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ORTHOPAEDIC PHYSICAL THERAPY PRACTICE

The publication of the Academy of Orthopaedic Physical Therapy, APTA

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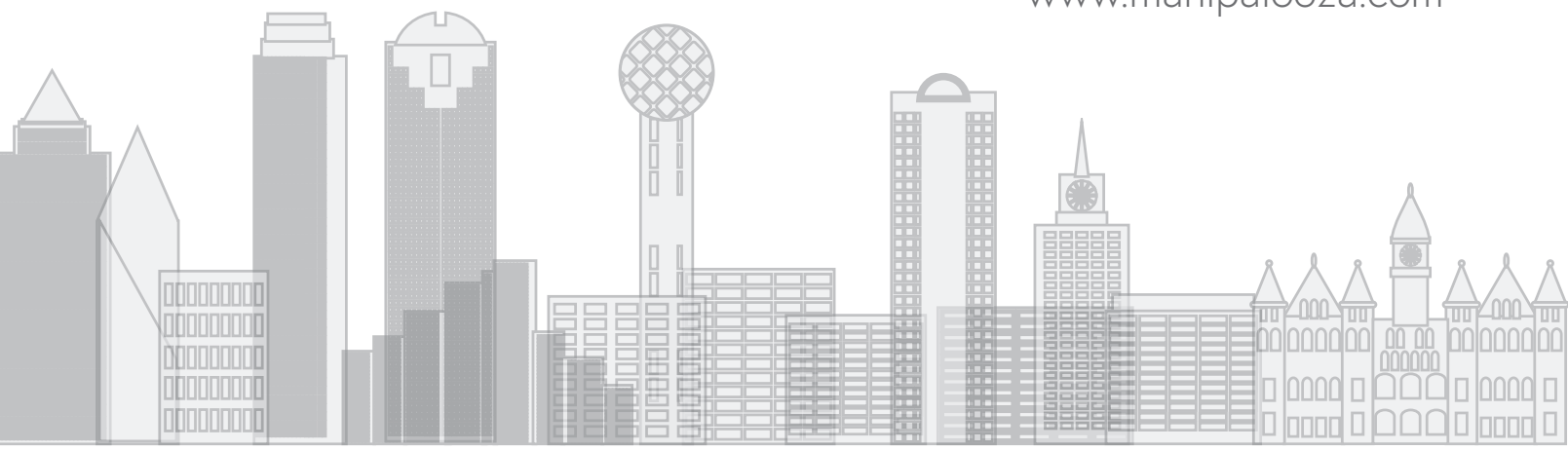

Patellofemoral Pain

Often known as "knee cap pain" or "runners knee"

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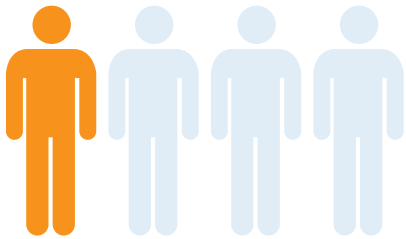

Affects 25%

of the general population every year.

Women experience knee cap pain twice as often as men.

Prevention of knee cap pain is challenging, based on the Clinical Practice Guidelines by the Academy of Orthopaedic Physical Therapy*, here are some suggestions:

- Gradually increase the amount of activity you are doing.
- Do a variety of activities; adolescents who specialize in a single sport have greater risk of knee cap pain.
- Maximizing knee strength may reduce the risk of developing knee cap pain.
- Age, height, weight, and leg posture are not risk factors in developing knee cap pain.

How can a physical therapist work with you and your kneecap pain?

- Hip and knee exercises are the best thing for people with knee cap pain.
- Knee taping or inexpensive shoe inserts can be helpful, but should be combined with an exercise program.
- There are no quick fixes: Exercise is the best treatment option over other options.
- Improving the way a person runs, jumps, or adjusting a training routine often helps reduce kneecap pain.

*This infographic is based on the guideline by Willy et al titled "Pallofemoral Pain" (*J Orthop Sports Phys Ther.* 2019;49(9):CPG1-CPG95. doi:10.2519/jospt.2019.0302)

Dr. Christian Barton, Senior Post-Doctoral Researcher, La Trobe University's Sport and Exercise Medicine Research Centre, Australia)Dr. Richard Willy, Assistant Professor, School of Physical Therapy and Rehabilitation Sciences, University of Montana

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In this issue

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President's Corner

Calling All Members: Thank You!

Joseph M Donnelly, PT, DHSc

It is hard to believe that as I am writing this message summer is almost over, and as you are reading this, we are amid the Fall season. I want to start this President's update with a big thank you to all the Academy of Orthopaedic Physical Therapy (AOPT) members who voted in the proposed Bylaw amendment in June. This bylaw amendment increases the number of elected Directors by two, and makes the Education, Practice, and Research Chair's Ex Officio voting members of the Board of Directors (BOD). The number of votes cast exceeded all previous casted ballots for both elections and bylaw amendments. In November, we will be having our general election of AOPT Officers, Directors, and SIG leadership positions. And, we need an even stronger member engagement to show support for members willing to step into leadership roles in the AOPT.

Additionally, on the ballot in November will be a proposed bylaw amendment to move the AOPT election cycle up from November to August as recommended by the Nominating Committee Task Force and approved by the BOD. This change in the election cycle will afford newly elected members to the BOD the opportunity to attend the October BOD Meeting. In addition, they will become familiar with their duties and responsibilities over a 4- to 5-month period before serving in their elected position following the CSM AOPT Membership Meeting. Currently, there is minimal to no onboarding period and that can lead to disruption and inconsistencies in AOPT BOD work and initiatives. This change in the election cycle will also facilitate the work of the Nominating Committee to recruit members for BOD positions knowing there will be an established transition and onboarding into their new leadership position.

The AOPT had their strategic planning meeting October 9-11, 2019, in LaCrosse, WI. The meeting included over 40 AOPT leaders and members that was facilitated by Janet Bezner, PT, Ph.D. In September, we sent out a survey asking for membership input and part of the introduction paragraph included some of the highlights that the AOPT leadership and members had accomplished between 2014 and 2019. We are all busy, and in case you missed it, I would like to present some of the highlights during the past 5 year's strategic plan.

Research Grants: The AOPT has awarded 21 research grants to advance the science of orthopaedic physical therapy totaling over $580,000.

Advocacy Grants: The AOPT awarded 15 advocacy grants to advance the practice of physical therapy totaling $75,000, awarded to 15 Chapters of the APTA.

Residency Startup Grants: The AOPT awarded 5 orthopaedic residency program start-up grants totaling $6,575.

Clinical Practice Guideline Development: The AOPT continues to be instrumental in the development and revision of clinical practice guidelines (CPGs), an AOPT innovation that strongly influences clinical practice. Between 2014 and 2019, the AOPT has developed 5 new CPGs (3 in collaboration with other Sections/Academies) and revised 6 existing CPGs. Moving forward, 10 new CPGs are in progress, 9 of which are collaborative.

An additional focus of the CPG initiative is on Implementation: https://www.orthopt.org/content/practice/clinical-practice-guidelines/implementation

Check out this page that contains resources and tools to help clinicians plan for using the recommendations from the CPGs into practice.

Implementation science *is the study of methods to promote the adoption and integration of evidence-based practices, interventions, and policies into routine health care and public health settings. Implementation research plays an essential role in identifying barriers to, and enablers of, effective global health programming and policymaking, and leveraging that knowledge to develop evidence-based innovations in practical delivery approaches (source: https://www.fic.nih.gov/researchtopics/pages/implementationscience.aspx)*

CPG Quizzes: https://www.orthopt.org/content/practice/clinical-practice-guidelines/cpg-quizzes

I look forward to sharing some of the new strategic initiatives guiding the AOPT BOD and AOPT leadership in the next 3 to 4 years in the January *Orthopaedic Practice* edition of the President's Corner. I look forward to seeing many of you at CSM 2020 in Denver, Colorado. Please, plan to attend the AOPT Awards Ceremony and Membership Meeting where you can voice your concerns, thoughts, opinions, or support. Happy Holidays and I look forward to updating you in the January 2020 President's Corner message.

Editor's Note

As you may remember, the last editorial brought up a discussion that I recently had at the Arizona Spring Conference about Evidence-based Practice. Since the last issue came out, the Academy has heard from our members about the editorial as well as about the cover of *OP* showing a therapist performing dry needling. My intention with this editorial is to weave the two of these topics together.

A reader makes some great points that I want to highlight by relating some of their comments and suggest that all encomiums go to the reader. The reader stated "Lack of evidence of effectiveness is not the same as evidence of ineffectiveness." This is an excellent point that we discussed at the spring meeting but I did not bring up in my last editorial. The reader goes on to say "lack of evidence means just that. There is a lack of evidence of anything. Unless an RCT is large enough to prove the null hypothesis, which is rarely the case for orthopedic conditions, it doesn't prove ineffectiveness and therefore cannot be used as evidence."

An example of this is in dry needling. Physical therapists performing dry needling know that it is an effective and efficient intervention but the evidence for effectiveness is very slowly accumulating. I don't perform dry needling but I have had effective treatment with dry needling and I work in a clinic where four of the six clinicians use it safely and effectively. It works and we need to establish more evidence for this intervention.

The OSHA standard, of course, for dry needling is to wear gloves when inserting a needle. Gloves are used to protect both the patient and the therapist. The evidence regarding infection being caused by insertion of a dry needle is limited but it is present in case reports (PubMed search through clinical queries using the search terms dry needling AND infection). Therapists who perform dry needling need to be aware of these cases and I refer the reader to those articles that I have included in my reference list that describe effectiveness or cases of infection.

We return to our reader's comments that summarize my point in the previous edition about clinicians and researchers improving their collaboration:

"One of my concerns about the use of "Evidence Based Practice" has always been that the people espousing it rarely look at all the evidence." Those that publish "systematic reviews, meta-analyses and CPG's usually go no further down the chain than RCTs in looking for evidence." Potentially this is due to the amount of time required on a given topic to consider the evidence. The reader points out that "your latest publication includes several excellent case reports. How many of them do you think would have been considered as worthy evidence in a systematic review, meta-analysis, or CPG? They should be because they do provide valuable evidence that should help guide clinical decision making but most likely they'd never get there." This is an excellent point by the reader that suggests that perhaps publishing case reports are the first step in bringing clinicians and researchers together.

As Editor of *OP,* I was excited to see all the comments from people who read this publication and send the Academy comments of concern, discussion, disagreement, or praise. Please continue sending your comments and concerns. Your contributions are the clinician's voice in this publication.

In thi issue, we are pleased to present the creative and novel research being done at the University of South Florida. These articles are fantastic examples that I believe will facilitate clinical decision making.

Professionally,
John Heick, PT, PhD, DPT
Board Certified in Orthopaedics, Sports, and Neurology

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Definition Variability of Chronic Non-specific Low Back Pain in Physical Therapy: A Scoping Review of the Literature

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ABSTRACT

Background and Purpose: Low back pain affects nearly 80% of adults sometime in their lifetime and potentially may persist as chronic low back pain. The most common type is non-specific meaning there is no known pathology. Despite the prevalence, there is variability of the definition of chronic non-specific low back pain in the literature. The purpose of this scoping review is to compare the definitions of chronic non-specific low back pain in the physical therapy literature over the last 10 years with an objective of determining a working definition of chronic non-specific low back pain. **Methods:** A literature search was conducted using PubMed, CINAHL, and Embase. The articles were reviewed independently by 4 reviewers to determine if they met the inclusion criteria of this scoping review. A quality analysis was performed using the PEDro scale. **Findings:** The search identified 481 articles with 86 meeting the a priori inclusion criteria. Of the 86 studies, 55 included an operational definition of chronic non-specific low back pain. In the remaining 31 studies, 26 defined chronic non-specific low back pain within the inclusion criteria. The most commonly used criterion to define low back pain was time frame (92% of studies). The second most commonly cited criterion was the location of the low back pain (27% of studies). The presence or absence of leg pain was included in 15% of definitions. **Conclusion:** The definition of chronic non-specific low back pain is heterogeneous in the current literature. **Clinical Relevance:** Clinicians are encouraged to use caution when using research to determine the best course of treatment for chronic non-specific low back pain patients and should rely on clinical expertise as well as clinical findings until more consistency in language appears in the literature.

Key Words: rehabilitation, lumbago, physiotherapy

INTRODUCTION

Low back pain (LBP) is the single leading cause of disability worldwide. It is a major cause of work-related disability as well as missed work days.[1] In the United States alone, LBP costs have totaled more than $100 billion per year.[2] About 80% of adults will experience LBP in their lifetime.[3] The most common type of pain affecting adults with LBP is acute in nature. About 20% of those acutely affected will develop chronic LBP.[4]

Low back pain can result from several pathologies, and depending on the cause of the pain, there are varying treatment options available. Potential pathologies include compression fracture, spinal stenosis, visceral disease, tumor or metastasis, or infection. There are known treatments for these specific pathologies. However, the most common causes are mechanical or non-organic in nature meaning that the pain is not caused by serious pathological conditions such as inflammatory arthritis, infection, fracture, or cancer.[1] Pain that cannot be traced to a pathology or to a mechanical cause is identified as non-specific LBP.

In the current literature, there are discrepancies when defining chronic non-specific LBP. This heterogeneity among the definitions directly affects how the condition is treated and has created a challenge to determining the best course of treatment. Although the exact origin of the pain is not frequently known, treatment is still commonly provided and is often the same for everyone affected with this condition. Many different strategies are being used and researched by physical therapists to treat chronic non-specific LBP, such as Kinesio Tape,[5-10] neuromuscular re-education,[11-14] and core stabilization.[15-22] Despite these multiple approaches to treat LBP, there is no gold standard when it comes to treating this condition, which may be likely due to the inconsistencies that exist within this classification.

Chronic non-specific LBP has such a high prevalence worldwide and is frequently treated in physical therapy clinics. The authors feel that one of the reasons for a lack of gold standard for physical therapy treatment is due to the heterogeneity that exists among the definitions of chronic LBP. The authors feel that until there is a universal definition for chronic non-specific LBP combined with thorough investigation, it cannot be treated optimally by physical therapy.

A scoping review provides a descriptive overview of the current state of the literature on a topic.[23] Due to the lack of consensus on the definition of chronic non-specific LBP, a scoping review of the literature is warranted. Therefore, the purpose of this scoping review is to compare the definitions of chronic non-specific LBP in the current physical therapy literature with an objective of determining a working definition of chronic non-specific low back pain.

METHODS

Search Strategy

A systematic search of the literature was performed using the CINAHL, PubMed, and MEDLINE databases between the years 2008 and 2018 using the following search terms: (1) chronic, (2) non-specific OR nonspecific, OR unspecific OR unspecified, (3) physical therapy OR physiotherapy OR rehabilitation, (4) low back pain OR lumbago OR lumbosacral pain OR low* back ache* OR low backache* OR sciatica OR sciatica neuralgia* OR (postural OR posterior compartment OR recurrent OR mechanical AND low back pain). English, randomized controlled trial, and articles from 2008 to 2018 were set as limits. After completing all 3 searches, duplicates were removed.

Eligibility Criteria

Inclusion criteria for this scoping review were as follows: randomized controlled trial, published within the last 10 years, text in English, human subjects, and interventions were performed by a physical therapist. References were excluded if they focused on acute or subacute low back pain, used surgical interventions, were study protocols, pilot studies, secondary analyses of a random-

ized controlled trials, cross sectional studies, abstracts from poster presentations, follow-up randomized controlled trials, and if the intervention was not explicitly stated to be performed by a physical therapist.

Quality Analysis

Article quality was determine using the PEDro Scale. The PEDro Scale includes 11 items, each worth one point if adequately reported. The first item determining if eligibility criteria was specified does not count toward the final PEDro score, making the maximum total score a 10.[24] Article quality was assessed independently by all 4 authors with discrepancies in the total score being resolved by consensus.

Statistics

Kappa and percentage agreement statistics were calculated for each individual criterion. Intraclass correlation coefficients (ICC) and corresponding 95% confidence intervals were used to assess reliability of the total score of the PEDro.

