convention Center's Stars at Night Ballroom 4. The PASIG main program for CSM "A Guide to Upper Extremity Nerve Entrapment Syndromes in Musicians," by Janice Ying, DPT, OCS, Adriaan Louw, PhD, PT, CSMT, and Erin M. Hayden, PT, DPT, OCS, will be on Thursday, February 16th from 3:00 p.m. to 5:00 p.m. in Room 301B of the convention center. We are very excited to hear about neurodynamics, pain neuroscience, and upper extremity nerve entrapments in musicians through case-based clinical reasoning. There will be two additional non-program meetings, one for members who are interested in starting a performing arts-related fellowship on Saturday, February 18th at noon, and another for members who are interested in dancer screening among pre-professional dancers on Thursday, February 16th at 1:00 p.m. Please contact Mariah Nierman or Laurel Abbruzzese if you are interested in attending the performing arts-related fellowship meeting, and Mandy Blackmon if you are interested in attending the meeting on dancer screening. If you are student submitting a performing arts poster or platform to CSM 2017, please consider applying for our student scholarship, by contacting Anna Saunders. For future conference content, contact Rosie Canizares with your ideas. To become a PASIG member, go to this link: https://www.orthopt.org/sig_pa_join.php

If you are already a member, please remember to update your membership: https://www.orthopt.org/login.php?forward_url=/surveys/membership_directory.php

Please consider sharing your ideas. We are always looking for members who would like to become more involved. Every voice counts.

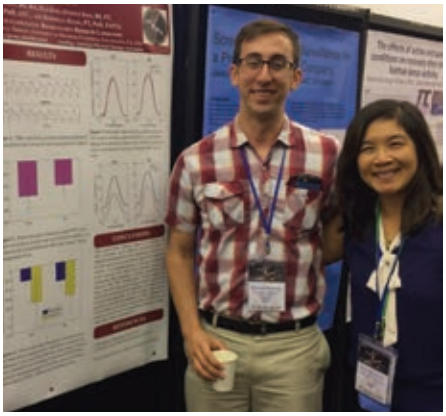
We welcome writers, students included! For the monthly citation blast, you will find a topic of interest, then 10 article abstracts from the past 5 years, and write a couple of paragraphs explaining your interest and findings. That's it! So easy! Contact Laura Reising for more information. If you have an article that you would like to submit for publication in the PASIG pages of *Orthopaedic Physical Therapy Practice (OPTP),* please contact me (Annette Karim); *OPTP* is published 4 times a year. Author instructions can be found at:

https://www.orthopt.org/uploads/content_files/Downloads/OPTP/OP_Instructions_to_Author_3.16_FINAL.pdf

Keep up with us on Facebook by contacting Dawn Doran. It is a closed group, so you need to contact Dawn first. Keep up with us and post on Twitter. We are PT4Performers. PASIG Board contacts are as follows.

The PASIG was well-represented at the recent International Association of Dance Medicine and Science with the PASIG's research grant recipient also awarded the Harlequin Floor Student Poster Award, and 3 of your PASIG officers providing two classes, a scientific presentation, a rehabilitation round table discussion, and a PASIG information booth.

PASIG Grant Recipient Research Team: Hai-Jung (Steffi) Shih, K. Michael Rowley, PhD candidate, and faculty mentor Kornelia Kulig, PT, PhD, Division of Biokinesiology and Physical Therapy University of Southern California



K. Michael Rowley, PhD candidate, Division of Biokinesiology and Physical Therapy University of Southern California and PASIG President Annette Karim, PT, DPT, PhD

PASIG officers Annette Karim (President), Rosie Canizares (Vice President), and Andrea Lasner (Nominating Committee) representing the PASIG at IADMS

SPECIAL INTEREST GROUP

THINKING ABOUT THE FOOT AND ANKLE SPECIAL INTEREST GROUP'S (FASIG) FUTURE…

The FASIG leadership has taken on some great initiatives in the last few years and is looking forward to our goals for the next year. One important goal completed was the development of entry-level curriculum recommendations. Educators from across the country are using these recommendations to guide our future FASIG colleagues–those being today's students! Now our attention has turned to another important group in our FASIG family–the working clinician!

We have two goals for the coming year each targeting growing and improving the FASIG network. First, we have taken the initial steps to develop social media tools to improve communication among us. We kicked-off the FASIG Facebook page and continue to expand its use. Next we have planned a wonderful opportunity to connect with all of the FASIG members at the fast approaching Combined Sections Meeting in February. We hope to see you there! On Wednesday, February 15th at 7:00 p.m. the FASIG will hold its first networking night to provide an opportunity to have FASIG leadership, members, students, and vendors gather. We hope this will be the first of many of these types of events and it will provide opportunity to build connections within our group. We have so many clinicians across the country with shared interests in patient care and novel interventions. Academic training enables students to be fully prepared and competent to represent the "next generation" of physical therapists. These current students are excited to be entering the profession and are full of new ideas. We also have industry partners that are focused on providing products that therapists find useful and that patients can use. Together we all share an interest in foot and ankle care.

We are also welcoming a new Vice President and Nominating Committee Chair to the FASIG leadership team. So, if you are interested in foot and ankle care, please get active in the FASIG and let's see what we can accomplish together!