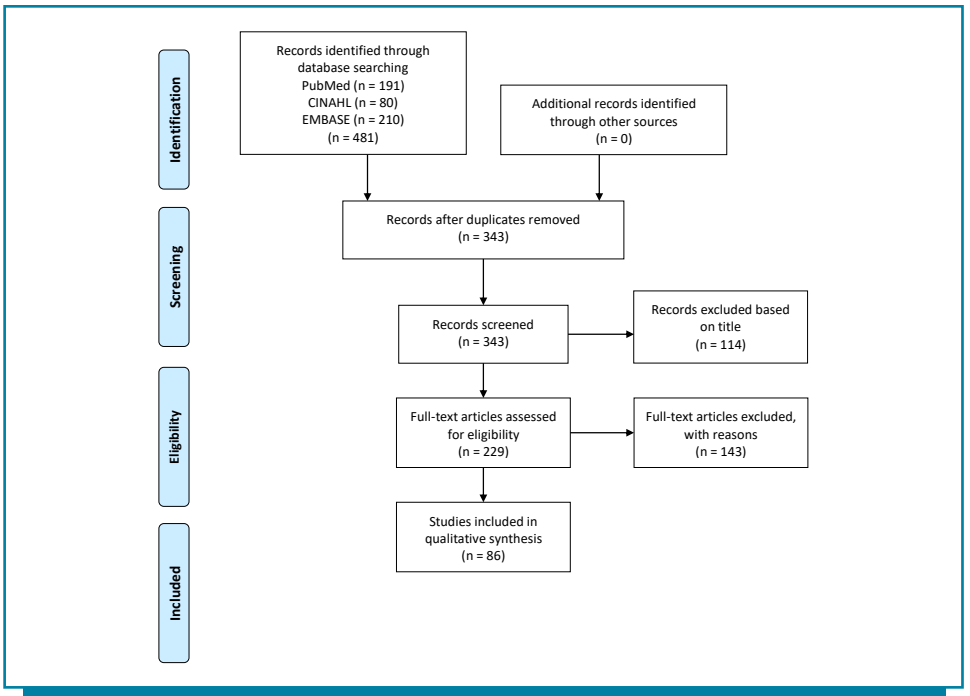

Figure 1. PRISMA flow diagram.

RESULTS

The search of PubMed, CINAHL, and Embase yielded 481 articles for review. There were 138 duplicates and 114 articles were eliminated based on title alone, as the title indicated it was not a randomized controlled trial. An additional 143 articles were eliminated if they were abstracts, included acute or subacute LBP, used surgical interventions, or if the intervention was not explicitly performed by a physical therapist. Eighty-six (86) articles fulfilled the inclusion criteria and were included in this review (Figure 1).

After performing quality analysis using PEDro, it was found that the mean score for our references was 7/10 with scores ranging from 2/10 to 9/10 (see https://www.orthopt.org/content/membership/publications for Appendix 1). Studies scoring 6 to 8 on the PEDro scale are considered methodologically to be of "good" quality; therefore, this is the criteria used within this study.[25] The ICC for the overall scores was a 0.80, which indicates good reliability.[26]

Of the 86 articles included, 31 did not include a definition of chronic non-specific LBP in their introduction, 26 defined chronic non-specific LBP. Whether defined in the introduction of the article or in the inclusion criteria, 79 articles (92%) included a timeframe for duration of back pain in order to be considered chronic. Thus, timeframe was the most frequently used criterion for a definition. Thirty-two articles defined chronic as 3 months or less in duration,[6,10,13,14,27-53] while 40 articles defined it as 3 months or greater.[5,7-9,11,15,17,19,21,22,54-83] Two articles defined chronic as 6 months[84,85] and 5 articles defined chronic as lasting for 1 year or longer.[18,20,86-88]

The second most commonly cited criterion was the location of the LBP, which was found in 23 (27%) articles (see https://www.orthopt.org/content/membership/publications for Appendix 1) with 12 varying definitions. Several included vague definitions for location including lower back[5,73,76] and lumbosacral area.[27,57,87] Seven of the other definitions included some variation of pain from the 12th rib or costal margin to somewhere in the gluteal region. Out of these, the most commonly used definition for location was pain below the costal margin and above the inferior gluteal folds.[8,14,46,71] When non-specific was included as a part of the definition, 18 (21%) studies defined it as not having a known cause and 14 (16%) defined it as not having a specific pathology. There were 13 (15%) articles that mentioned the presence or absence of leg pain in the definition. When determining if pain that radiates down the leg is considered a criterion for chronic non-specific LBP, 10 out of the 13 definitions that included leg pain did not have a preference if radiating pain was present. Two articles stated that chronic non-specific LBP did not include radiating or leg pain.[8,72] One article stated that projection of pain into the buttock or thigh region was a requirement of chronic non-specific LBP.[87] Two (2%) of the definitions included mechanical cause as the reason for chronic LBP.

Fifty-five articles excluded individuals if there was a history of spinal surgery[5-7,12-16,20,21,31-35,37,38,41-43,46-52,54,55,59,60,62-68,70,74-78,80-84,86-91] and 36 excluded those that had a current or previous spinal fracture.[14,16,20,22,32,33,36,38,39,41-43,45,49,51,53,54,56,57,60,62,63,65,68,70,75,76,83,85,86,88,90,92-94] Twenty one articles excluded those with a rheumatic disorder.[5-7,36,38,42,43,47,48,51,54-56,60,70,76-78,80,84,85,90] Nineteen articles excluded individuals that had a disc herniation[5,7,12,20,36,41-43,45,55,57,62,75,77-79,87,88,93] and another 19 excluded those with spinal stenosis.[5,12,18,34,42,43,45,49,52,57,60,75,77,78,81,82,85,87,93]

In considering location of the collection of references used in this scoping review, much of the research on chronic non-specific LBP in the last 10 years has been performed in Brazil, Iran, Spain, Italy, and Australia (see https://www.orthopt.org/content/membership/publications for Appendix 1).

DISCUSSION

The main finding of this scoping review is that there is a lack of consistency within the definition of chronic non-specific LBP. Of the 86 articles included in this review, there were various differences between how the terms "chronic," "non-specific," and "low back" were defined. In many of the articles,

the inclusion and exclusion criteria provided more of a definition by explaining what chronic non-specific LBP was not.

Timeframe

While timeframe was the most frequently used criteria for a definition, discrepancies still existed. Since chronicity of pain plays a large role in the type of treatment provided, this presents an issue. An individual with pain existing for 3 months versus 12 months may present very differently. This is important as the stage of tissue healing may affect the patient's response to treatment. Duration of pain can have both physiological as well as psychological impacts, which can influence the plan of care. For this reason, it is important to have a consensus on the definition of chronic for those diagnosed with non-specific LBP. As discussed previously, there is a lot of heterogeneity among the timeframe when defining chronic LBP. Different research studies are not only heterogeneous, but have contradictory definitions of what chronic means. In our scoping review, chronic was defined as either 3 months or less, 3 months or greater, 6 months, or 1 year. Since there is so much diversity among the definitions of chronic in the literature, it raises the question whether timeframe should even be used in the definition. In the past, it was believed that most occurrences of LBP were of short duration and would resolve in about 6 weeks, irrespective of the type of treatment. It was also believed that only a small percentage of patients would develop chronic LBP.[95] However, there has been a more recent focus on LBP recurrence since most patients experience multiple episodes of LBP throughout their life. Current research suggests that around 33% of people will have a recurrence within 1 year of recovering from a previous episode.[96] There is a lot of variation in the reported number of recurrence rates among patients. This large variation may be explained by how recurrence is defined in the literature. Not all patients seek care when they have recurrence of LBP, depending on severity of their episodes.[97] Patients could have chronic pain with one acute episode that is very disabling or multiple acute episodes that do not greatly affect their quality of life. It is important to know how the number and severity of LBP recurrences the patient has had in the past, since current research says that experiencing more than two previous episodes of low back pain triples the odds of a recurrence within 1 year.[97] Therefore, researchers should also consider recurrence and frequency of LBP episodes and their impact on the individual, as well as the timeframe when defining chronic low back pain.

Location

Among the 12 different definitions specifying the location of the pain, 4 (17%) use the costal margin and above the inferior gluteal folds. This was the most frequently used definition for location. These margins for the low back are identical to those defined in an epidemiological study on the global burden of LBP. In their study, Hoy et al[98] delineate the location of the low back to be the area on the posterior aspect of the body from the lower margin of the twelfth ribs to the lower gluteal folds. This congruity between 30% of location-specific definitions and an epidemiological study estimating the global burden of LBP, may provide an initial basis for determining exact location. Still, some defined the location as a small surface area, such as pain in the lumbar vertebrae 1 through 5,[78] whereas others defined it as from the bottom of the scapula to above the cleft of the buttock, which covers a much larger surface area.[64]

Location is an important aspect of the definition of chronic non-specific LBP because it will help to determine treatment strategy. Treatment of pain limited to the lumbar area will differ from treating pain that spans from the scapula down to the gluteal folds. The existence of pain radiating into the lower extremities will change the treatment as well. It is important to consider whether the same diagnosis should be given if the location of the pain differs. This raises the question of whether different classification systems need to be created, as opposed to placing everyone in this heterogenous category. The presence or absence of leg pain and whether leg pain was radiating were all found in some definitions, but there was little agreement between definitions.

Criteria for Non-specific

The term "non-specific" is the primary descriptor within this category of LBP. Only 34% of the articles actually operationally defined this term. This is problematic as these criteria may play the largest role in determining the best course of treatment for the patient. More importantly, the literature states that most LBP (about 90%) is considered non-specific.[99] Since most patients experience non-specific LBP, it is critical to know how to manage it. While knowing the exact pathology may not always be crucial, understanding the potential causes of pain can help narrow down treatment options.

Country of Origin

The variety of countries performing research on LBP may play a role in the heterogeneity of the definitions found. In 2014, the World Economic Situation and Prospects classified Iran and Brazil as developing countries, whereas Spain, Italy, and Australia are developed countries.[100] This could also contribute to the diverse array of definitions since each country may have differing levels of education, practice guidelines, and tools available for research. However, after further review of the definitions from these countries, there was no correlation found between how chronic non-specific LBP was defined and the country in which the research was performed.

Exclusion Criteria

While many articles lacked a definition of chronic non-specific LBP, the exclusion criteria were able to define what populations were not in this category which supported chronic non-specific LBP as a diagnosis of exclusion. The most common reasons for exclusion in a study were history of spinal surgery, spinal fracture, rheumatic disease, disc herniation, or spinal stenosis. In order to identify many of the pathologies listed, some kind of imaging would be necessary to confirm the diagnosis. While a few articles did state that MRI confirmation was used to diagnose, most of the studies did not identify how they confirmed the presence of pathology. It is also important to note that many of these pathologies may exist in absence of back pain. According to a study by Brinjikji et al, imaging evidence of degenerative spine disease, including disc bulge and protrusion, is common in asymptomatic individuals and increases with age.[101] Therefore, even if proper imaging had been done for exclusion purposes, it cannot be certain that what appears in the image is the cause of the LBP.

Quality of Current Research

The mean PEDro score of the included articles was 7/10, which indicates that the current research on chronic LBP is of good quality. However, even though good quality research exists, clinicians should approach it with caution since there are discrepancies between definitions of chronic LBP in the literature. Despite the quality of the evidence performed in the last 10 years, the best treatment for non-specific LBP is still unknown.

In addition, the PEDro scale does not evaluate whether the subjects being researched are clearly defined in the study. Therefore, additional caution should be exercised when interpreting PEDro scores with a heterogeneous population such as chronic non-specific LBP.

Limitations

One limitation of this scoping review was that the database search contained articles that did not include the term "non-specific," despite it being in the search terms. This could have impacted the data by having it appear that there were a fewer number of definitions for this term. The spelling of the word "non-specific" could have influenced our search results since it can be spelled with or without a hyphen. Although we included various spellings of the word in our search, it is possible that some studies were excluded. Another possible limitation is only searching for articles written in English. The authors may have missed important research regarding chronic non-specific low back pain that was published in other languages.

CONCLUSION

The definition of chronic non-specific LBP is heterogeneous across the literature throughout the past 10 years. This creates difficulty when treating patients that are placed in this category, since they present in diversified ways. Chronic non-specific LBP appears to be more of a diagnosis of exclusion than inclusion. There are no distinct predetermined criteria; rather one is diagnosed by ruling out pathology that could be causing the pain. Therefore, the diagnosis of chronic non-specific LBP presents with very few commonalities between patients. If common characteristics are not identified within this category, it will become increasingly challenging to find an effective treatment for patients with this diagnosis. It is therefore recommended that clinicians exercise clinical judgement when treating patients with a diagnosis of non-specific LBP. Clinicians are encouraged to be aware of the discrepancy in the definition and, in these cases, rely primarily on clinical expertise and clinical findings for the management of patients with non-specific low back pain until more consistency in language appears in the literature. More consensus needs to take place to determine if there is a more suitable way to define chronic non-specific LBP so that quality of care can improve when treating this group of patients.

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SEBT vs. YBT – Effectiveness in Assessing Lower Extremity Functional Balance in Individuals with Lower Extremity Dysfunction: A Systematic Review

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ABSTRACT

Background and Purpose: There is limited evidence that directly addresses which balance measure is more clinically efficient in detecting performance deficits and assessing injury risks in individuals with lower extremity (LE) dysfunction. The purpose of this systematic review was to assess whether the Y-Balance Test (YBT) or Star Excursion Balance Test (SEBT) was more effective in assessing LE functional balance. **Methods:** Computerized searches were executed from March 11 to August 30, 2016, with specific inclusion criteria. Specific data extracted included the dynamic balance assessments in individuals with or without injury, comparison of these measures, and predictors of athletic injury risk. **Findings:** The YBT is more time efficient, standardized, and exhibits high interrater and intrarater reliability. Interpretation of kinematic variables found the YBT to both challenge and evaluate dynamic stability better than the SEBT. Finally, the YBT's elevated central footplate seems to simulate everyday situations of maintaining postural control on uneven surfaces. **Clinical Relevance/Conclusion:** The YBT is recommended for clinical use of dynamic balance assessment due to the benefits of a standardized approach, that it is clinician-friendly in terms of efficiency, and is more applicable in challenging postural stability in those with or without LE dysfunction.

Key Words: lower extremity injuries, dynamic balance tests

INTRODUCTION

The maintenance of lower extremity (LE) balance for activities of daily living, such as walking and stair climbing, is based on information received and integrated by the vestibular, visual, and somatosensory systems, as well as the sensorimotor integration pathway. This creates a response to control an individual's center of gravity over their base of support.[1-4] Balance and postural control impairments have been observed in athletic populations with LE musculoskeletal injury, such as anterior cruciate ligament injury, ankle sprains, and patellofemoral pain.[1,3,5] Authors showed 73% of all athletes across 19 different sports had recurrent ankle sprains and 59% of these athletes had significant residual symptoms resulting in performance impairments.[6] During the retrieval of the somatosensory feedback, LE injuries can alter the proprioception and kinesthetic characteristics of the hip, knee, and ankle. This affects the motor response in postural/neuromuscular control during dynamic motions and perturbations.[7] Hence, evaluation of balance and postural control deficits after sport injuries has become essential to reduce risk of recurrent injury and develop appropriate plans of care.[1,5] Balance control involves a combination of stability and postural orientation to maintain a position in space, while moving in a controlled and coordinated fashion.[2] Therefore, balance and dynamic postural control will be used interchangeably in this systematic review.

Currently, there are a wide variety of balance assessment tools used to assess non-contact injury risk prevention and guide injury prevention programs.[8] Such tools have been deemed useful as they are quick and easy to use and do not require a lot of equipment to implement. However, the subjectivity of the results, potential ceiling effects, and decreased responsiveness to measure small progress or deterioration in balance are limitations of these available tools.[9] Many of the available dynamic balance assessment tools require the patient to perform a series of motions to detect any form of postural deficiency, eg, Drop Jump Test's landing protocol and Functional Movement Screen's In-line lunge.[10] In contrast, the Y-Balance Test (YBT) and Star Excursion Balance Test (SEBT) use relatively static poses that are thought to assess high-level balance; requiring strength, proprioception, coordination, and flexibility as compared to other available balance assessment tools. Additionally, the nature of the movements/testing could make it easier for the clinician to detect deficiencies, as the individual performs the task slowly potentially limiting the need for video analysis.

The SEBT is a dynamic test that requires adequate strength, proprioception, and flexibility.[4] The main goal of the SEBT is to maintain single leg stance while reaching as far as possible with the contralateral leg (Figure 1). The SEBT is used to assess one's ability to maintain balance and measure physical performance. This test has been historically used to identify those with ankle instability.[8] Recently, the SEBT has been used as a tool to identify athletes who are at greater risk for LE injury.[7,8,11] The test consists of reaching in 8 directions while standing on each foot. Many protocols have been established in an attempt to standardize the SEBT. The challenge is the accuracy in measuring the farthest reach point and simultaneously determining a successful reach attempt within the SEBT. These findings suggest that an assessment tool that explicitly evaluates these directions is more clinically sufficient and time efficient than the SEBT.

The YBT is a test that uses the anterior (ANT), postero-medial (PM), and posterolateral (PL) components of the SEBT (Figure 2). The YBT was developed to improve measurement repeatability and to standardize the performance of the test through use of the YBT equipment platform.[8] Like the SEBT, the YBT is used to predict injury risk and performance in athletes.