CSM PROGRAMMING

7:00 a.m. – 7:45 a.m.
FASIG Membership Meeting

11:00 a.m. – 1:00 p.m.
"Achilles Tendinopathy: Beyond Eccentrics"
Speakers: Ruth Chimenti, Mari Lundberg, Karin G. Silbernagel, Jennifer A. Zellers

Description: This session will review the evidence and current knowledge concerning treatment of individuals with Achilles tendinopathy. Achilles tendinopathy has been reported to have an incidence of 2.35 per 1,000 adults. Gradual loading of the Achilles tendon has been reported to reduce symptoms and improve lower leg function in 80% of individuals. This session will address how to implement the evidence-based rehabilitation guidelines, as well as provide for additional rehabilitative considerations, particularly in the case of patients who fall in the 20% of non-responders. These rehabilitation considerations include length of recovery in tendon healing, portion of the tendon affected (insertion versus midportion versus paratenon), and demographics/comorbidities of the tendinopathic individual. Several other treatment modalities (eg, laser, shock-wave, injections) have been proposed to be beneficial in combination with exercise, and this session will review the evidence and utility of some of these. In addition, kinesiophobia has been highlighted as a possible barrier for recovery of Achilles tendinopathies. Hence, it might be beneficial to consider psychosocial factors in the case of an individual who is not responding to an eccentric only program.

Please join us for the first
Foot and Ankle Special Interest Group (FASIG)
Networking Night on the
opening evening of the
Combined Sections Meeting
in San Antonio, TX.

We are looking forward to this gathering on Wednesday, February 15th from 7:00 PM-10:00 PM at the Grand Hyatt San Antonio, "Crocket B" room.

The FASIG leadership is hopeful this will be a nice opportunity to informally gather with our growing network of individuals who are interested in the foot and ankle region. We have also included some industry partners, who have graciously offered to sponsor this event. Watch for more information to come about our partners and plans for the night.

This invitation is open to all FASIG members, as well as those members of the Orthopaedic Section who are interested in joining the FASIG.

We do hope that you can arrange your travel plans and attend on Wednesday evening, February 15th from 7:00 PM-10:00 PM.

See You in San Antonio!

PAIN MANAGEMENT

SPECIAL INTEREST GROUP

President's Letter

Dana Dailey, PT, PhD

CSM 2017: It is time to register for CSM 2017 in San Antonio, Texas, February 15-18! Our Pain Management Special Interest Group Business Meeting will be Friday, February 17th, 7:00 a.m. to 7:45 a.m. prior to our CSM programming. We are pleased to collaborate jointly with the Occupational Health Special Interest Group (OHSIG) for the CSM 2017 presentation on Friday, February 17 from 8:00 a.m. to 10:00 a.m.: *"Evolving Paradigms in Psychosocial Management of Debilitating Pain Conditions"* by Michael Sullivan, PhD.

Pain Management Article Submission: We are soliciting submissions for upcoming issues of *Orthopaedic Physical Therapy Practice*. These may include case reports, clinical pearls, or other brief clinical commentaries.

Case Reports: Case reports are welcome that focus on pain management and highlight clinically relevant pain management topics, pain management treatment, or patient outcomes. The case reports should include: Background, Case Description, Outcome, and Discussion.

Clinical Pearls: Clinical pearls are brief, clinically relevant summaries of information based on experience or observation. These should be focused on information related to Pain Management.

Submissions for articles, case reports, or clinical pearls may be sent to dana-dailey@uiowa.edu.

Clinical Practice Guideline (CPG): A CPG is being developed by the Education and Orthopaedic Sections of the APTA, and other Sections may join this effort in the future. David Morrisette will be the workgroup leader of this CPG along with Joel Bialosky, PT, PhD; Nancy Durban, PT, MS, DPT; and Derrick Sueki, DPT, GCPT, OCS, AAOMPT.

Pain Management: Key Developments, Core Competencies in Pain Management

Pain management for chronic pain is an increasing topic of conversation throughout health care, especially physical therapy. Our knowledge of pain mechanisms and management has grown allowing us to better help patient's manage their chronic pain as part of our physical therapy plan of care. One of the most common themes I hear when I talk to physical therapists is how to further their education regarding chronic pain. When considering pain education or continuing education about pain as a physical therapist, it is important to keep in mind the many resources available to us for assessing how pain education meets your needs. This article will review some of the influences (Figure 1) regarding pain management and the resources available to assist you in assessing pain education.

According to the Centers for Disease Control and Prevention (CDC), in the United States, the problem of prescription opioid abuse and addiction has grown to epidemic rates for those with chronic pain. Chronic pain affects more than 50 million Americans with more than 25 million United States adults reporting daily pain and with greater than 23 million reporting severe pain.[1,2] The care of patients with pain has been gaining greater scrutiny on a national level following the 2010 Patient Protection and Affordable Care Act of 2010 that required a collaboration between the Institute of Medicine and the Department of Health and Human Services to recognize pain as a national health problem. In addition, it called for increased activities to "identify and reduce barriers to appropriate care, evaluate the adequacy of assessment, diagnosis, treatment, and management of acute and chronic pain across the population, and improve pain care research, education and care."[3]

In 2011, The Institute of Medicine (IOM) published the report, "Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research"[1] which recommended the development of a national strategy for pain. This report lead to the development of The National Pain Strategy by the U.S. Department of Health and Human Services, released in 2016, outlining the 6 key areas for improvement in the area of pain: (1) population research, (2) prevention and care, (3) disparities, (4) service delivery and payment, (5) professional education and training, and (6) public education and training (Figure 2). The goal of the National Pain Strategy is to create a transformation about how pain is perceived, assessed, and treated.