Comparison of the SEBT and YBT reveal both tests measure dynamic postural control/balance in a similar manner, yet minimal research is available that discusses which test is more efficient and effective to use in clinical settings. Although the SEBT is the most widely accepted clinical method at assessing dynamic balance, the YBT has been adapted as a more concise and efficient version of the SEBT with a standardized approach.[12] The SEBT uses different directions, thus it may appear to be a more thorough examination. The 8 directions include the 3 main directions (ANT, PM, and PL) used in the YBT. By evaluating the 3 main directions only, the YBT has the individual advantage

Figure 1. The posteromedial reach of the Star Excursion Balance Test performed while balancing on the right limb.

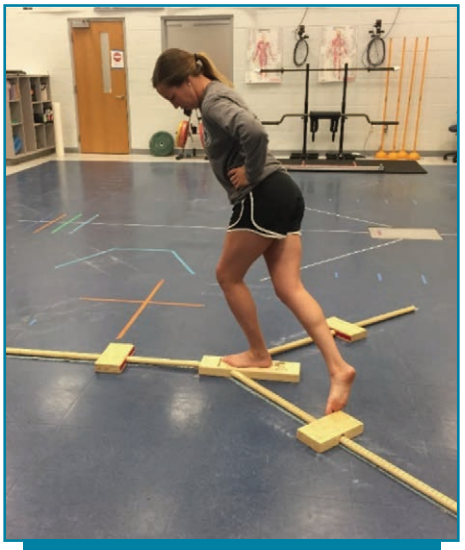

Figure 2. The posteromedial reach of the Y-Balance test performed while balancing on the left limb.

of completing fewer total repetitions, possibly reducing fatigue. The YBT could be more efficient in collecting the data needed to identify an individual's impairments and develop their customized plan of care.[13]

Although the efficacy of these two balance tests has been studied, the relationship between their results remains relatively unknown. Given the limited research on which is the most clinically efficient test to assess LE dysfunction, the purpose of this systematic review was to determine whether the YBT or SEBT was more effective in assessing LE functional balance in those with LE dysfunction. The hypothesis was that the YBT would be an effective and appropriate assessment tool for LE functional balance in this population.

METHODS

Literature Search

The initial search was performed through the PubMed database with extensive search terms formulated relating to the topic of interest. The original search terms developed: ("YBT" OR "Star Excursion" OR "Modified Star Excursion") AND balance AND "lower extremity injuries" yielded two published articles, exhibiting limited publications associated with the direct comparison of these two dynamic balance assessment tools. A revised search strategy was devised with the following Boolean operators and search terms: ("YBT" AND "Star Excursion") AND "lower extremity", ("Y Balance Test" OR "Star Excursion" AND "dynamic postural control"), ("YBT" OR "Y Balance Test" AND "SEBT" OR "Star Excursion Balance test") AND balance, "Star Excursion Balance Test" AND "dynamic balance", and "dynamic balance tests." A more comprehensive search was implemented in the CINAHL, Google Scholar, and PEDro databases to cross-reference the articles for any duplication. The previously mentioned search strategies were implemented with the latter databases. The computerized searches encompassed the period of March 11 to August 30, 2016, to review and retrieve the most updated articles and publications at that time.

Inclusion and Exclusion Criteria

Studies were included if they had the following elements: all study designs relating to topic of interest, incorporation of both dynamic balance tools, as well as the relationship of the subject's kinematics/performance, reliability/validity measures, and clinical application of these tests. Both genders were included and the age range of subjects were from 18 to 30 years. Additionally, studies that compared subjects who had any form of LE dysfunction (hip, knee, or ankle) to a healthy control group were included. Only English language publications were considered.

Studies were excluded if only the upper extremity was assessed, YBT or SEBT was not thoroughly discussed or analyzed, or the results did not explore the concept of balance and/or postural control. Studies were also excluded if there was limited access to the full text publication.

Quality Assessment

Quality of the selected studies was determined by the use of the PEDro scale. This scale is a fast, convenient, and efficient form to determine the internal validity and statistical significance of a study. Evidence has shown that a 'good' PEDro score is ≥ 5.[14,15] Should a study lack a PEDro score, two unblinded reviewers independently assessed and assigned a PEDro score to the study. The two scores were then added and averaged, which yielded an averaged PEDro score per individual study. Disagreements between the reviewers were discussed and resolved during a consensus meeting with the senior author.

Data Abstraction

The systematic review consisted of 11 studies. Data abstraction was performed independently. This included database cross-referencing, extensive article reviews and critique, and the application of our established inclusion and exclusion criteria. An evidence table was used to record the studies' authors and citation, level of evidence, study design, sample characteristics, methods used for the YBT/SEBT testing protocols, kinematic variables, and inclusion/exclusion criteria as determined per study (see https://www.orthopt.org/content/membership/publications for Appendix 1). A second evidence table recorded each study's results (see https://www.orthopt.org/content/membership/publications for Appendix 2).

RESULTS

A total of 301 studies were identified with the developed search terms across identified databases. These studies were narrowed down to 76 articles for abstract review after the elimination of duplicates and screening of title relevance. After further evaluation relating to the established criteria and availability of full text in English, a total of 11 studies were selected (Figure 3). These consisted of 7 level II evidence[5,13,16-20] and 4 level III evidence articles.[8,21-23] During the literature search, there were no randomized controlled trials available related to the topic of interest. Upon analysis of the literature, the studies were classified into 4 subcategories to assist in the interpretation of their results and clinical relevance. Two unblinded reviewers assessed the quality of the articles using the PEDro scale and assigned an average score of 5.3, with the highest score a 7 and the lowest a score of 4.

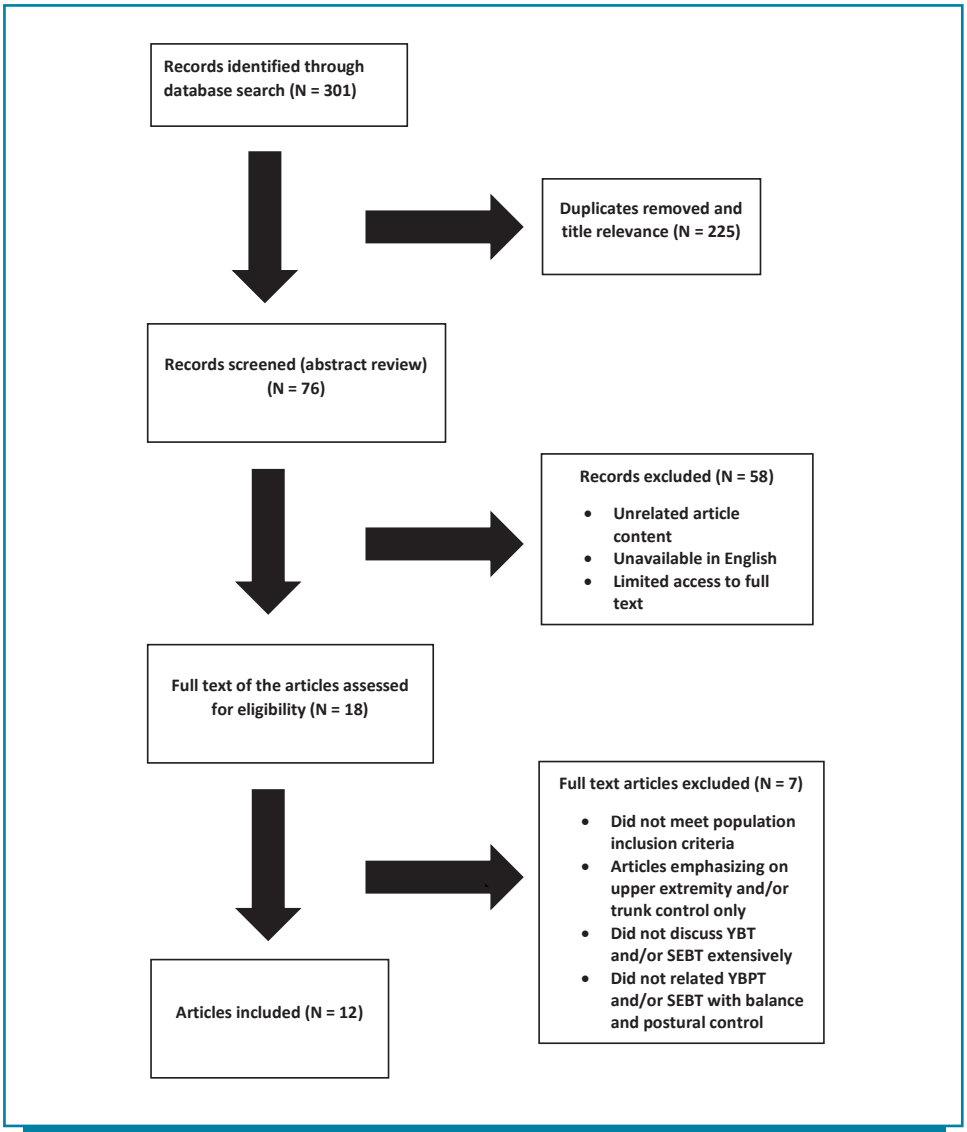

Figure 3. PRISMA statement.

Dynamic Balance Assessment (SEBT) in Subjects with LE Dysfunction

Hertel et al[21] focused on individuals with and without chronic ankle instability (CAI) and found the PM reach direction of the SEBT was the most significant directional reach of the 8 directions. The study reported the alpha values of .67 and .79 for all 8 directions in subjects with CAI and healthy subjects, respectively, suggesting considerable redundancy in performance of different reach directions of the SEBT.[21] In addition, the study found significant group-by-side interactions of the affected limb in the anteromedial (AM), medial (MED), and PM reach directions in the CAI group. The reach distances were significantly less than those of the contralateral limb as well as the side-matched sham-involved limbs of the control group.[21]

Another study evaluated the criterion and divergent validity of the SEBT on 15 patients with bilateral femoral acetabular impingement (FAI), who presented with unilateral clinical symptoms versus a group of 15 control subjects.[16] Study results exhibited during the SEBT in the PL and PM directions had high to moderate criterion validity in relation to the Copenhagen Hip and Groin Outcome Score (HAGOS) subscales for pain intensity (r=0.75, p=0.001; r=0.70, p=0.004, respectively) and symptoms (r=0.65, p=0.009; r=0.55, p=0.034, respectively).[16] In addition, the SEBT had good divergent validity in the PL and PM directions (p=0.006 and p=0.001, respectively) between the symptomatic side in FAI patients and control subjects.[16] Likewise, there were significantly decreased performance in the PM direction (p=0.008) on the asymptomatic side of FAI patients compared to subjects without FAI.[16]

Direct Comparison and Reliability and Validity of SEBT and YBT

Hyong and Kim[22] evaluated the intrarater and interrater reliability of the SEBT to further establish the tool's efficacy in clinical use. For intrarater reliability, the intraclass correlation coefficients (ICC) values for all directions ranged from 0.88 to 0.96, SEM values ranged from 2.41-3.30, and the standard deviation differences (SDD) value ranged from 6.68-9.15. Interrater reliability ICC values for all directions ranged from 0.83 to 0.93, SEM values ranged from 3.19-4.26, and the SDD values ranged from 8.85-11.82.[22] These results indicate intrarater measurements were more reliable than interrater measurements.[22] Whereas, Plisky et al[8] examined the reliability of the YBT using ICC testing. This study found ICC values for intrarater reliability of 0.91 for ANT, 0.85 for PM, 0.90 for PL, and 0.91 for composite, while interrater reliability ICC values of 1.0 for ANT, 0.99 for PM, 0.99 for PL, and 0.99 for composite.[8] To determine the differences between the SEBT and YBT, Coughlan et al[13] compared the reach performance of the ANT, PM, and PL directions in both tools with 20 healthy active male participants. Significant differences were observed in the ANT reach direction, where the left leg reached 5.08% (% of limb length) greater with the SEBT than the YBT, while the right leg reached 4.59% greater.

Kinematic Variables Analysis

Fullam et al[23] found both healthy male and female participants to have greater ANT reach distance with the SEBT (67.05% ± 4.97% Maximized Reach Distance) when compared to the YBT (59.74% ± 4.85% Maximized Reach Distance). The study also compared the kinematic patterns associated with the test performance on the reach directions of both SEBT and YBT. The authors found a significant mean difference of 7.95° in the sagittal-plane hip joint angular displacement at the point of maximum reach between the ANT reach direction of the SEBT and YBT.[23] Finally, a negative correlation (r=-0.06) was observed between hip joint flexion angle and reach distance achieved on the ANT reach direction of the SEBT, and a positive correlation (r=0.43) between hip joint flexion angle and reach distance achieved on the ANT reach direction on YBT.

Unlike other studies that compared the two assessment tools, Kang et al[17] focused on identifying the kinematic predictors to explain performance variance on the lower quarter (LQ) Y-Balance test (YBT-LQ)

when evaluating dynamic postural control. The normalized reach distance was 59.42 ± 5.59% of leg length for ANT direction, 100.06 ± 8.82% of leg length for PM direction, and 98.80 ± 10.63% of leg length for PL direction. The study reported ankle dorsiflexion (DF) accounted for 50% of the variance in the ANT normalized reach with hip flexion accounting for 60% of the variance in the PM normalized reach and 71% of the variance in the PL normalized reach.

To further investigate the clinical efficacy of the YBT, a study by Overmoyer and Reiser[18] specifically investigated the correlations between bilateral flexibility in LE active range of motion (ROM) measurements with bilateral performance in the YBT test. The second purpose of this study explored the relationship between LE asymmetries in active ROM and asymmetries in YBT. The significant findings included weak-to-moderate correlation with degrees of active hip flexion and average and maximum PM direction, average and maximum composite scores, and average PL scores (r= 0.457- 0.583). In addition, a significant weak-to-moderate correlation was identified with ankle DF at 90° knee flexion on average and maximum ANT, PL, and composite scores as well as maximum PM (r=0.497-0.795). On the other hand, ankle DF at 0° knee flexion showed moderate correlation on average and maximum ANT and composite scores (r = 0.472-0.795), while nearly moderate with average PL (r=0.497). When comparing active ROM asymmetries with YBT asymmetries, there was a moderate correlation of asymmetry of ankle plantar flexion active ROM with average and maximum ANT and average PL and composite reach scores (r=0.565, 0.636, 0.520, and 0.565, respectively).

Predictive Injury Risk in Athletes

Authors have suggested that poor dynamic balance may be associated with an elevated risk for athletic injury. In search of an inexpensive and reliable assessment for dynamic balance, Plisky et al[5] examined the relationship between SEBT reach distance and LE injury among high school basketball players. The study found all the players, who presented with ANT had right/left limb reach distance difference ≥ 4 cm, demonstrated decreased normalized right ANT reach distance, demonstrated decreased normalized PM, PL, and composite reach distances bilaterally, and were significantly associated with LE injury (p < 0.05) related to high school grade level, reach distance, and bilateral limb reach distance differences. After adjustment of various risk factors, the authors determined that normalized composite right reach distance of ≤ 94.0% was significantly associated with LE injury for girls (p < 0.05), while ANT right/left reach distance with a difference of 4 cm or more was significantly associated with LE injury for boys.

With the development of the YBT, Butler et al[19] evaluated the relationship between YBT-LQ reach performance and risk of LE injuries. The study identified a cut-off point of 89.6% limb length to be associated with an elevated risk of LE injury with a positive likelihood ratio of 3.5 and probability of sustaining a non-contact LE injury raised from 37.7% to 68.1%. Another study focused on professional soccer players to determine if the YBT was a valid tool to detect the risk of soft tissue injury. The results suggested players with a reach difference ≥ 4 cm between lower limbs in PM direction were 3.86 times more likely to sustain a LE injury (p = 0.001) and players with composite scores lower than the composite result average of 99.91 were almost 2 times more likely to sustain a LE injury.[20]

DISCUSSION

In this systematic review, the topic of interest primarily focused on the validity and reliability of the assessment tools in selecting the most appropriate and relevant screening device for dynamic balance. Although none of the available literature was Level I Evidence, these publications still provide sufficient evidence in formulating the conclusion and clinical recommendation in regards to the topic of interest.

The primary aim of this systematic review was to evaluate the applicability and utility of the SEBT versus the YBT. It is critical for the physical therapist to be able to select a reliable and valid assessment tool for screening individuals with LE dysfunction that yields quality information and efficacy in clinical practice. The SEBT is an established outcome measure of dynamic balance with the reaching tasks designed to challenge postural control, strength, ROM, and proprioceptive abilities.[13,23] Studies justified the clinical use of the SEBT in active, healthy individuals and pathologic populations for detecting functional performance deficits and screening for the risk of LE injury.[8,13,21] However, the causality between the reach directions and CAI is not clear, which warrants further investigation. In relation to the FAI, reach directions may assist clinicians in prognosticating change in symptoms, eg, pain.[16] Johansson and Karlsson[16] stated the primary intention of conservative and surgical treatment of FAI is to reduce the patients' pain and symptoms. The SEBT has been presumed to be a clinically relevant functional assessment for individuals with FAI to monitor their symptoms. A trend between these two studies was the association of specific directional reaches with certain LE conditions.[16,21] This suggests that performing all 8 directions may be redundant and unnecessary. Based on the Plisky et al[5] findings, use of the SEBT could assist coaches and health care providers with insight into which high school basketball players are at risk for injury. Based on the results of SEBT, appropriate pre-season interventions could be implemented to reduce this risk.

However, there were various limitations with the SEBT. It lacks a definitive published protocol for its administration and allows individuals' LE to be supported by the ground, which questioned the authenticity in examining postural stability.[13] In addition, the test is very time consuming requiring the individual to perform 3 trials for each of the 8 different directional reaches on each limb.[13,21] The assessment tool was found to have considerable redundancy in performance of the different reach directions.[21]

Direct comparisons were conducted to explicitly explore the differences of the two assessment tools in the ANT, PL, and PM directions.[13,23] Coughlan et al[13] reported participants achieved a longer reach distance in the ANT direction of the SEBT than the YBT. This was further investigated by Fullam et al[23] who found that greater hip flexion at the point of maximum reach with the SEBT resulted in increased reach distance. The authors hypothesized that differences in the SEBT were attributed to reduced anterior displacement of the participants' center of mass. This resulted in greater reach distance with the SEBT when compared to the YBT.[23] Interpretation of these results implied the data collected with these two tests should not be used interchangeably. Yet, after considering the variations in kinematic and postural control within Coughlan et al[13] and Fullam et al[23] studies, the YBT seems to truly challenge and evaluate an individual's dynamic stability with greater displacement in center of mass with the directional reaches. Finally, the raised central footplate on the YBT seems to simulate everyday situations of maintaining postural control on uneven surfaces.

To further analyze the clinical practicality of the YBT, studies reported ankle DF to be the best predictor of performance and injury risk for the ANT reach direction, while in

the PL and PM directions, hip flexion is the better predictor.[17,18] These findings convey that decreased ANT direction reach performance may suggest an ankle DF deficiency with increased risk of ankle injuries.

Although YBT is relatively new compared to the SEBT, authors have suggested this test be incorporated into preseason physical examination to identify athletes, who may be more susceptible to injuries. Butler et al[19] reported football players with a composite SEBT score of less than 89% were 3.5 times more likely to sustain a non-contact LE injury. Whereas in soccer players, a difference of ≥ 4 cm between lower limbs in PM direction are 3.86 times more likely to sustain a LE injury.[20]

Limitations of Individual Publications

Upon addressing limitations of the available literature, a set of themes were noted. Six studies dealt with a limited study population (15-30 subjects per study).[8,13,16-18,23] Additionally, only two studies directly addressed whether the sample size was enough to detect a level of significance after performing a power analysis.[16,17] While the other half of the studies[5,19-22] ranged from 48 to 235 subjects, the lack of a power analysis among any of these studies challenges the degree of significance found. In addition to the sample sizes, the vast majority of these subjects are either healthy individuals or athletes. Only 78 of the combined data of 627 subjects included in the analysis had some form of LE dysfunction, which limited the subject population of interest in this review.

Studies that involved the use of the SEBT had considerable variance in their protocols, which made side-by-side study comparison as well as interpretation of their respective results difficult.[5,13,16,21-23] Control for leg dominance was variable through the studies, with only one study adjusting for it in its statistical analysis.[21] Other studies used either the dominant or non-dominant leg to weight bear, and established differing rationale for their decisions regarding this methodology.[5,13,16,22,23] None of the studies mentioned whether upper extremity (UE) and trunk control may have attributed to the performances in either the YBT or SEBT. Subjects were not screened to determine if their UE/trunk control would have a significant effect on their respective studies. Lastly, fatigue due to the repetitive trials in SEBT was addressed in the protocol of one study only.[5] The remaining studies did not discuss the influence of fatigue as a limiting factor for their respective results.

Limitations of the Systematic Review

Various limitations challenged the critical analysis of the available literature. The first challenge was the limited amount of evidence discussing the comparisons of the assessment tools. Considering specific populations with lower extremity dysfunction, available evidence was limited. Due to the decreased amount of evidence, inclusion and exclusion criteria were expanded in order to better identify appropriate studies. Since the topic of interest focused on using the tools as a screening assessment rather than an intervention, a lack of RCT studies was not considered a limitation for this review. The computerized searches encompassed the period of March 11 to August 30, 2016. More recent evidence may have been published since that time that could add to this topic.

RECOMMENDATIONS AND CONCLUSIONS

The findings of this systematic review suggest that the YBT is recommended for clinical use of dynamic balance assessment. In addition to its time and energy-efficiency and less patient fatigue, this test offers a more standardized approach to measurement and demonstrates higher reliability. Based on these factors, the YBT should be considered as a component of the physical examination to assess the potential of sustaining a LE injury. In comparison, the SEBT has a wide variety of protocols, redundancy in directional reaches, and does not challenge center of mass displacement as compared to the YBT. These issues question the propriety of the tool in predicting or identifying LE injury. Lastly, due to the lack of standardized protocols in the studies using the SEBT, the authors recommend the results from a SEBT should not be used interchangeably with those from an YBT and vice versa, as it appears that differing postural control strategies are performed to complete these similar assessment tools.

The YBT allows clinicians to provide preventive care in addressing functional deficits in conjunction with other performance evaluations. In healthy and athletic subjects, an ANT reach difference ≥ 4 cm, reduced individual reach distances in all directions, and composite scores were predictive of LE injury. However, in subjects with a known LE dysfunction (ie, CAI, FAI), their performance varied considerably as did the directions that were significantly hindered due to their musculoskeletal deficits. The variance in performance of healthy vs. subjects with LE dysfunction implies that different musculoskeletal complications might lead to varying kinematic variables in specific YBT directions. Further studies are needed in additional patient populations with LE dysfunction using the YBT to determine which kinematic variables are predictors of performance deficits and consequent injury risk.

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Musculoskeletal Injuries in Irish Dancers: A Systematic Review

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ABSTRACT

Background and Purpose: Irish dance has become an increasingly popular dance form; requiring core and lower extremity strength, stability, flexibility, and endurance. The repetitive stress of Irish dance motions may lead to an increased risk of overuse musculoskeletal injury. The purpose of this review was to summarize the evidence on the incidence of and risk factors for musculoskeletal (MSK) injuries in Irish dancers. **Methods:** Computerized searches were executed using search terms related to Irish dance and injury between 2006 and 2016. Assessment of methodological quality was determined using the *Strengthening the Reporting of Observational Studies in Epidemiology* (STROBE) statement. **Findings:** Ten studies of varying designs and populations were analyzed. Professional and amateur dancers were included (n=876). There was a 60% risk of MSK injury, with the ankle/foot regions being most commonly injured. Stress injuries and fractures (52%), patellofemoral maltracking (64.2%), and Achilles' tendinopathy (77%) were the most frequently cited pathologies. Risk factors were related to shock absorption, specifically footwear and dance surface as well as lack of early intervention. Finally, 70% of injuries were described as chronic. **Clinical Relevance/Conclusion:** There is a high incidence of MSK injury in Irish dancers, specifically in the ankle/foot regions. Preventative measures, eg, screenings as well as education related to proper footwear and dance, should be considered to minimize risk of injury.

Key Words: Irish step dance, Irish dance, Irish dance injury

INTRODUCTION

Irish dance has become an increasingly popular dance form with over 1,500 registered instructors in more than 30 countries, throughout 5 continents.[1,2] Irish dance competition has been recorded as early as 1899.[3] The growing popularity has led to an escalation in the competition and athleticism of the dance form, as evidenced by the approximately 5,000 competitors from 20 different countries at the 2016 World Irish Dance Championships in Glasgow, Scotland.[4]

Irish dance is characterized by swift, precise footwork with rigid arms and torso, and can be divided into "light" and "heavy" styles. The "light or soft" shoe dances are similar to ballet, where dancers stay high on their toes, performing graceful leaps. Unlike ballet, Irish dancers land on an extended knee with a plantar flexed ankle. The soft shoe is constructed of black, flexible leather with laces that cross over the dorsum of the foot and are tied around the arch. In "heavy" dancing, dancers wear "hard shoes." The shoes have a fiberglass covering that is about 0.75 inches in the toe box and about 1.5 inches in the heel. The objective of heavy dancing is to be loud, powerful, and rhythmic, while remaining on the balls of the feet (plantar flexed position). One component of heavy dancing, taught to dancers over the age of 12, is a "toe stand." This position is similar to ballet's 'en pointe.' Each form of Irish dance requires core and lower extremity (LE) strength and stability, as well as flexibility and endurance. A full Irish dance consists of 1 to 2.5 minutes of vigorous, high impact, LE movements. The dance movements may consist of leaps, kicks, and other repetitive motions performed while maintaining stance high on their toes. With competitive dancers practicing an average of 11 hours per week, the repetitive stress of Irish dance motions may lead to an increased risk of overuse musculoskeletal (MSK) injury.[2]

While elements of Irish dance have been studied, the characteristics of MSK injuries however, in Irish dancers has not been systematically reviewed. The purpose of this systematic review was to summarize the literature on the incidence of and risk factors for MSK injuries in Irish dancers.

METHODS

Search Strategy

A systematic search of the scientific literature was performed for any studies reporting on injury sustained during Irish dance. The electronic databases PubMed (2006 to May 2016), CINAHL (2006 to May 2016), and Physiotherapy Evidence Database (PEDro) (*Updated* May 2016) were used to conduct this search. Indexed terms and text words, such as *Irish Dance Injuries, Injuries in Irish Dance, Irish Dance Injury,* and *Irish Dance,* were used to search the databases and identify relevant evidence (Table 1). Use of these MeSH terms resulted in the following search strategy: ("wounds and injuries"[MeSH Terms] OR ("wounds"[All Fields] AND "injuries"[All Fields] OR "wounds and injuries"[All Fields] OR "injury"[All Fields] AND Irish[All Fields] AND "dancing"[MeSH Terms] OR "dancing"[All Fields] OR "dance"[All Fields]. In addition to searching online databases, the reference lists of all relevant studies were examined. Major Irish dance websites were also scanned for unpublished literature.

Inclusion Criteria

The inclusion criteria were any studies reporting epidemiological findings related to Irish dance injuries in the identified timeframe. Studies were excluded if they were not epidemiologic in design or not published in the defined period.

Assessment of Methodological Quality

Assessment of methodological quality was independently conducted by 2 reviewers (BM and AW), using the *Strengthening the Reporting of Observational Studies in Epidemiology* (STROBE) statement. This assessment strives to accommodate the diverse use of observational research (Cohort, Case Control, or Cross Sectional).[5,6] The reviewers used the statement to assess the effectiveness of epidemiologic studies in an accurate and thorough fashion. The STROBE Checklist identifies 22 items with 18 items applied to all 3 study designs; whereas 4 are design specific[6] (see https://www.orthopt.org/content/membership/publications for Appendix 1).

The authors developed a scoring system using this checklist to obtain a quantitative score for each study. Each criterion was scored as follows: "1 point" for "yes," and "0 points" for "no" or "not applicable" (N/A). In order for criteria to be classified as a "yes," all criteria in the question had to be met. If all points were not met in a single question, the question was scored a "no" and given zero points. In questions with multiple parts (A, B, C,

Table 1. Search Terms	
Database Search Terms	Irish Dance Injuries Injuries in Irish Dance Irish Dance Injury Injuries in Ballet Dancers Musculoskeletal Irish Dance Injuries Irish Dance Irish Step Dance Injury Irish Step Dance Injuries Musculoskeletal
Google Search Terms	Irish Dance Styles Irish Dance Competitions Irish Dance Injuries Irish Step Dance Ballet Dance Injuries Musculoskeletal Injuries in Irish Dance Competitive Irish Dance Injuries Professional Irish Dance Companies

etc), the score was equally divided to allow the entire question to equal one full point.

- For questions with a part A and B (questions 1 & 6), each was valued at 0.5 points.
- For questions with parts A, B, and C (questions 13, 14, & 16), each was worth 0.3 points.
- Finally, for questions with parts A, B, C, D, and E (question 12), the point value was 0.2 points each.

In questions related specifically to an individual study design (Questions 6 & 14), if part A was relevant, but not part B, the score would be either full points or zero points, depending on the appropriate study design (see https://www.orthopt.org/content/membership/publications for Appendix 2). Disagreements between the reviewers on individual checklist items were discussed and resolved during a consensus meeting with the senior author (ABK).

Data Extraction and Synthesis

An evidence table was used to record the studies' authors and citation, study size, study type, dancer's demographics, and STROBE score. Additional tables were generated to document occurrence of injury, type of injury, joint(s) involved, injury acuity, and risk factors for injury. This synthesis of information summarized our findings and allowed for further evaluation of the data in comparison to ballet dance.

Data Analysis

Data analysis were confined to the STROBE checklist score for each individual study. For a study to be considered sound quality reporting, the authors chose a cut-off score of 15.4 out of 22 possible points (70%). This is consistent with PEDro scores of ≥ 7/10, where fair agreement was found.[7] Once the studies were independently graded, the reviewers met to discuss any scoring differences; and an average of the two reviewers' scores was taken for each study.

RESULTS

Search Strategy

Ten studies relating to the occurrence of MSK injury were identified. Eight studies were comprised of one cross sectional study, one cohort study, one chart review/survey, one written questionnaire, two cross-sectional retrospective chart reviews, and two self-report questionnaires were included in this systematic review. The additional two studies included were one case report and one case study that related to demographic data due to their study design (Figure 1).

Methodological Quality

Two studies, O'Halloran et al[8] and Errigo-Vitale and Rubino[9] were unable to be scored, as case studies/series do not meet STROBE criteria. Based on STROBE scoring, 7 of the 8 remaining studies demonstrated effective presentation of epidemiologic data based on the 70% criteria (see https://www.orthopt.org/content/membership/publications for Appendix 3). All studies identified will be included for the discussion of age and dancer demographic.

A total of 10 articles were assessed and 876 subjects comprised this systematic review. Study populations varied in terms of level of dance, gender, age, and geographical location. Student Irish dancers, who participate in local, national, and international recreational competitions, were assessed in 8 of the 10 studies.[2,8-14] The remaining 2 studies assessed current and retired professional Irish dancers.[15,16] Male (n=122, 13.9%) and female (n=749, 85.5%) dancers were included in all studies reviewed, with the exception of one study. Noon et al[11] investigated injury prevalence in only female (N=5) student Irish dancers. Across all studies, the participant ages ranged from 4 to 47 years old, with 95% under age 19.[2,8-15] In studies where the population was professional Irish dancers, the age range was 21 to 34 years.[15,16] The majority of dancers originated from the United States of America (42.2%), Canada (22.2%), and Ireland (13%) with the remaining from England, Australia, and New Zealand (13.8%)[2,10,11,13,15,16] (see https://www.orthopt.org/content/membership/publications for Appendix 3).

Incidence/Prevalence of Musculoskeletal Injuries in Irish Dancers

Nine of the 10 studies examined prevalence or incidence of MSK injuries. Three studies[2,13,15] examined prevalence of MSK injuries, while 6 studies[9-12,14,16] assessed incidence of MSK injuries. In Irish dancers, the ankle was the most commonly injured joint (46%), closely followed by the foot (42%). The knee was the next prevalent joint to sustain a MSK injury (23%).[2,12,15] Surprisingly, the lumbosacral spine and pelvis comprised only 5.1% of all MSK injuries[11] (Table 2).