As a part of the National Pain Strategy, pain education for professionals is a key area. It is important to keep in mind the biological, psychosocial, and environmental components of pain and the influence they have with our patients/clients. We know that physical therapy assessment and treatment of patients with pain benefit from an interdisciplinary approach to pain (eg, dentistry, medicine, nursing, occupational therapy, pharmacy, physical therapy, psychology, and/or social work). The International Association for the Study of Pain (http://www.iasp-pain.org) has developed an Interprofessional Pain Curriculum Outline for Pain (http://www.iasp-pain.org/Education/CurriculumDetail.aspx?ItemNumber=2057). In 2011, Core Competencies for Interprofessional Collaborative Practice were established,[4] outlining 4 domains for competencies in interprofessional education (Figure 3). The IASP also developed a Curriculum Outline on Pain for Physical Therapy (http://www.iasp-pain.org/Education/CurriculumDetail.aspx?ItemNumber=20550). In 2013, Core Competencies in Pain Management established 4 domains for competencies (Figure 4) for pre-licensure students.[5] A more in-depth review of pain education curriculum in physical therapy for pre-licensure students reviews the curriculums and the major domains for the competencies.[6] A review of the curriculums established by the IASP and the Core Competencies for both interprofessional and pain management are both excellent resources for helping determine areas of need for your pain education and pain management assessment and treatment.

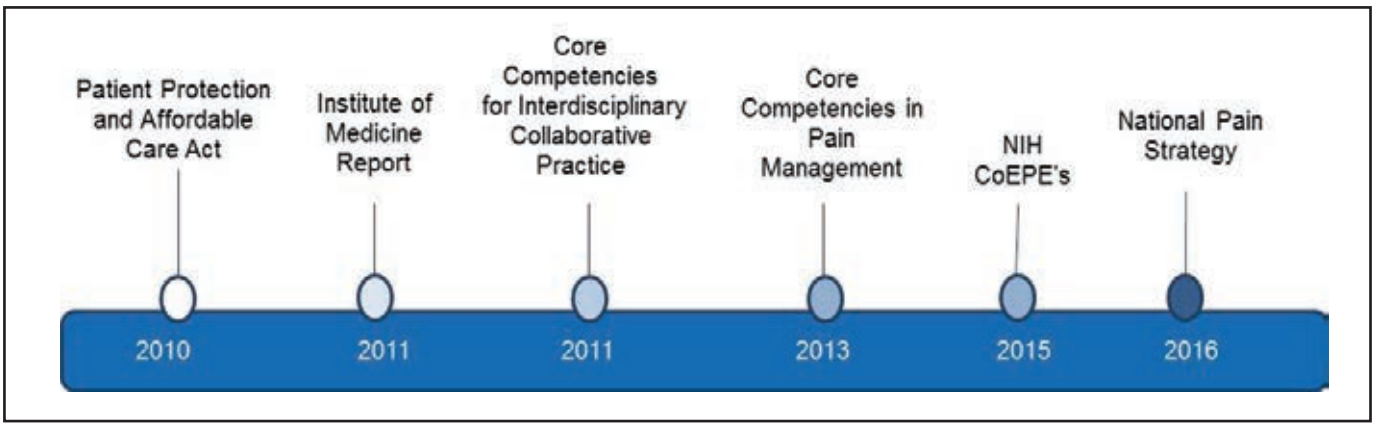


Figure 1. Timeline of events in the development of the national pain strategy.

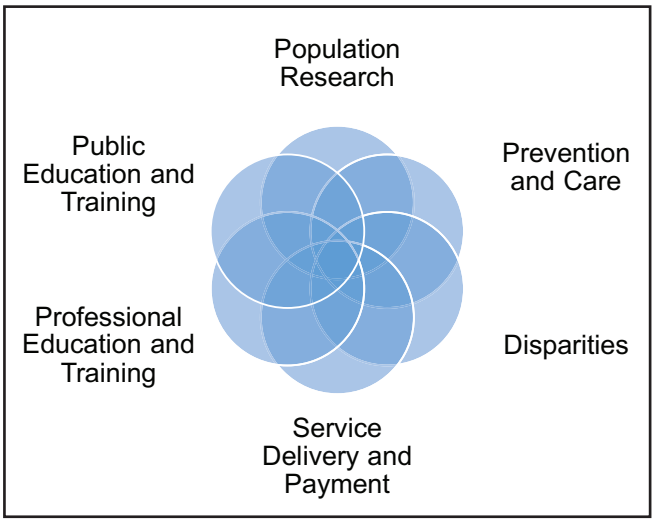


Figure 2. Key areas of the national pain strategy.

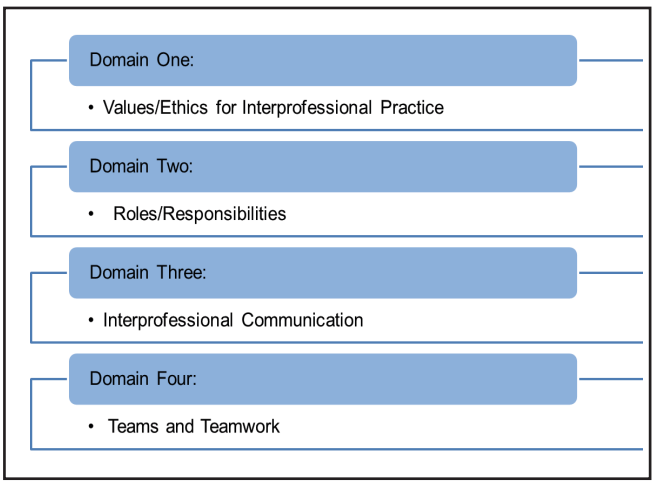


Figure 3. Domains for core competencies for interprofessional education competencies.

For continuing education for pain management, it is important to evaluate courses so that they meet your needs as a clinician. Figure 5 contains a list of questions to ask regarding continuing education courses so that they meet your needs. An additional educational opportunity is emerging for interdisciplinary health care professionals being developed by the National Institute of Health's Pain Consortium's Centers of Excellence in Pain Educa-

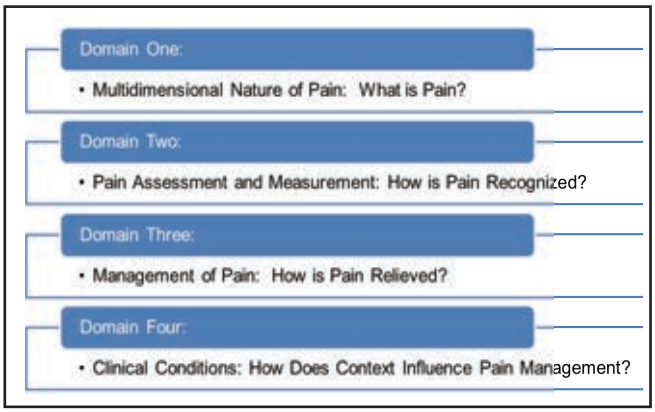


Figure 4. Domains for core competencies for pain management.

1. Does the course meet your needs for pain education?
2. Does the course advance your knowledge regarding biological, psychosocial or environmental contexts focused on pain?
3. Does the program description identify the target audience and the learning outcomes? Is the information a broad overview or in-depth?
3. Does the course have clear learning outcomes that are reasonable for the time frame and state what you will be able to do as a result of the program?
4. Is the instructor qualified to deliver a meaningful program? Does the instructor have expertise in the topic?
5. Are the instructional methods described and designed to engage the audience?
6. Is the program utilizing the latest current evidence to guide the presentation? Is the presenter combining his/her expertise and experience with the best available, current evidence to guide the presentation?
7. Is it clear which concepts are rooted in published evidence versus clinical experience?
8. Is a theoretical framework or rationale for the approach being taught?
9. Are specific populations applicable for the research findings?
10. Is peer reviewed research provided that supports and/or contradicts the rationale for the course topic and information presented?

Figure 5. Evaluation questions for continuing education.

tion (CoEPE). The NIH Pain Consortium selected 11 sites as CoEPEs, who will act as resources for the development, evaluation, and distribution of pain management curriculum resources for medical, dental, nursing, pharmacy, and other schools to enhance and improve how health care professionals are taught about pain, pain management, and the treatment of pain.

The CoEPEs are tasked with developing interactive pain management case modules and the first has been published and is entitled, Edna. The Edna case study is a 70-year-old woman with chronic low back pain. The case module has a pretest and posttest, video demonstrations, and interaction with Edna for health history and physical examinations. The upcoming release of the next interactive case study is title Peter James. Peter James, a former stone mason, was called up from the reserves to serve in Afghanistan. His convoy hit an improvised explosive device and caused extensive damage to his left leg that required amputation. He is now dealing with posttraumatic stress disorder, insomnia, and phantom limb pain. You can follow his interdisciplinary treatment as he moves away from the overuse of opioids and toward comprehensive treatment and recovery (https://painconsortium.nih.gov/NIH_Pain_Programs/CoEPES.html). The NIH Pain Consortium is in the process of developing the additional interactive case modules from each of the 11 CoEPEs.

Pain education is available from a vast array of resources for both pre-licensure students and for practicing clinicians. The goal of the article was to give you a framework for a needs assessment specific to you through use of the IASP recommended curriculums for pain for physical therapy and interprofessional practice, core competencies for physical therapy and interprofessional practice, the focus of the national pain strategy and finally a list of questions to ask about continuing education.

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IMAGING

SPECIAL INTEREST GROUP

SCHOLARSHIP COMMITTEE

The Imaging SIG will be establishing a scholarship for students attending Combined Sections Meeting and will support submissions to CSM that focus on imaging topics. The seed money for this scholarship arose from the donations of those presenting at the Education Leadership Conference, including Bob Boyles, Brian Young, and Aimee Klein. The intent of this undertaking is to raise our visibility and simultaneously encourage and reward student interest in the SIG and imaging in physical therapy practice. We will be forming a committee to establish procedures and review submissions/applications for this new venture. If you are interested in serving on this committee, please contact Chuck Hazle at crhazl00@uky.edu.

ASSOCIATIONS AND PARTNERSHIPS

The Imaging SIG is currently working on establishing some external relationships that may potentially benefit physical therapist practice of those using real time imaging. As of this writing, the process is still developing. We hope to have a formal announcement by the Combined Sections Meeting.