For purposes of this systematic review, injuries were first classified as muscle (22.6%), ligament (13.2%), bone (15%), and pain (6.8%). These injuries were further categorized into tendon involvement, plantar fasciitis, cartilage and nerve involvement, stress fracture, and instability (Table 3). Achilles' tendinopathy (77%) was the most commonly reported muscle injury in Irish dancers.[16] Sprains of the anterior talofibular ligament were the most frequently cited ankle ligamentous injury (17.1%).[2,11] Patellar tracking disorders comprised 64.2% of all bone related injuries.[10] The frequency of stress injuries and fractures was 52% with sesamoid fractures the most predominant

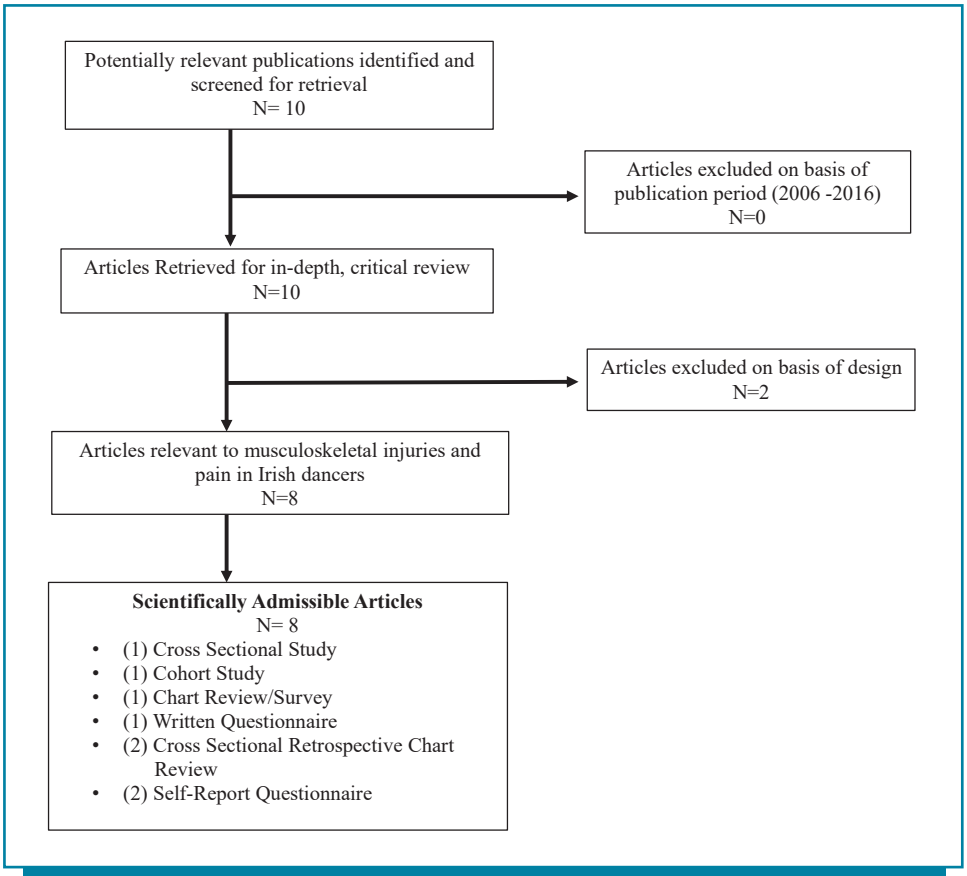

Figure 1. PRISMA statement.

fracture at 27.7%.[2,11,12] An additional classification system was found in the literature that was based on those pathologies that were classified as "Pain-Related Disorders." When this classification system was applied, an even distribution of pain-related disorders were revealed amongst Irish dancers, specifically Patellofemoral Pain Syndrome, instability, swelling, and weakness.[10-12] Finally, chronic and overuse musculoskeletal injuries (85.4%) were cited at a much higher rate than acute onset (14.9%)[8,10,12,16] (Table 2).

There was limited available evidence regarding severity of injury and amount of time spent recovering. The evidence suggests most injuries were mild or moderate, allowing the dancer to return to or continue dancing despite sustaining an injury.

Risk Factors for Musculoskeletal Injuries in Irish Dancers

Irish dance's unique movement patterns place these dancers at an increased risk for overuse MSK injuries.[12] The impact of shock absorption and its relationship to Irish dance injuries was a recurring theme in a majority of studies (70%) examined for this review.[2,8-10,12,15,16] Shock absorption was described in terms of footwear (70%)[2,8,9,12,14-16] and performing surfaces (50%).[2,8,12,15,16] Footwear was labeled as hard and unsupportive, while performing surfaces were considered poor, if hard and/or concrete, in comparison to better performing surfaces, such as springwood flooring (Table 3). Delayed intervention, defined as within the first month post-symptom presentation, and intensive training in combination with immature technique and muscle weakness were cited as risk factors[2,9,10,15] (Tables 3 and 4). Lastly, typical class/rehearsal time was 3 to 20 hours per week, with increased days and hours of practice leading up to competition.[2,9,10,12,15]

DISCUSSION

To our knowledge, this systematic review is the first synthesis of occurrence of and risks factors for MSK injuries in Irish dancers. The evidence represented in this systematic review is illustrative of the Irish dance population. The data compiled demonstrates a large number of dancers (n=876) of varying ages (4-47 years) in numerous geographical locations, enhancing the generalizability of this research.[2,8-12,15,16] Additionally, the included studies assessed professional and amateur Irish dancers, therefore encompassing skill levels across the spectrum of Irish dance.[2,8-16]

This review found the most common types of injuries occurring in Irish dancers were stress injuries and fractures, Achilles tendinopathy, and patellofemoral pain or maltracking.[2,10-12,16] When the common techniques used in Irish dance are further examined, hypotheses can be drawn regarding the cause of these injuries. The high incidence of stress fractures, especially occurring in the sesamoids, may be related to the repetitive stresses and increased impact loading on the first ray when dancers perform toe stands or land on their metatarsal heads.[11,17] In normal ambulation, the sesamoids bear up to 50% body weight, but this can increase up to three times during leaps and push off.[11,17,18]

Typically, Irish dancers perform steps on either their tiptoes and/or metatarsal heads. During these foot postures, the Achilles tendon is repetitively maintained in a shortened position.[16] Achilles tendinopathy may be exacerbated by factors, such as muscle strength and flexibility limitations, as well as limb alignment.[18] One descriptive case series of 18 subjects found that 17 subjects demonstrated a pronated and calcaneal valgus foot posture, and all 18 subjects exhibited limited gastrocnemius-soleus flexibility.[9] This foot posture has been associated with an increased incidence of Achilles tendon pathologies and magnified force absorption in the metatarsal region, predisposing dancers to metatarsal stress fractures.[9,16] Similarly, patellofemoral pain and maltracking have been associated with muscular imbalance, weakness in knee extensors and hip musculature, and dynamic knee valgus stress.[10] This results in a more pronated foot posture and Achilles tendon injuries.

"Light" styles of Irish dance share common ground with other dance styles due to the large elegant leaps and performance in a sustained plantar flexed, equinus forefoot position.[12] Based on the available data, the authors suggest the Irish dance injury rate of 60% is similar to that reported in other styles of dance.[2] For example, in ballet LE injuries were reported at a rate of 77%.[19] Upon further consideration, the distribution of injuries in this dance style were similar to those in Irish dance; ankle injuries commonly reported at 33%, shin and calf 22%, and foot 20%.[19] Lastly, knee injuries were reported as 13% of all LE injuries.[19] However, one major difference in injury distribution between these two styles of dance was regarding injuries in the trunk region. Approximately 16% of ballet dancers report trunk injuries with 60% of these injuries occurring in the lumbar spine.[19] Noon et

Table 2. Irish Dance Variables

Variable	Irish Dance*
Area of Injury	• Foot (32%)[2,12,14,15] • Ankle (29%)[2,12,14,15] • Knee (14%)[2,12,14,15] • Lumbosacral spine & pelvis (5.1%)[11]
Type of Injury	• Muscle & Tendon (22.6%)[11-13,15,16] • Ligament (13.2%)[2,11-13,15] • Bone (15.0%)[2,10-13,15,16] • Pain$^{\Delta}$ (6.8%)[10-13]
Chronic vs. Acute	• 70.5% Chronic[8,10-13,16] • 27.3% Acute[10-13]
Shock Absorption	• Factors involved: unsupportive footwear, flooring surface (hard vs. springwood flooring)[2,8,9,12,14-16] • Landing from leaps/jumps with foot plantar flexed and knee extended, absorbing 6x body weight[9,16]
Risk Factors	• Poor shock absorption[1,2,5,8,10,12,15,16] • Intensive training[2,8-10,15] • Muscle weakness & fatigue[9,15,22] • Unique movement patterns[12,15] • Decreased temperature-work conditions[2,15] • Immature technique[10,13-15] • Postural changes[9,11] • Decreased stretching/warm up[12,14] • Limited cross-training & strengthening[12] • Lack of early intervention after injury[15] • Previous injury[15] • Psychological difficulties[15] • Broader pelvis in women[11,13] • Greater ankle ROM[16] • Decreased flexibility[9,13] • Poor Balance[13] • Participation in other Physical Activities[14]
Gender/Age	• 749 females (86%) • 126 males (14%) • Aged 4 to 47 (median: 21.5 years old) • 95% of dancers under age 19
Injury Rate	• The only data currently available would suggest injury rates of 60% similar to that reported in other types of dance[2]

*Based on aggregate data from systematic review.
$^{\Delta}$Pain includes instability, patellofemoral pain syndrome, swelling and weakness, and plica syndrome.

al[11] in their study of Irish dancers reported only 5.1% lumbosacral and pelvis injuries. These differences in injury presentation from Irish dance may be due to variances in landing techniques. Irish dancers land in plantar flexion with an extended knee position, thus reducing the ability to dissipate landing forces.

The majority of Irish dance injuries sustained were described as chronic or overuse injuries, with only a small fraction comprising acute and traumatic injuries. This could be due to the nature of the dance style, repetitive and high intensity. However, it is speculated that Irish dancers tend to dance through their injuries and pain resulting in more of a chronic presentation.[8,10,12,16]

In the studies reviewed among the suggested risk factors, most common were poor shock absorption and intensive training, yet these factors did not conclusively link to increased risk of injury. In the 6 studies rated >70% using STROBE criteria, risk factors were discussed as a projection based either on the authors' findings or through a survey of dancers opinions.[2,10,12,15,16] Repetitive impact was associated with many of the common LE injuries found in dancers, including stress fractures, Achilles tendonitis, and plantar fasciitis.[20] As previously described, Irish dancers frequently land from leaps and jumps with the ankle plantar flexed and knee fully extended, imparting forces up to 6 times the body weight.[16,20] Trégoët and Merland[20] found the highest forces as well as the greatest plantar loading, occurred in the forefoot while wearing a soft shoe. Therefore, it is important to consider the role of footwear and dance surfaces in shock absorption and prevention of injury.

Numerous risk factors were similar across different dance styles. Common risk factors were psychological characteristics, muscle weakness and fatigue, and intensive training and timing.[2,6,8,11,13,17,19] These were predominant during the time prior to upcoming performances or competitions, regardless of style, practice frequency, and duration increases, therefore accelerating the risk of injury.[8-10,15,21,22] However, risk factors such as soft shoe and floor surface were more specific to Irish dance.

LIMITATIONS

Despite the similar populations in each study, it was difficult to draw conclusions from the literature due to the wide variety of injuries reported and risk factors attributed to the injuries in this dance population. Some limitations of this systematic review include (1) no universal definition of MSK injury among the cited studies, (2) errors of omission with retrospective chart reviews, and (3) differing categorization of type of injuries. In addition, it was difficult to determine the severity of injury. The majority of the studies did not report the time off from dance or the type of treatment provided to the dancer. Beasley et al[10] reported maltracking disorders in 64% of all reported bone injuries. However, other studies reported stress injuries and fractures to be the most commonly reported bone injury in Irish dancers at 52%.[2,11,12] Finally, the majority of research failed to identify whether injuries were based solely on Irish dance or whether dancers were participating in other forms of dance or athletic activities.

RECOMMENDATIONS

Considering the occurrence of injury in Irish dancers, some hypotheses can be drawn

Table 3. Musculoskeletal Injury Classification

Primary Classification	Additional Classification
Muscle **22.6%**	• Tendon Injury (13%)[12,13,15] • Tendonitis - Posterior Tibialis (4.6%)[11] • **Tendinopathy- Achilles (77%)[16]** • Unspecific (12.8%)[12,13,15]
Ligament **13.2%**	• **Ankle Sprain - Anterior Talofibular Ligament (17.1%)[2,11]** • Ankle Sprain – Unspecific (15.1)[13] • Plantar Fasciitis (5.1%)[11,13] • Unspecific (13.0%)[12,13,15]
Bone **15.0%**	• Apophysitis - Patella (11.4%)[12] • Cartilage & Nerve (< 2%)[15] • Degeneration - Calcaneocuboid Joint (11%)[16] • Fracture (9.5%)[12,13] • Osgood Schlatter (5.8%)[10] • **Patellofemoral Maltracking Disorders (64.2%)[10]** • Sever Condition (6.0%)[11] • Sinding Larsen Johnsen (4.7%)[10] • **Stress Injury/Stress Fracture (15.4%)[2,11-13]** • Unspecific (25%)[15]
Pain **6.8%**	• Bursitis (1.9%)[13] • Instability (10.8%)[12] • Nerve Damage (1.9%)[13] • **Patellofemoral Pain Syndrome (11.1%)[11]** • Plica Syndrome (4.7%)[10] • Swelling and Weakness (10.5%)[10]

Table 4. Risk Factors for Musculoskeletal Irish Dance Injuries

- Poor Shock Absorption (Footwear and Performance Surfaces)[2,8-10,12,13,15,16]
- Increase in dancing workload (Intensive Training)[2,8-10,15]
- Muscle Weakness & Fatigue[2,9,15]
- Unique Movement Patterns[12,15]
- Decreased Temperature - Work Conditions[2,15]
- Immature Technique[10,13-15]
- Postural changes[9]
  - Higher incidence of femoral anteversion in women[11]
- Decreased Stretching / Warm Up Time[12,14]
- Limited Cross-Training and Strengthening & Conditioning[12]
- Lack of Early Intervention after Injury[15]
- Previous Injury[15]
- Psychological Difficulties (Stress, Anxiety, Work Dissatisfaction)[15]
- Broader Pelvis in women placing the femur more lateral thus increasing hip adduction and the valgus angle from hip to knee to ankle[11,13]
- Greater ankle ROM with alternating positions in Irish dance[16]
- Decreased Flexibility[9,13]
- Poor Balance[13]
- Participation in other Physical Activities or Sports other than ID[14]

regarding prevention strategies. Authors have suggested a comprehensive screening process to assess general health and fitness, strength, flexibility, postural alignment, neuromuscular control patterns, and history of injury.[10,12] It has also been recommended the screening should be a requirement to participate in dance classes, and that dance teachers could include a strength and conditioning program and adjust training schedules to allow for rest periods, as needed.[12] Since dancers fail to report injuries in a timely manner it is important to promote early reporting, intervention, and comprehensive rehabilitation after injury.

Due to the direct impact of injuries on the health of Irish dancers, further research is recommended in prevention methods and screening to reduce injury and to determine which dancers have a higher injury risk.

CONCLUSIONS

There is a high incidence of MSK injury in Irish dancers, specifically in the ankle and foot regions due to soft shoes and dance floor surfaces. Despite the limitations in available research, the authors concluded MSK injury is an important health issue in Irish dancers.

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Short-term Management of a Patient Following a BioCartilage Allograft of the Talar Dome: A Case Report

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ABSTRACT

Background and Purpose: Osteochondral lesions of the talar dome are a frequent consequence of traumatic ankle sprains and chronic ankle instability often resulting in gait abnormalities with chronic ankle pain. If conservative management fails, various surgical techniques are used to encourage healing. A BioCartilage Allograft, which contains type II collagen, proteoglycans, and cartilaginous growth factors, has been introduced to increase long-term success and durability. The purpose of this case report was to describe a short-term criteria-based rehabilitation protocol following this surgical technique. **Case Description**: The patient was a 19-year-old male undergraduate student with a 4-year history of right ankle pain secondary to two osteochondral lesions of the talar dome. These lesions were a consequence of an ankle sprain that occurred while the patient was playing football. The patient began therapy 10 weeks post-BioCartilage Allograft implantation. The patient presented with limited dorsiflexion and inversion active range of motion (ROM), an antalgic gait pattern, lack of hip internal rotation passive ROM, and poor talocrural joint mobility. Two functional outcome measures, the Lower Extremity Functional Scale (LEFS) and Foot and Ankle Ability Measure (FAAM), including the Sports and Activities of daily living (ADL) subscales, were assessed throughout the episode of care. At 18 weeks postoperatively and 6 months postoperatively, the patient's ability to perform the Y-balance test was also assessed. The plan of care addressed impairments, activity limitations, and participation restrictions. **Outcomes:** At 18 weeks postoperatively, the patient was symptom free during ADL, but was still not allowed to return to running and jumping per the surgeon's postoperative protocol. The LEFS improved to 64/80 and FAAM was a 74/84 (ADL) and 0/32 (Sports). All objective measures increased and equaled the left lower extremity at 18 weeks postoperatively. The patient returned to therapy 6 months postoperatively for one visit where he received a conservative running protocol and jumping progression. At 6 months, the FAAM progressed to 79/80 (ADL) and 28/32 (Sports). All objective measures were maintained between 18 weeks postoperatively and 6 months postoperatively except for dorsiflexion and inversion active ROM due to the patient's reported lack of compliance with his home exercise program between the visits during this timeframe. **Discussion:** This case report demonstrates a time- and criteria-based approach to the procedure with short-term impairments and functional outcome measures. This approach guided advancement in treatment to maximize short-term and subsequently long-term function in a patient with osteochondral lesions.