SOCIAL MEDIA

A reminder of our presence on social media with Facebook and Twitter. The Facebook page is available only to members and can be accessed at https://www.facebook. com/groups/1534624566841610/. Then, click "Join Group." Once your Imaging SIG membership is verified, you will be added to this private Facebook page. Additionally, our Twitter handle is @PTImgSIG; please follow and contribute with posts directly related to imaging.

IMAGING SIG PROGRAMMING AT CSM

Preconference Course: A one-day pre-conference course by Scott Epsley and Doug White is scheduled on Wednesday, February 15. The course is titled, *"Musculoskeletal Sonography for Common Orthopedic and Sports Conditions."* This course will be a very hands-on, problem-solving course for clinicians. The speakers will present the application of musculoskeletal sonography for common conditions managed by physical therapists. These conditions include the rotator cuff, hip instability, bone stress injury, tendinopathies, and myopathopathies. Remember, that by attending the preconference course, you are supporting the SIG.

Saturday Main Conference Programming: The 2-hour educational session by the SIG will be Saturday, February 18th at 8:00 a.m. to 10:00 a.m. The session is titled, *"Imaging in Physical Therapy - from Classroom to Clinical Practice."* The session will address introductory imaging education in physical therapist curricula through various educational institution models that bridge clinical experiences to the practice setting. With imaging content now being specifically required by CAPTE, the session will feature an interactive exchange among participants and presenters, discussing the challenges and successes of incorporating imaging into physical therapy education curricula. Presenters include Jim Elliott, Bob Boyles, Becky Rodda, Brian Young, and Chuck Hazle.

Membership Meeting at CSM: Each year at Combined Sections Meeting, the Imaging SIG holds a membership meeting. In San Antonio, the meeting will take place on Saturday, February 18 at 7:00 a.m., immediately prior to the SIG main conference programming. If you are attending CSM and a member of the SIG, please join us. The location of the meeting is scheduled to be in the Stars at Night Ballroom 2 in the Convention Center.

ON THE RESEARCH FRONT

The Research Committee, led by George Beneck, has begun working diligently on projects assessing the impact of imaging in physical therapist practice in Wisconsin and other areas. We are trying to analyze the changes in practice and the related effects that have begun to occur within certain jurisdictions in the United States. We are confident this work will eventually lead to noteworthy findings. We will keep you informed of developments by this committee.

Case Report: Change in Neurological Status Indicating the Need for Early Imaging in Acute Low Back Pain

Ben Barnes, PT, OCS, FAAOMPT[1]
Christopher Mitchell, SPT[2]

[1]*Concentra, Beaverton, OR*
[2]*School of Physical Therapy, Pacific University*

BACKGROUND

Acute, sudden onset of low back pain, with radicular referral should be managed conservatively. However, significant and progressively worsening radicular symptoms should lead to the decision to refer a patient for further imaging.[1]

DESCRIPTION

The patient was a 31-year-old male who initially presented to an urgent care facility with a complaint of low back pain due to a work-related injury. The patient was lifting a large, 400-pound box from floor level with a partner at work 4 days prior and reported an immediate pain in the center and right side of his lower back. The patient was referred to physical therapy following his doctor visit. The patient's primary complaint was central and right-sided lower back pain, with lumbar flexion activities being the patient's most aggravating factor. The patient described a long history of lower back injuries over the past 10 years, but none that had caused this much pain and immobility. The patient denied any changes in bowel or bladder function.

The patient presented with a positive straight leg raise at 20° of hip flexion, positive slump test with reproduction of his symptoms with right knee extension, and positive Gower's sign. Due to the patient's description of symptoms following initial evaluation, the therapist had the patient perform a trial of repeated extension in lying while in prone. Following completion of this,

the patient reported a decrease in lower back symptoms. The patient was issued a lumbar roll for sitting and was advised to perform repeated extension while lying in prone as his home exercise program. He was also advised to avoid lumbar flexion activities. The patient returned the following day to physical therapy and reported a significant decrease in pain and showed increased lumbar active range of motion in all planes.

The patient cancelled his physical therapy visit 2 days later for personal reasons. He returned one week later with severely increased lower back pain, as well as the onset of numbness and tingling down the right buttock, anterior right thigh, lateral right calf, and medial right foot/ankle. The patient described no specific incident that led to an aggravation of his symptoms. He reported that they only progressively worsened over the weekend. The patient reported 8/10 pain level at rest. Further examination revealed normal reflex testing, hyposensitivity in the L2-4 dermatomes, and nonpainful weakness in L2-5 myotomes. The patient again described an increase in symptoms with lumbar flexion and was able to centralize symptoms with repeated extension while lying in prone. The patient was not able to tolerate any sitting due to pain.

Two days later the patient called in prior to his scheduled physical therapy appointment and reported his lower back and right lower extremity symptoms were severely worsened and that he could not come into the physical therapy clinic due to severe right-sided leg complaints. He was offered the opportunity to see a physician immediately but the patient stated that he was not able to find transportation. The patient was scheduled to see the physician first thing the next morning and was instructed to monitor his bowel and bladder function, and to report to the hospital if any problems or changes arose. Due to the sudden and significant increase in lower back pain, as well as the onset of right-sided lower extremity radicular symptoms, the patient was immediately referred for an MRI without contrast of the lumbar spine.

OUTCOMES

An MRI without contrast showed a paracentral extruded disk herniation at L3-4 extending approximately 1.6 centimeters below the level of disc space resulting in severe impingement of the central and right aspect of the thecal sac as well as the right lateral recess (Figures 1 and 2). The patient was immediately referred to a neurosurgeon who placed him on a Medrol dose pack, referred him back to physical therapy, and scheduled him for a follow-up appointment for the following week to assess any changes in conservative management. The physical therapy treatment selected for this particular patient moving forward was still impairment-based, and initial impairment goals consisted of centralizing radicular symptoms with manual therapy and repeated movements. There was no change in the patient's neurological or subjective status at the next physician follow-up and it was recommended that he pursue surgical intervention.

DISCUSSION

Early imaging in the first 4 to 6 weeks of a lower back injury is seldom warranted. According to Williams et al,[2] a number of high quality studies have demonstrated the ability to centralize radicular symptoms with repeated movements in patients with discogenic involvement. In cases where there is a change in neurological status, it is indicated that the patient be referred for early imaging to determine the extent of pathology. The ability to recognize more serious pathology and refer patients for further imaging when it is indicated, based on standard imaging guidelines, is necessary to provide appropriate care and well within the scope of standard physical therapist practice.

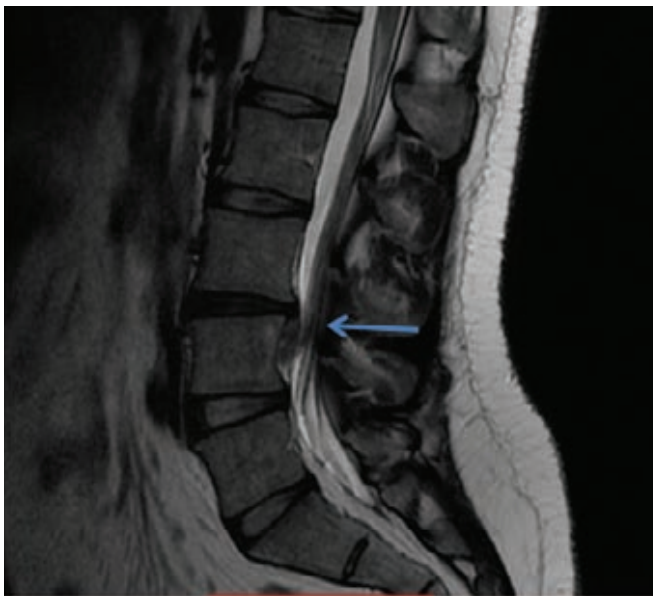

Figure 1. Sagittal view of the lumbar spine showing the extruded portion of the disk at L3-4 extending 1.6 cm inferiorly.

Figure 2. Axial view of the lumbar spine showing the right sided posterior protrusion of L3-4 disk.

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Sternal Stress Fracture in the Adolescent Athlete

Giorgio Zeppieri, MPT, SCS; Michael Seth Smith, Pharm D, MD

A 13-year-old male was referred to physical therapy reporting a 7-month history of anterior chest pain. The patient stated that while performing weighted dips, he felt a sudden onset of sharp pain in his sternum. He reported that he initially had minor swelling and pain along the lower part of the sternum. The pain was rated as 5/10, and increased to 7/10 with inspiration. The patient stated that his symptoms gradually decreased when he took time off from lifting at the gym. The patient attempted to return to the gym, but every time he attempted any upper body exercise consisting of pressing or pushing motions his symptoms increased. His past medical history included a chiropractic consultation (4 months after the initial injury), where he was diagnosed with costochondritis. He underwent multiple (5-7) sessions of costovertebral manipulations. His symptoms persisted and he was referred to his pediatrician, 6 months after the initial injury, where he was diagnosed with a pectoralis major strain, prescribed nonsteroidal inflammatory drugs (NSAIDs), and referred to physical therapy.

During the physical therapy examination, the patient reported no relief with NSAIDs, worsening symptoms at night, and a dull aching sternum pain exacerbated by inspiration and palpation. Symptoms were aggravated by shoulder abduction, extension, and rotation. Cervical and upper extremity strength and ROM were within normal limits. Sensation and reflexes were intact. Based on history and objective findings, the physical therapist's differential diagnoses were a possible sternum stress fracture, rib stress fracture, or xiphoid related syndrome. The patient was referred to the orthopaedic physician, who proceeded to order a chest radiograph.

Chest radiograph was unremarkable for evidence of sternal pathology. An MRI was subsequently ordered but after discussion with musculoskeletal radiology, the orthopaedic physician determined that a chest CT was a better option due to concern for motion artifact with an MRI, which would have given poor image quality. Both the patient and his mother understood the increased radiation exposure with CT but agreed to proceed forward for thorough evaluation. The chest CT showed a chronic, stable fracture of the xiphoid process (see Figures 1 and 2).

Fractures of the sternum are a result of deceleration type injuries or blunt anterior chest trauma, which can be further defined as either direct or indirect trauma. Direct trauma occurs due to impact sports, motor vehicle accidents, or falls; whereas indirect trauma occurs due to severe osteoporosis, patients on long-term steroids use, post-menopausal women, or repetitive upper extremity exercise. Sternum fractures are rare, which the majority (60-90%) occur due to motor vehicle accidents, which are only present in 3 to 7% of all motor vehicles accidents, with the majority occurring at the manubriosternal joint. However, fractures to the sternum have been known to occur in athletes who lift weights due to severe hyperflexion of the torso.

The patient was instructed to refrain from activities that would exacerbate symptoms for 4 to 6 weeks. Rehabilitation progression would be based on improvement of signs and symptoms. This case highlights the rare occurrence of anterior chest pathology that may occur in a young athletic population.