Key Words: osteochondral lesion, talus, criteria-based protocol, ankle sprain

BACKGROUND AND PURPOSE

Ankle sprains are a common injury among athletes, especially adolescent athletes.[1] The most common mechanism of injury is forceful forefoot adduction with hindfoot internal rotation, ankle inversion, and plantar flexion.[2] The majority of patients heal quickly without long-term repercussions. However, 5% to 25% of individuals will suffer from symptoms 3 years after the initial injury.[3]

Osteochondral lesions are commonly a consequence of traumatic ankle sprains or chronic ankle instability. An osteochondral lesion is defined as a local lesion that is deep enough to alter the subchondral bone.[4,5] There is a discrepancy within the literature regarding terminology used to describe osteochondral lesions. Numerous terms including osteochondritis dissecans, osteochondral defect, and osteochondral fracture have been used to describe osteochondral lesions of the talus.[6]

Osteochondral lesions are classified by examining many factors including the type (chondral, subchondral, or cystic), the stability, displacement, location, containment, and size of the lesion (< or > 1.5 cm2 or < or > 15 mm diameter).[6] The first common classification system used was developed by Berndt and Harty in 1959. This system was based on lesions seen on plain radiographs. Talar lesions are ranked from Stage 1 (small area of compression) to 4 (displaced lesion within the joint).[7] However, Loomer et al[8] discovered that 50% of lesions were not seen on plain radiographs. As new forms of imaging have developed, other classification systems have been proposed. However, these classification systems are also lacking in clarity and have many disadvantages.[9]

If conservative management is not successful, surgical options include bone marrow stimulation, microfracture, osteochondral autograft transplantation, osteochondral allograft transplantation, matrix-associated chondrocyte implantation, classic autologous chondrocyte implantation, and autologous matrix-induced chondrogenesis. Other studies have also included implanting metal components or vascularized bone graft into the lesion site.[10] There is lack of consensus regarding which particular treatment is superior to another as many of the procedures are successful.[10-14] There is currently minimal evidence to support choosing a surgical type based on the grade or stage of injury.[15]

One of the first-line treatments for osteochondral lesions under 1.5 cm^2 is a microfracture procedure, which involves removing the cartilage piece and stimulating bleeding from the subchondral bone.[14] Clot formation occurs as a result of the microfracture procedure. The clot contains bone marrow derived growth factors and pluripotent mesenchymal cells that eventually become fibrocartilage. Fibrocartilage is made of type I collagen, which differs from the type II collagen that comprises articular hyaline cartilage. The stiffness, resilience, and wear characteristics of fibrocartilage are inferior to the original hyaline cartilage.[4,16] Evidence suggests that patients' return to function and decrease in pain is variable.[4,14,16,17] Success rates have been reported as high as 90% and as low as 46% by some authors.[4,16] Furthermore, it has been suggested that lesions greater than 1.5 cm^2 or greater than 15 mm in diameter are inappropriate for a microfracture procedure.[6,18]

After a microfracture procedure, there is very little evidence to support the proper postoperative protocol. Most postoperative protocols are time-based instead of criterion-based.[6,17,19,20] McGahan et al[6] noted that the typical release to full activity is 3 to 6 months postoperatively with an initial 6 to 8 week non- or limited weight-bearing time period.

To increase the long-term success and durability of the microfracture procedures, surgeons have been supplementing microfracture procedures with a BioCartilage Allograft (Arthrex; Naples, FL).[10] This allograft cartilage extracellular matrix (ECM) is applied to the microfracture site to fill the cartilaginous defect. The matrix contains type II collagen, proteoglycans, and cartilaginous growth factors, which are intended to integrate better with the natural cartilage surface of the talar dome, increase cartilage durability, and improve the patient's functional outcomes.[9]

At this time, there are no studies assessing progress of specific impairments, short-term outcomes, and functional criteria for highly active individuals who underwent a microfracture procedure with a Biocartilage Allograft. Without this objective data, it is difficult to predict the proper rehabilitation progression, as well as identify factors for short-term or long-term success for a patient. Consequently, the purpose of this case report was to analyze the process of return to function and describe the criteria used to progress a young patient with high level goals who underwent this procedure.

CASE DESCRIPTION

The patient was a 19-year-old male college student who was a former wrestler, football player, and recreational biathlete. The patient was referred to physical therapy 10 weeks post-BioCartilage allograft implantation of the right talus due to a 9 mm to 10 mm anterior to posterior and 5 mm to 7 mm medial to lateral on the medial talar dome osteochondral defect and a lateral talar dome defect that was 2 cm in diameter.

The injury occurred 4 years prior to surgery when the patient "sprained" his ankle during football practice. In the subsequent years, the patient had symptoms with cutting and sprinting during sport activities. The patient was forced to abandon football but continued to compete with ankle pain in track in mid-distance events, wrestling, and biathlons in high school. Prior to surgery, the patient was informed that he had developed avascular necrosis of the talar dome, which would eventually lead to a total joint replacement or fusion of the ankle. After receiving multiple opinions, the patient chose to undergo a BioCartilage allograft implantation.

Postoperatively, the patient was given an immobilization ankle brace and assigned a home exercise program (HEP) by the surgeon, which included open kinetic chain exercises (drawing the alphabet with his foot and performing right ankle active range of motion (ROM) in all planes of motion). The patient admitted to poor adherence to the HEP. In accordance with most postoperative protocols, the referring physician had encouraged the patient to be nonweight bearing for the first 6 weeks postoperatively and to begin progressive weight bearing at 6 weeks postoperatively.[4,16]

At initial evaluation, patient reported that his greatest activity/functional limitations included walking on both even and uneven surfaces and ambulating up and down stairs. He reported 7-8/10 pain on the Numeric Pain Rating Scale (NPRS) when ambulating without axillary crutches and 0/10 pain at rest. The NPRS is a reliable and valid scale that can be used to document the intensity of a patient's symptoms for multiple types of orthopedic injuries/impairments.[21] Per the surgeon's protocol, the patient was not allowed to return to running or jumping until 6 months postoperatively. The patient's goals included returning to running, competing in local biathlons, and competing on his college club wrestling team. The patient provided verbal and written consent for this case report.

EXAMINATION

The Lower Extremity Functional Scale (LEFS) was used to assess the patient's functional progress. It is an 80-point patient-reported scale where lower scores denote greater disability.[22] The patient scored a 26/80 (67% disability) on the LEFS at the initial evaluation. Foot and ankle posture were not assessed initially due to guarding.

At the time of the initial evaluation (10 weeks postoperatively), the referring physician's orders were to begin progressive weight bearing as tolerated. There were no ROM restrictions. In quiet stance the patient used axillary crutches with a slight anterior pelvic tilt and inappropriate right knee flexion to avoid right lower extremity weight bearing. The patient wore a lace-up ankle brace on the right. There were no signs of abnormalities (infection, bruising, or swelling). Portal healing was appropriate. Sensation to light touch was assessed along the dermatomes and peripheral nerve patterns with no impairments noted.

Ankle active and passive ROM of the right ankle was measured in supine as described by Norkin and White.[23] There was a firm end feel with no pain or guarding during all passive talocrural and subtalar ROM. The left lower extremity strength was assessed with the patient sitting at the edge of a table as suggested by Berryman Reese.[24] Right ankle strength was not assessed via manual muscle testing secondary to postoperative restrictions. Assessment of plantar flexion strength was performed for the left lower extremity in standing with the patient performing repetitive heel raises as reported by Hislop et al.[25] The patient had normal left ankle strength. Knee active ROM was assessed in supine with the patient's foot on the table.[23] Strength of the knee was assessed in sitting.[24] Please refer to online supplementary material (see https://www.orthopt.org/content/membership/publications for Appendix 1) for specific results.

Hip strength was assessed in sitting when comparing flexion, external rotation, and internal rotation between the lower extremities.[24] Hip abduction was evaluated in side-lying with emphasis on the gluteus medius by slightly externally rotating the hip.[24] Hip extension was tested in prone with 90° of knee flexion.[24] Hip external rotation and internal rotation passive ROM was assessed in supine with the hip and knee flexed to 90°. The stationary arm was in alignment with the right and left anterior superior iliac spines (ASIS) and the movement arm was in alignment with the femur.[26] (see https://www.orthopt.org/content/membership/publications for Appendix 1).

Formal balance and power-based tests, such as the Y-balance test and a single leg jump for distance, were not completed at the initial evaluation due to postoperative restrictions and the patient's activity tolerance. However, the Y-balance test was performed at the 9th visit and at the follow-up appointment at 6 months postoperatively. Additionally, the single leg jump for distance test was performed 6 months postoperatively. The flexibility of the gastrocnemius was examined in long sitting with no knee flexion as well as joint mobility of the ankle/foot, as described in the Orthopedic Physical Therapy Assessment[26] (see https://www.orthopt.org/content/membership/publications for Appendix 1).

The patient's gait was observed with and without the axillary crutches as the patient ambulated across the gym floor. A Balance System™ SD unit (Biodex Medical Systems; Shirley, NY) was used to measure weight bearing percentage on the lower extremi-

ties in quiet standing, marching, and squatting activities with optional upper extremity assistance available, if needed. Throughout all objective measures, except for gait without the axillary crutches, the patient noted 0/10 pain on the NPRS. The patient stated he experienced 7-8/10 pain on the NPRS during gait without the axillary crutches.

CLINICAL IMPRESSION

Given the noted impairments, the patient was diagnosed with subacute right ankle mobility deficits and pain as associated with BioCartilage allograft implantation of the right talus. As expected, recent immobility and partial weight-bearing status resulted in expected strength deficits due to disuse. In addition, due to recent immobilization and lack of compliance with the referring physician prescribed HEP and adherence to protocol, an increased immobility in talocrural active ROM (dorsiflexion and plantar flexion), lack of gastrocnemius length, and posterior talocrural hypomobility was discovered. The patient's neuromuscular control was also suboptimal during ambulation compared to his weight-bearing tolerance. Weight-bearing tolerance was even between lower extremities in quiet static standing but he was unable to ambulate or move dynamically with proper arthrokinematics of the talocrural joint due to pain and poor neuromuscular control. The patient was in the subacute stage of healing due to appearance of a healthy incision, lack of edema, and pain at end ROM. Positive factors that enhanced prognosis included high level of motivation, intact comprehension, young age, overall health, and supportive home environment. Negative factors included lack of compliance with his previously prescribed HEP, delayed initiation of physical therapy treatment, and goals to return to high level dynamic activities with complete healing.

INTERVENTION

The patient was seen for 9 visits beginning 10 weeks postsurgery. In the subacute stage of healing (Phase 1, sessions 1-3), the patient had pain at end ranges with manual overpressure. During this phase, goals included improving ankle ROM and joint mobility, especially in the sagittal plane. Throughout phase 1, the patient struggled to gain talocrural joint mobility. He was able to gain enough talocrural joint mobility and ROM to improve his gait pattern, but his talocrural ROM and joint mobility were not within normal limits by the end of phase 1. Refer to Table 2 for specific interventions performed. At the end of phase 1, the patient was ambulating without an assistive device. His HEP included seated self-mobilization of the talocrural joint, drawing the alphabet with his right ankle, isometric exercises, and TheraBand exercises (TheraBand, Inc; Akron, OH). Criteria required to progress to phase 2 included the ability to ambulate without an antalgic gait pattern and to have no fatigue with isometric and light TheraBand exercises.

Phase 2 began at 12 weeks postsurgery (sessions 4-6). Phase 2 goals were to strengthen in weight-bearing positions and emphasize hypertrophy, improve neuromuscular control, and to normalize arthrokinematics thru joint mobilization. Refer to Table 1 for specific interventions performed. Due to lack of right talocrural joint mobility at the end of phase 1, joint mobilizations were progressed to mobilizations with movement (MWM) while the patient was in standing.[27] This allowed the therapist to better stabilize the talus as a belt was placed at the distal end of the tibia to encourage an anterior glide of the concave surface of the talocrural joint. To progress to phase 3, the patient was required to maintain his balance during static single leg stance for at least 30 seconds and no longer fatigue with open kinetic chain strengthening and stationary closed chain strengthening exercises for hypertrophy and neuromuscular re-education.

In phase 3 (sessions 7-9), the goal was to introduce dynamic balance training and functional strength training that simulated running and wrestling positions. Phase 3 was initiated at week 16. Refer to Table 2 for specific interventions performed. At the end of phase 3, the patient was able to accurately perform his prescribed exercises without frequent cues from the physical therapist and demonstrated that he was independent with his HEP but was not able to progress to the next stage of rehabilitation (jumping/running) per his referring provider's postoperative protocol. To allow the patient to maintain his progress, a comprehensive HEP which included balance exercises on a pillow with eyes opened and closed, single leg standing dead lift, lateral squat walks, monster walks, single leg squats, and single leg standing heel raises was prescribed.

At 6 months-postoperative, radiographs revealed almost complete healing of the talar dome, and the surgeon cleared the patient to begin a slow-progressive running protocol. The patient was given a jumping and running protocol developed by Ohio State University[28] with firm instructions not to progress to the next level if he had any symptoms.

OUTCOMES

The patient was seen for 9 visits over a 6-week period. At the end of treatment, the patient experienced a 38-point increase on the LEFS (20% disability), which exceeds the minimal detectable change (MDC) of 9 points.[3] The Foot and Ankle Ability Measure (FAAM) was also introduced as a reliable measure based on its specificity to our patient's injury/impairments and frequent usage within clinical research.[29] All objective measurements are in the online supplementary material (see https://www.orthopt.org/content/membership/publications for Appendix 1). The patient had an average pain level of 0/10 on the NPRS. At most his pain was a 2/10 during quick/abrupt changes in movement. The patient was discharged at this time and encouraged to return to therapy 6 months postoperatively to receive professional assistance to return to running and jumping safely. At 6 months postoperatively, the patient decided to only partake in one treatment session to review objective measures and receive a jumping/running protocol. The FAAM ADL improved by 5 points (MDC = 5.7 points) and the Sports subscale improved by 28 points (MDC = 12.3 points). There was also a slight reduction in right ankle dorsiflexion and inversion active ROM compared to previous objective measures. Subsequently there was a slight loss of distance during the anterior portion of the Y-balance test, which assesses sagittal plane movement patterns. In addition, there was a lack of right ankle neuromuscular control/balance compared to the left lower extremity when observing the patient's ability to perform static single leg balance on the floor and Airex pad with his eyes open and then closed. Finally, the patient had less force production of the right lower extremity and a neuromuscular deficit that was assessed with a single leg jump for distance. When assessing the right lower extremity, the patient struggled to maintain his balance during this test.

DISCUSSION

This case report highlights several aspects of clinical reasoning to determine the appropriate criteria used for a patient's plan of care following a BioCartilage allograft implant. The criteria, including proper gait pattern, pain levels, strength, and increased balance, were identified and followed to ensure short-term and long-term success.