RECOMMENDED READINGS

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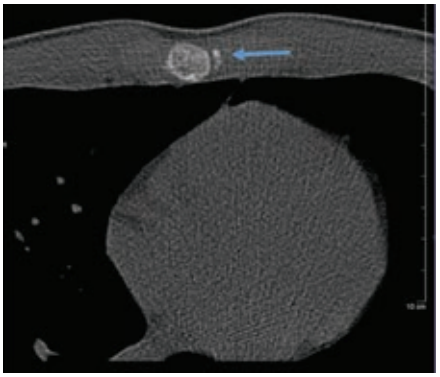

Figure 1

Figure 2

ANIMAL REHABILITATION

SPECIAL INTEREST GROUP

President's Message

Kirk Peck, PT, PhD, CSCS, CCRT, CERP

ANIMAL REHABILITATION PROGRAMMING AT CSM

If you are interested in learning more about animal rehabilitation and how physical therapists integrate into this unique area of practice, then please attend the 2017 APTA Combined Sections Meeting in San Antonio, February 15-18. The ARSIG Business Meeting is scheduled at 7:00 a.m. on Thursday, February 16th to discuss various topics of interest in animal rehabilitation pertaining to both current members, nonmembers, and students. The Business Meeting will immediately precede a 2-hour education programming session on manual therapy for the canine cervical spine. These outstanding events offer excellent opportunities to network with experienced animal practitioners working with both equine and canine clients.

PRACTICE ANALYSIS UPDATE

You should have already received a web link to the newly revised ARSIG Practice Analysis survey. The purpose of this survey is to assess the current state of animal practice by physical therapists and physical therapist assistants in the United States. Therefore I ask that you please complete the survey as soon as possible to assist the future success of the ARSIG. The survey takes approximately 60 to 90 minutes to complete.

CALIFORNIA VETERINARY MEDICAL BOARD

The California Animal Rehab Task Force continues to move forward with negotiations leading to potential legislation in 2017. As noted in the prior President's Message, a Gofundme campaign has been organized to support the efforts of the task force. If you wish to donate to the fund you may do so at the following link: https://www.gofundme.com/mqzmtu3g.

POLITICAL CAVEAT-DEMYSTIFYING VETERINARY SUPERVISION OF PT ANIMAL PRACTICE

We have all heard the following argument echoed repeatedly by regulatory advocates, "In the name of public safety, PTs treating animals should be directly supervised by veterinarians." But have you ever pondered the rationale, or should I say lack of sound rationale, supporting this impractical statement? Supporters of direct supervision claim that physical therapists (PTs) lack sufficient education to recognize and/or respond to physical conditions or abnormal behaviors that may require medical care. This assumption however, is false.

While it is true that acquiring a basic certification in animal rehabilitation does not compare to a degree in veterinary medicine, what is routinely absent in dialogue is the fact that prior to completing a certificate program, licensed PTs have "already" acquired an advanced clinical doctorate degree in rehabilitation allowing for direct access with human clients, a privilege now available in all 50 states. The education physical therapists acquire in academic programs is replete with competencies to recognize and respond to medical signs and symptoms presenting as yellow or red flags. In addition, all PTs are well educated to know when it is appropriate to consult with a medical doctor when clinical signs and symptoms present beyond one's scope of practice. Transferring this aptitude of clinical reasoning to animal rehabilitation is absolutely within the scope and ability of a physical therapist. A quick analogy comparing human to animal care may assist the reader in understanding this extremely important point; a point that needs to be highlighted during any political debate on PT competencies in animal rehabilitation.

In human practice, PTs work in a variety of settings including acute care hospitals, skilled nursing facilities, and outpatient clinics to name a few. Aside from PTs, the number of medical personnel immediately available to render care to patients largely depends on the "acuity" of services provided. For example, in hospital settings patients are more acute and medically unstable therefore requiring supervision and care from multiple health care providers. There is no doubt that having a human physician onsite, but not in direct line of supervision, is a necessity in acute medical settings. However, human clients who are treated in outpatient rehabilitation clinics are more medically stable and therefore can be safely and competently managed by physical therapists without the physical presence of other health professionals. This same model of collaborative care is not only possible between veterinarians and PTs, but has already been successfully implemented in several states.

In states where laws have already been enacted for PTs to practice animal rehabilitation, little to no debate was had over whether or not veterinarians should remain the primary care providers who "medically clear" patients prior to referral. In fact, no state has direct access laws for PTs to treat animals. Therefore, the real political question should be, *"What is the desired level of supervision believed necessary by the referring veterinarian as opposed to having this key issue predetermined by a state regulatory body?"* In other words, any regulatory language restricting PTs from practicing by medical clearance on animals is in reality a regulatory restriction on the capacity for veterinarians to think for themselves and render their own professional judgment.

Finally, when discussing direct vs. indirect supervision of animal care all PT practice models must be considered. Physical therapists who treat sporting dogs and equine athletes for example are generally working with medically stable clientele that sustain a variety of musculoskeletal injuries. In addition, many interventions are provided directly on-site at sporting events, or with equine, at privately owned barns. Any regulatory provision requiring a veterinarian to be onsite at all times during these encounters would not only be illogical, but completely impractical and financially unreasonable for both practitioners and owners alike. So please keep these political caveats in mind when negotiating with state regulatory bodies since most efforts to impose direct supervision laws on PT animal practice germinate out of personal self-interest and professional turf protection, as opposed to authentically protecting the public.