At the end of his formal treatment (18 weeks postoperatively), the patient demonstrated significant improvement in all objective outcome measures and returned

Table 1. Interventions by Phase

	Phase 1	Phase 2	Phase 3
Range of Motion	Seated self-directed dorsiflexion passive range of motion with overpressure hold to improve joint mobility and tissue length		
Strengthening	TheraBand sagittal plane progressive resisted exercises using a yellow and red TheraBand for hypertrophy	Squatting to the level of an 18-inch step posterior to the patient for hypertrophy	Single Leg heel rises for hypertrophy
		7-inch step-ups for right lower extremity power and strength	
	Isometric resisted ankle eversion/ inversion by resisting the right foot against the left foot for hypertrophy and neuromuscular control	Shuttle: Progressive resistive exercise for eccentric plantar flexion strength	Single leg squats to improve power
		Green TheraBand right ankle inversion, eversion, dorsiflexion progressive resistance exercises for hypertrophy	Single leg dead lift for strength and balance
Manual Therapy	Grade III and IV anterior to posterior and posterior to anterior talocrural mobilizations performed in long sitting to improve joint mobility	MWM in the sagittal plane to increase dorsiflexion range of motion and talocrural joint mobility: belt was placed at the distal end of the tibia to supply an anterior glide of the concave surface of the joint. Patient stood on a 24-inch box during mobilization	Continued MWM in the sagittal plane to increase dorsiflexion range of motion and joint mobility
	Manual overpressure into dorsiflexion was applied to increase gastrocnemius and soleus tissue length		
Gait Training/Functional Mobility	Gait training to increase right ankle mobility throughout the gait cycle and to encourage right knee extension at terminal stance and initial contact. Performed with a single axillary crutch	Biodex weight-bearing squat to normalize equal weight bearing between lower extremities during functional activities	Lateral squat walks for frontal plane hip muscular performance
		Gait training on stairs	Monster walks for anterior/lateral hip muscular performance
Neuromuscular/Balance Training	Sagittal range of motion on BAPS board while in sitting to improve neuromuscular control	Clockwise and counter clockwise rotation on BAPS board to improve neuromuscular control: Level 2-4	Single leg stance on Airex pad and dyna disc with opposite lower extremity perturbations (flexion/extension, abduction/adduction, rotation) to progress balance-based exercises
		Static single leg stance on the floor and Airex pad to improve balance	Lower extremity reach on Y balance lines (in all three planes) to improve balance and neuromuscular control
	Drawing the alphabet with ankle to improve neuromuscular control and joint mobility	Tandem stance on floor and Airex pad for balance	Stepping on and off of Airex/ Bosu Balance system to improve neuromuscular control
			Random control and maze programs on Biodex Balance System
Home Exercise Program	Seated self mobilizations of the talocrural joint	Green TheraBand for progressive resisted exercises (inversion, eversion, and dorsiflexion)	Single leg dead lift
	Isometric resisted ankle eversion/ inversion exercise		Lateral squat walks
	TheraBand sagittal plane progressive resisted exercises using a yellow and red TheraBand	Single leg stance balance on floor and pillow	Monster walks
			Single leg heel rises
	Alphabet tracing	7-inch step ups	Single leg squats
			Single leg stance on a pillow

Abbreviations: MWM, mobilization with movement; BAPS, Biomechanical Ankle Platform System

to all ADL without complaint. While minor impairments remained, the patient was progressing appropriately based on tissue healing mechanics.

Possible factors limiting the patient's long-term success were the patient's self-reported lack of compliance with his HEP between 18 weeks and 6 months postoperatively and his desire to only participate in one formal physical therapy treatment session at 6 months postoperatively. However, the outlined criteria ensured short-term success. Previous published studies that use BioCartilage allograft are only time-based.[4,16] Other postoperative protocols for different orthopedic surgical procedures are criteria-based recognizing that even in the short-term not all patients will progress biomechanically as quickly as outlined in time-based protocols.[30] This case report outlines a criteria-based protocol that could be used with similar patients and investigated with future research.

In contrast to current evidence-based recommendations, this patient had lesions much larger than 1.5cm^2 on both the medial and lateral talar dome.[6] However, the patient's success with this criteria-based protocol may encourage future research of this method of repair for larger talar dome lesions.

There are several limitations in this case report. The patient was not consistent with his HEP, so his outcomes may have been different at 6 months postoperatively. The authors used 2 different functional outcome measures (LEFS and FAAM) at different times during the course of care. This inconsistent use of functional measurements inhibits our ability to interpret functional change. The authors suggest that in the future, a reliable and valid outcome measure needs to be consistently used at the end of each phase to assess functional progress. The nature of the study, a case report impacts generalizability to larger populations with this condition. Additionally, not all clinical measures were taken at all 3 stages due to postoperative restrictions and limited by the patient's pain tolerance.

Future research with a greater number of subjects and a standard criteria-based protocol should be performed within the first 6 months following a BioCartilage allograft repair of the talar dome. It should demonstrate knowledge of the healing process by analyzing the biomechanics of the ankle, pain, neuromuscular control, functional status, and strength to safely return to ADLs, work, and recreational function.

CONCLUSION

A time- and criteria-based approach was demonstrated in this case report following a BioCartilage allograft of the talar dome with short-term impairments and functional outcome measures. Each phase was specific and considered the patient's stage of healing, symptoms, and current impairments. Functional exercises were incorporated into each phase to demonstrate to the patient his progress toward his goals. By following this criteria-based approach the patient met all of his short-term goals and was on track to begin higher level activities. A criteria-based approach as described in this case report should be used to maximize short-term and long-term outcomes post a BioCartilage allograft of the talar dome.

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An Extension-based Treatment Approach for a Patient with a Hip Arthrodesis and Radiating Low Back Pain

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ABSTRACT

Background and Purpose: Despite classifications for treatment of patients with low back pain (LBP), the relation between hip mobility and radiating LBP although well reported, is not consistently used by clinicians. The purpose of this case report was to describe the management of a patient with radiating LBP status post hip arthrodesis using a modified extension-based treatment approach. **Case Description:** A 79-year-old male with a pre-existing left hip arthrodesis and radiating pain into the left lower extremity presented to physical therapy. Peripheralization of symptoms occurred with flexion-based movements and centralization of symptoms with facilitation of prone lumbar extension. **Outcomes:** Clinically important reductions in pain, disability, and perceived benefit were present after 6 visits, at discharge, and 8-month follow-up. Secondary improvements were present in trunk extensor strength and joint mobility. **Discussion:** Pain, disability, and perceived benefit improved with modified extension-based interventions to restore spinal mobility. These results highlight the benefit of a proximal approach to address thoracic and lumbar mobility deficits in those populations with significant hip mobility restrictions.

Key Words: spine, mobility, chronic, specific exercise

BACKGROUND AND PURPOSE

Low back pain (LBP) has become a major public health issue worldwide.[1] Point prevalence of LBP is estimated to be at least 20% of the general population, yearly prevalence estimated to be at least 40%, and lifetime prevalence from 40% to 70%.[2] Most patients with LBP will experience resolution of symptoms anywhere from 3 to 12 months after onset with regards to a non-radicular presentation.[3] Prognostic models have been developed that help determine the rate of a patient's recovery[4]; however, literature describing the natural history of radiating LBP is uncertain.[5] Recent models describing the nature of LBP have suggested treating it as a long-term condition as opposed to an individual event.[3] Furthermore, research to date has focused on subgroupings of patients with LBP to improve evidence-based treatment and patient outcomes.[3,6,7]

Subgroupings of patients with LBP have sought to develop effective methods to improve symptom duration through classifications that better identify prognosis and predicted intervention response.[6,7] Hip mobility is one criterion considered for classification of LBP. Ellison et al[8] suggested a link between reduced hip internal rotation and LBP. Further research has supported the relationship between reduced hip range of motion (ROM), general movement patterns, and hip strength deficits in the onset of LBP.[3,9] Lumbopelvic coordination with forward bending tasks has shown to be influenced by LBP which resulted in compensatory movements in the frontal and transverse planes.[10] Additionally, altered hip mobility can lead to a resultant increase in lumbar spine motion in order to achieve optimal movement.[11] Therefore, the role of hip function should be a valuable aspect of rehabilitation for individuals with LBP.

Despite previous literature regarding hip function and LBP, most results regarding hip mobility have been inconclusive. Prather et al[12,13] observed the connection between hip function in a population of patients with LBP, but no significant difference in LBP was observed when comparing numeric pain rating values in those with and without hip ROM deficits. In addition, the relationship between hip motion loss and low back function was inconclusive with variable scores observed on the Oswestry. Ben-Galim et al[14] found significant improvement in Oswestry and visual analog scores (VAS) in patients following total hip replacement; however, they did not include specific ROM measurements, which would help to highlight the potential relationship between hip mobility and LBP prior to surgery. To our knowledge, there is little research that describes and quantifies significant reductions in hip ROM and their role and potential relationship in the development and treatment of LBP. In particular, minimal research has been published that links significant hip ROM loss stemming from a hip arthrodesis with LBP. In a retrospective study by Kirkos et al,[15] repeated LBP episodes were present in 75% of patients (n=33) having undergone hip arthrodesis between 1952 and 1976. However, there was no description on whether associated leg pain was present. Considering that hip arthrodeses were more common prior to the development of total hip replacements, it could be viewed as a potential factor affecting rehabilitation of older patients that present with this surgical history along with LBP.

Similar to the role of hip function in the assessment and treatment of LBP, extension-based treatment following the principles of McKenzie have been proposed for the management of leg pain associated with LBP.[2,16,17] Various systematic reviews have outlined the importance of incorporating repeated movements as a component of a general evaluation to help guide exercise interventions and allow eventual transition toward strengthening and re-initiation of more functional movement patterns.[17,18] Specific movements and mobilization, particularly into extension have shown to be effective in reducing back and related leg pain while improving ROM.[19] A good prognosis has been associated with established centralization and directional preference; however, these findings are primarily reflected in younger populations with reduced chronicity of symptoms.[17] Identification of subgroupings and clinical practice guidelines have helped establish and combat some of the uncertainty associated with the role of centralization and reduced hip mobility in evaluation and treatment.[3,6,7] This has ranged from treatment-based classifications systems for specific exercise and manipulation to subgroupings of LBP based on chronicity and symptom presentation to determine the most effective guidelines for assessment

and management.[3,6,7] Most extension-based specific exercise programs have proven effective, but exercises remain standardized with little variation for patients with reduced hip mobility.[16,19]

Despite clarifications in the literature and summation of methods to enhance patient subgroupings, there is a need for identifying the correlation between decreased hip mobility and referred or radiating LBP. In addition, there has been little description of a modified extension-based specific exercise program that considers limitations in hip mobility. Research has primarily addressed the role of a functional hip in the treatment of LBP, but does not describe the method of treatment for patients that lack a fully functioning hip. The purpose of this case report was to highlight the limitations in the treatment of a patient with radiating LBP status post hip arthrodesis, as well as, describe a modified extension-based treatment approach to manage this presentation.

CASE DESCRIPTION

Patient History and Systems Review

The patient was a 79-year-old Asian Indian male. He was 5'3" tall and weighed 121 lbs (BMI = 21.47). His medical history consisted of hypertension, stage III chronic kidney disease, hypothyroidism, degenerative disk disease, and prior left hip arthrodesis secondary to osteomyelitis as a child. He presented with an extended history of low back and bilateral leg pain with recent progression of left leg pain one month prior to evaluation. His right leg pain had recently resolved over the past 3 to 4 weeks. He had previously received 3 fluoroscopic injections (roughly 3 months apart) varying between the L4-5 and L5-S1 segments over the past year to assist with pain relief. Symptoms typically improved for 3 to 4 weeks following each injection. The back and leg pain were fairly constant aside from the relief he had from injections, and his most recent progression occurred one month prior to the initial evaluation. He had yet to receive another injection before consulting physical therapy. The initial Oswestry Disability Index (ODI) score indicated a 51% disability with notable worsening of back and leg pain when first getting out of bed, standing after sitting >15 minutes, bending forward to pick items up, and standing/walking >10 minutes. Pain was primarily located across the low back near his belt line and was described as a dull, constant ache. Additionally, he noted sharp, shooting pain that would occur along the posterior aspect of his left leg terminating at the plantar aspect of the left foot. Pain ratings are included in Table 1. Most provocative activities included prolonged sitting and standing or walking >10 minutes. At the time of evaluation, his back pain was 3/10 and leg pain was 5/10. With pain provocation, leg symptoms typically required 1 to 2 hours to resolve. He had little relief with use of pain medication, but had some relief with initial position changes. He had not received physical therapy since the "early 2000s" to address localized back pain, which he reported as not being as severe at that time.

In addition, he reported a left surgical hip fusion due to osteomyelitis he had sustained as a child, which had continually caused difficulty with daily activities and possibly contributed to his progression of back pain. The patient was unable to provide any additional information regarding this surgical history. He denied any bowel or bladder issues, numbness or tingling into his legs, unrelenting night pain, or saddle anesthesia.

He was employed as an endocrinologist, which required frequent periods of sitting, standing, and transitional movements throughout the day. He described an inability to sit comfortably at work that he felt most contributed to the onset of his symptoms.

Clinical Impression 1

Considering the patient's extended history of LBP and progression of leg pain, these findings were potentially consistent with his prior diagnosis of degenerative disc disease with advancement to include radiating pain into his legs. Symptoms were consistent with Maitland's criteria for moderate irritability and severity.[20] The primary problem was a decreased tolerance to sitting, forward bending, walking, and transitional sit-to-stand movements. The presence of a left hip fusion resulting in a more flexed hip position along with other provocative flexion-based movements indicated the possibility of a positive result and potential centralization with lumbar extension. The plan for examination was to include an assessment of posture, lumbar and hip ROM, neurological function, hip and trunk strength, gait, balance, joint mobility, and flexibility. The main goal of the assessment was to determine if symptoms could be provoked and improved within the session in order to classify the patient into the most relevant treatment subgroup.

Examination

The examination began with a standing postural assessment, which noted increased left hip flexion, adduction, and internal rotation position, as well as a forward flexed and right rotated trunk, mild left rib hump, and reduced lumbar lordosis. Increased weight bearing on his right leg was confirmed via visual observation and patient report. Myotomes and sensation were impaired at L4-S1 and Achilles and patellar reflexes reduced on the left leg (1+) and normal on the right leg (2+).

The patient exhibited a significantly

Table 1. Pain Rating and Outcome Measures

Numeric Pain Rating Scale (initial/mid-term/discharge/8-month follow-up)	**Average back pain:** 3/10 // 2/10 // 2/10 // 2/10 **Average leg pain:** 6/10 // 2/10 // 0/10 // 1/10 **Best back pain:** 3/10 // 0/10 // 0/10 // 0/10 **Best leg pain:** 5/10 // 0/10 // 0/10 // 0/10 **Worst back pain:** 4/10 // 3/10 // 2/10 // 2/10 **Worst leg pain:** 8/10 // 2/10 // 1/10 // 2/10
Oswestry Disability Index (ODI) *	Initial = 23/45 (51% disability) Mid-term = 7/45 (14% disability) ** Discharge = 4/45 (8% disability) 8-month follow-up = 6/45 (8% disability)
Global Rating of Change	Discharge = 4 (on a scale from -5 to 5) 8-month follow-up = 4 (on a scale from -5 to 5)
Patient Satisfaction	Discharge = 8/10 8-month follow-up = 8/10
*MCID = 12 pts **After 6 visits	

altered gait pattern consisting of increased left hip flexion and internal rotation during left stance and increased right trunk lean and left hip hike to facilitate left swing phase. Compensatory lower lumbar extension was also present when advancing his right leg during the swing phase. Lumbar spine[7] and hip ROM measurements were included in Table 2. Pelvic compensation was noted during lumbar ROM testing indicating altered lumbopelvic rhythm within the available range. The patient's lumbar ROM was significantly limited primarily due to his left hip arthrodesis at 34° of flexion, 10° of internal rotation, and 5° of adduction. Any attempt at active hip motion resulted in pelvic movement. Passive mobility of the left hip resulted in a bony end feel in all planes with focal pain at the front of his hip with passive extension. Repeated motion testing[7] in standing and prone were unable to be performed at the time of initial examination due to reduced mobility of his left hip and inability to perform isolated lumbar extension in these positions. Lower extremity muscle strength results were noted in Table 3. Left hip strength values reflect isometric strength in a seated position given his reduced left hip mobility.

The patient initially exhibited a negative straight leg raise (SLR) bilaterally with increased pelvic mobility noted during testing on the left. Using a dorsiflexion sensitizing maneuver,[21] SLR testing was positive on the left with reproduction of the patient's leg pain; testing was negative on the right. Due to the lack of left hip mobility, slump testing could not be used to further assess neural mobility.

Segmental mobility was assessed with the patient in prone and left leg hanging off the side of the table with the foot supported on the ground to establish a neutral pelvic position. Mobility was determined to be hypomobile, using Kaltenborn's grading schema,[22,23] at the middle and lower thoracic spine (2/6) and at L1-3 (2/6). Slight hypermobility was present at L4-S1 (4/6). Left leg pain reduced from 5/10 to 2/10 with terminal movement migrating from his distal, posterior left calf to his buttocks with Grade III-IV posterior to anterior (PA) mobilizations[20] targeting the L1-3 segments. Reported leg pain with walking and standing was decreased from 5/10 to 2/10 following PA mobilizations.