A NEED FOR NEW SCHOLARS

I am literally running short on persuasive arguments to entice SIG members to submit quality articles for publication in the

OPTP…but I will try once again. I need members to contribute articles for publication in the *OPTP*. As noted in past requests, I am interested in receiving materials on the following topics: (1) canine or equine nutrition; (2) updates on scientific evidence for any therapeutic physical agent including shock wave, laser, or dry needling, and (3) unique treatment techniques or exercise options for any given pathology or physical condition. A critical review of a current article of interest would also be an appropriate contribution.

CONTRIBUTORY ACKNOWLEDGMENT

In this edition of *OPTP*, Lisa Bedenbaugh offers a brief but important commentary on canine hip dysplasia. The article provides a summary overview of the pathology, followed by current research findings and treatment options. Lisa has been practicing canine rehabilitation for many years in Atlanta, Georgia, and gives generously of her time to the ARISG.

The Sweet Taste of Winter

Contact: Kirk Peck,
President ARSIG
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Treatment Considerations For Dogs With Hip Dysplasia

Lisa Bedenbaugh, PT, CCPR
Director of Rehabilitation Services, North Georgia Veterinary Specialists

Hip dysplasia (HD) is a term used to describe poor congruency of the coxofemoral (CF) joint. Hip dysplasia is characterized by a femoral head that lacks normal space within the acetabulum creating a less than optimal fit of respective joint surfaces. According to one study,[1] HD is the most common developmental orthopaedic condition in dogs, and usually presents in medium to large breeds. Although HD has a congenital relationship, expression of the condition is multi-factorial, including genetics, nutrition, conformation, and other environmental factors. Over time, poor joint congruency with HD will lead to increased intraarticular movement, friction, and degeneration, ultimately progressing to various levels of osteoarthritis (OA). The osteoarthritic joint will have associated sclerosis, pain, atrophy of the surrounding muscles, and generally some degree of lameness.

A study looking at the prevalence of HD at a veterinary teaching hospital revealed that 19.7% of purebred dogs and 17.7% of mixed breed dogs had signs of HD.[2] With an estimated 70 million pet dogs in the United States according to the American Veterinary Medical Association,[3] that correlates to over 12 million dogs with some degree of HD. Treatment strategies related to HD for the canine rehabilitation therapist are focused on relieving discomfort, maximizing painfree range of motion (ROM) in the CF joint, improving strength in the muscles surrounding the CF joint, and improving functional mobility. Skilled treatments may include manual therapy interventions such as joint mobilization, massage, stretching, and neuromuscular facilitation techniques. In addition, therapeutic physical agents such as low-level laser, electrical stimulation, heat/cold therapy, pulsed electromagnetic field therapy (PEMF), therapeutic exercises for ROM and strength, and aquatic/hydrotherapy interventions may also be beneficial.

Two studies found that the development and progression of HD was significantly delayed or decreased in dogs maintained at a lean body condition through caloric restriction as compared to litter-matched dogs with a higher body condition score.[4,5] It is therefore important for the canine rehabilitation therapist to educate clients on maintaining a healthy lean weight in dogs with HD since body mass is a controllable factor.

Other studies on dogs with HD have explored differences in muscle activation and gait patterns in comparison to normal dogs. In one study,[6] dogs with hip OA were found to have a loss of both hip flexion and extension, resulting in overall decreased functional ROM in the hip joint during the gait cycle. In addition, hip flexion in the OA dogs was found to occur earlier at the beginning of the swing phase, which was theorized as a desire to minimize the amount of time in weight bearing stance phase on the painful hip. In another study,[7] dogs with unilateral lameness demonstrated a decrease in peak vertical force on the lame side, but even dogs without lameness (but diagnosed with HD via radiographs) were found to show decreased ground reaction forces. Related to the study by Bockstahler,[6] Hicks and Millis[7] showed that a lame dog delays touchdown during initial stance phase, and has decreased force production during toe-off. Based on results from these two studies, therapists should focus on interventions to decrease pain in the affected joint(s), and engage dogs in therapeutic exercise to increase total stance time and stride length of the affected leg to maximize symmetry of motion during the gait cycle.

Finally, muscular activation in normal dogs compared to those with hip OA has also been studied. Vastus lateralis force in OA dogs was decreased during the transition from stance to swing phase, and was also decreased in comparison to normal dogs. The biceps femoris also demonstrated an overall decrease in activity (as compared to normal), however, the gluteus medius in OA dogs showed increased activity during the late swing and early stance phase (eg, expected pain may have led to increased muscle activity as theorized by the authors), but then quickly decreased during the stance phase. In the same study, different therapeutic exercises were performed (in sound dogs), and associated muscle activity was recorded. Vastus lateralis was activated more with cavalettis than with incline walking and incline walking was subsequently found to be better than walking on the flat for increasing gluteus medius activation.

Hip dysplasia is a common and often disabling pathology in dogs regardless of breed. Treatment options consist of medical and pharmacological care, in addition to structured rehabilitation techniques to reduce pain, improve ROM and strength, restore function, and increase overall quality of life. Canine rehabilitation therapists have the expertise and knowledge to address many physical limitations associated with hip dysplasia guided by current research and personal experiences with a goal to achieve positive quality outcomes.

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