Table 2. Range of Motion Scores from Admission and Discharge

	Admission		Discharge	
	Right	Left*	Right	Left*
Lumbar flexion	25°		35°**	
Lumbar extension	0°		13°**	
Lumbar side flexion	15°	10°	15°	15°
Lumbar rotation	10°	8°	12°	10°
Hip flexion	100°	30°	WFL	30°
Hip extension	20°	-30°	WFL	-30°
Hip internal rotation	30°	10°	WFL	10°
Hip external rotation	30°	-10°	WFL	-10°
Hip adduction	15°	5°	WFL	5°
Hip abduction	30°	-5°	WFL	-5°

*Left hip ROM limited by prior hip fusion
**Notable improvement in range of motion

Abbreviation: WFL, within functional limits

Table 3. Trunk and Lower Strength Values for Admission and Discharge

	Admission		Discharge	
	Right	Left	Right	Left
Trunk extension	2/5		4/5	
Abdominal contraction	3 sec		10 sec*	
Hip flexion	4+/5	4/5	4+/5	5/5
Hip extension	4/5	4/5	4/5	4/5
Hip abduction	4/5	3+/5	4/5	4+/5
Hip adduction	4/5	4/5	4/5	4/5
Hip internal rotation	4/5	4-/5	4/5	4/5
Hip external rotation	4/5	4-/5	4/5	4/5
Knee flexion	4+/5	4+/5	4+/5	4+/5
Knee extension	5/5	5/5	5/5	5/5
Dorsiflexion	4/5	4/5	4+/5	4+/5
Plantar flexion	4/5	4/5	4+/5	4+/5

*Able to maintain contraction from sit to stand

Clinical Impression 2

After completion of the examination, the patient presented with signs and symptoms consistent with an acute exacerbation of chronic LBP with radiating pain.[6] Centralization of symptoms were achieved with mobilizations for lumbar extension. Based on this movement-related diagnosis, initial treatment would focus on facilitating lumbar extension and improved lumbar posture with specific exercise and mobilization. Modified positioning would be needed during exercise to neutralize pelvic mobility secondary to his pre-existing left hip position and his compensatory pelvic motion during lumbar extension. Due to the need for these modifications and extensive patient instruction in their performance to ensure successful patient participation, additional exercises were not considered at the time of evaluation.

His overall prognosis was good based on initial symptom improvement with specific extension exercises. However, the extended history of LBP and the pre-existing left hip fusion were noted as factors that could impede progress or maintenance of improved function. Targeted interventions would need to address lumbar strength, mobility, motor control, and ergonomic positioning. The initial plan of care was 2 times a week for 3 weeks followed by a reduction to once a week for an additional 3 to 4 weeks for facilitation of a home management program.

Intervention

In order for strengthening, mobility, motor control, and ergonomic positioning interventions to be performed successfully, left hip modified positioning had to be considered in order to achieve optimal movement at the lumbar spine and avoid compensatory thoracic or pelvic motion. This was primarily achieved through maintenance of the left hip in its resting flexed position and the contralateral hip in extension to neutralize pelvic motion.

The main focus of the initial plan of care was to improve lumbar extension and reduce the severity, frequency, and intensity of lower extremity pain. This was accomplished through the use of manual therapy and specific extension-based exercises. Specific exercises included prone on elbows, prone press ups, and standing extension exercises using the above modified positions.[24] Prone press ups and prone on elbows used a more forward hand placement to target the upper lumbar segments.[24] Manual therapy techniques were applied to facilitate lumbar extension that included PA mobilizations, mobilization with movements (MWMs), and self-MWMs particularly to the hypomobile L1-3 regions of the lumbar spine.[20,25] Additional PA mobilizations were applied to the hypomobile thoracic spine segments throughout the lower and middle regions. An initial home exercise program was included to emphasize the frequency of extension movements throughout the day with additional instruction provided on methods to enhance lumbar lordosis in seated positions. The home exercise program allowed self-progression by the patient with less visit frequency required, as well as, the flexibility to add other exercises throughout the duration of treatment (see https://www.orthopt.org/content/membership/publications for Appendix 1).

Due to the patient's prolonged history of altered posture from his fused hip, additional motor control and active ROM exercises were implemented in standing to emphasize lumbar extension. This was primarily achieved through standing anterior pelvic tilts in a lunge position to neutralize his left hip position and reintroduce movement into lumbar extension. Additionally, shoulder flexion was included to emphasize overall trunk extension in this position. As the patient's familiarity and lumbar extension ROM improved, strengthening exercises were added to target lumbar and thoracic paraspinals, gluteal musculature, and deep lumbar stabilizers.

One of the main areas addressed throughout the patient's plan of care was the need for altered ergonomic positioning. Considering the patient's occupation as an endocrinologist, his frequent periods of sitting throughout the day, and his onset of low back and leg pain during and after periods of sitting, it was important to address methods that would enhance his lumbopelvic positioning. Chair height, desk height, and computer positioning were discussed with the patient to provide a more natural lumbar lordosis. The use of a sitting wedge was important to establish an improved left hip position and lumbar spine curve through an enhanced anterior pelvic tilt. Research in support of seating wedges has primarily targeted adolescent populations[26,27]; however, the anterior pelvic tilt provided by the seating wedge helped to relieve the patient's low back and left leg pain. The patient was encouraged to apply these modifications at work, while driving, and when sitting for prolonged periods at home.

OUTCOMES

The patient was seen for a total of 11 visits over 10 weeks with an average of 1 visit per week. A home exercise program was emphasized during this period as described above in order to maintain and progress his improvements in function, while facilitating long-term resolution of symptoms. Treatment sessions toward the end of the plan of care focused on enhancing patient independence with seating and ergonomic modifications, including a newly ordered seating wedge. Considering the importance of this seating modification, it was necessary to assess his weekly progress and success with implementation of this modification.

Following the patient's participation in physical therapy, improvements were noted with overall function and tolerance to sitting, standing, bending, and walking activities. He experienced no associated back or leg symptoms during the day or with changes in position, which was his primary complaint during evaluation. A clinically significant change in function was noted on the ODI, an improvement of 16 points (MCID = 12 points)[28] following 6 visits over a span of 5 weeks. This improvement was maintained at 8-month follow-up. Global rating of change (MCID=2 points)[29] and patient satisfaction scores were assessed at time of discharge and 8-month follow-up. All changes in outcomes measures are noted in Table 1.

Per visual observation and patient report at the time of discharge, lumbar lordosis was improved, and more symmetrical weight bearing was exhibited in static standing. Limitations in ROM remained present due to non-modifiable restrictions in left hip motion; however, clinical improvements were seen in lumbar extension ROM (increase of 13°) and strength (4/5) (Table 2 and 3). In addition, joint mobility assessment was determined to be normal at L3-4 (3/6). The patient no longer displayed a positive SLR with dorsiflexion test on his left side. Patellar and Achilles' reflexes were normal (2+), myotomes were strong and intact, and sensation was normal and without discrepancies throughout both lower extremities.

DISCUSSION

The purpose of this case report was to highlight the limitations in the physical therapy management of a patient with radiating LBP status post hip arthrodesis and describe a modified extension-based treatment approach to manage this clinical presentation. The term "regional interdependence" has been used in the published literature with Wainner et al[30] describing the importance of this interrelationship among different regions of the body, as well as the importance of its consideration within standard evaluations in physical therapy. While this term may not be universally accepted or used among clinicians, an effort has been made to better describe the relationship between certain regions of the body, in particular the hip and lumbar spine, with regards to patients with a primary complaint of LBP.[9,11,12,13] Mobility deficits such as hip internal rotation loss have been associated as a key finding for hip osteoarthritis and for those patients likely to respond well to lumbar manipulation. The Academy of Orthopaedic Physical Therapy's LBP Clinical Practice Guidelines (CPG) have recommended incorporating assessment of hip ROM into the examination for individuals presenting with LBP.[6] Clinicians should consider linking deficits in hip ROM with more subacute and chronic cases of LBP with mobility and movement coordination impairments.

In regard to the patient described in the case report, he was classified within the subgrouping of acute (on chronic) LBP with radiating lower extremity pain per the LBP CPG's criteria.[6] However, there were also mobility deficits within his lumbar and thoracic spine due to his chronically flexed posture secondary to his left hip arthrodesis. The patient's compensatory trunk extension during ambulation correlated with lower lumbar spine hypermobility and his reduced left hip extension mobility. His protracted

history of LBP included a referral pattern of pain into his hip and post thigh; however, his most recent exacerbation radiated into his left lower leg and foot.

Standard treatment may involve addressing hip mobility to facilitate extension at the lumbar spine; however, this case needed to consider management of thoracic spine mobility, which may not routinely be limited in a patient with LBP. To address referred or radiating lower extremity pain, Delitto et al[6] recommend incorporating specific exercise to improve centralization of symptoms; in this case, lumbar extension. Previous research has described the positive prognosis and benefit associated with centralization and specific exercise.[16,17] Therefore, it was important with this case to consider all modifications necessary to neutralize pelvic position and establish centralization and reduction or abolishment of symptoms, considering the improvement obtained during the initial evaluation. This was a significant challenge throughout the course of care. This required constant attention toward compensatory movements that would prevent lumbar extension including substitutions at the pelvis and thoracic spine. Examples of specific modifications to minimize these compensatory movements included prone press ups with the left hip in a resting, flexed position and the contralateral hip extended to neutralize the pelvis, and lumbar extensor strengthening with both hips maintained in a flexed position while bent over a wedge support. Standing lumbar mobilizations were performed with a mobilization belt in a staggered stance with the left leg in front to prevent pelvic and thoracic compensation. Additional challenges included proper use of ergonomic modifications to ensure optimum comfort and efficiency while working. Finally, consistent patient performance of a home exercise program was essential to minimize any regression in function. The patient's symptoms improved significantly in a relatively short period of time, but the focus on full participation and independence with a home program and ergonomic positioning were of utmost importance considering his prolonged history of LBP. To address this component, additional visits toward the latter half of his physical therapy episode of care were needed to establish long-term recovery. Given the patient's long-term reduction in hip mobility, moderate disability on the ODI, recurrent episodes of LBP, and the link between posture and his pain, the potential inter-regional relationship was highlighted between his limited hip mobility and the progressive development of LBP.

CONCLUSION

Future research should continue describing the role of impaired hip ROM in the onset and progression of LBP in order to establish effective methods to manage and/or prevent recurrences of back pain. Additional research to establish the prevalence of hip arthrodeses and LBP in older populations, especially in clinical settings that may see this specific population. Considerations for ergonomic modifications should be addressed for patients with more chronic symptoms and significant reductions in hip mobility, such as severe osteoarthritis or hip fusions that may limit capacity for normal seated positions. The importance of hip function in the presentation, prognosis, and classification of LBP should continue to be an area of focus to better enhance subgroupings of LBP, determine the most effective treatment, and determine the likelihood of success within physical therapy.

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SHORT-TERM MANAGEMENT OF A PATIENT FOLLOWING A BIOCARTILAGE ALLOGRAFT OF THE TALAR DOME: A CASE REPORT

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Interpreting the Modified Low Back Pain Disability Questionnaire in a Patient with Chronic Low Back Pain

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ABSTRACT

Background: Low back pain (LBP) is one of the most prevalent and expensive health care problems in the United States. The purpose of this case report is to describe a patient's perception of the meaning in the use of the Modified Low Back Pain Disability Questionnaire (MLBPDQ) in the physical therapy management of a patient with LBP. **Case Description:** A 60-year-old female retired nurse was referred to the clinic for LBP greater than 10 years. An MLBPDQ was administered prior to her physical therapy evaluation, and again at the 10th visit. **Outcomes:** At reassessment, the patient reported a 2-point increase in her MLBPDQ, despite subjective reports and objective measures indicating improvement. Upon further investigation, she reported fear of discharge based on the MLBPDQ. After education of the discharge process, the MLBPDQ was administered again demonstrating a clinically meaningful change with a 50% reduction from her initial evaluation. **Discussion:** Outcome measures are collected as part of standard practice; however, clinicians need to be aware of factors that influence patient responses. Developing ways to review outcome measures may be important when using them to assess patient status and while establishing patient-related goals.

Key Words: low back pain, outcome measures, patient education

BACKGROUND AND PURPOSE

Low back pain (LBP) is one of the most common causes of disability among adults in the United States.[1,2] In order to accurately assess the effect of interventions for patients with LBP, professionals need to routinely use objective standardized outcome measures that are both valid and reliable. Several outcome measures have been recommended by expert panels to monitor patient response to interventions for LBP, one of which is the Modified Low Back Pain Disability Questionnaire (MLBPDQ).[3,4] The MLBPDQ is a self-report outcome measure that has acceptable validity, reliability, and responsiveness to change in status over a patient's episode of care.[1,3,4] The purpose of this case study is to describe a patient's interpretation of the meaning in the use of the MLBPDQ in physical therapy.

CASE DESCRIPTION

Patient History and Systems Review

A 60-year-old female retired nurse was referred to the clinic for chronic LBP of greater than 10 years duration. The initial injury occurred in a clinical setting while lifting a patient when at work. She had previously undergone L2-3 lumbar fusion, L2-3 discectomy and L3-5 laminectomy several years prior to her physical therapy evaluation, which were not effective in relieving her LBP. Hence, approximately 5 years later she underwent a L3-S1 fixation with hardware removal one year afterwards. Upon initial examination and at re-examination (visit 10), she completed the MLBPDQ.

Symptoms were reported as a "frozen" sensation. Pain on the numeric pain scale was reported as 1/10 at best, and 8/10 at worst. Aggravating factors included prolonged standing, ambulation, bending over to clean, and negotiating stairs and curbs. The patient did not report any alleviating factors.

Examination

The examination was structured based on the LBP guidelines,[2] following the patient client management model. She did not present with any red flags. The MLBPDQ was used per recommendation of the guidelines. Objective findings are located in Table 1.

Clinical Impression

The patient presented with chronic LBP with related generalized pain, per the LBP clinical guidelines.[2] This impression was made based on the findings from the subjective and objective findings as presented above in Table 1. Her pain had been present for over 10 years. The patient did not have relief of her LBP with surgical, conservative, holistic, and pharmaceutical management. Her response to treatments were partially due to poor adherence to these treatment plans. She presented with thoracolumbar hypomobility, decreased lower extremity strength and muscle endurance, poor balance, an impaired gait pattern, increased pain with movement, poor tolerance to prolonged walking, prolonged standing, and tenderness to palpation. Positive factors on her prognosis included the patient's age, absence of red flags, a supportive family environment, and her health literacy. Negative factors included poor adherence to her home exercise program in the past, co-morbidities, and the chronicity of her symptoms.

Intervention

Treatment frequency was planned to be twice weekly for 8 weeks. The interventions (Table 2) were chosen based on the initial evaluation, and guided based on her goals and prior level of function.

Stage one interventions were introduced to reduce her fear of movement. Transfer training also occurred early, to allow her to improve her ability to get in and out of bed at home. Patient education occurred during all three stages, however, this phase included frequent education for her and her spouse about the importance of home exercise adherence to continue to allow her to return to an independent state.

Stage two included a progression of strengthening interventions, as she now was able to demonstrate an improved lumbosacral posture with reduction of her genu recurvatum and anterior pelvic tilt without support of the table. She performed most of her home exercise program in standing in her home swimming pool. Thoracic mobilizations were attempted due to manual therapy being a strong recommendation based on clinical practice guidelines for patients with LBP receiving physical therapy,[2] However, the patient was not able to tolerate the mobilizations. Various balance activities were also implemented using the mirror for visual feedback to reduce lateral trunk flexion compensations.

Table 1. Initial Data for the Examination Findings and Functional Outcomes

Test	Initial
Blood Pressure	123/78 mmHg
HR	59 bpm
BMI	38.19
Posture	Increased thoracic kyphosis, anterior pelvic tilt, bilateral knee genu recurvatuum, external femoral rotation
Gait	Antalgic, slow pace, reduced arm swing bilaterally, reduced pelvic rotation; no assistive devices
Lumbar Active ROM, degrees, inclinometers	
Flexion	15°, reproduced pain
Extension	18°, reproduced pain
R Flexion	10°, reproduced pain
L Flexion	10°, reproduced the most pain
Hip Active ROM	
R Internal Rotation	5°, asymptomatic
L Internal Rotation	30°, asymptomatic
Strength	
Hip extension	3/5 bilaterally
Gluteus maximus	3/5 bilaterally
Hip abduction	4/5 bilaterally
Hip adduction	4/5 bilaterally
Hip ER (sitting)	4-/5 bilaterally
Hip IR (sitting)	R 3-/5, L 4/5
Flexibility tests	
Thomas	Positive bilaterally
Ober	Positive bilaterally
FABER	Negative bilaterally
90/90	Negative bilaterally
Spine provocation tests	
Segmental mobility	Hypomobile T1-T7
ASLR	Negative bilaterally
Slump	Negative bilaterally
Modified Trendelenburg	Positive bilaterally
Transfers	Modified independent, requiring increased time to perform
5x sit-to-stand	30 seconds, unassisted, from 16 inch surface
Balance	
Single leg stance (seconds)	R: 5, L: 3
Neurologic Screen	
LE dermatomes	Intact L1-S2
LE myotomes	Intact, L1-S2
Clonus	Negative
Babinski	Negative

Abbreviations: HR, heart rate; BMI, body mass index; ROM, range of motion; R, right; L, left; FABER, flexion abduction external rotation; ASLR, active straight leg raise; LE, lower extremity

In stage 3, interventions progressed to transfer training to meet her goals of painfree activities. She practiced postures for vacuuming, lifting, and reaching into low cabinets. Interventions were function based involving various household activities that included lifting and moving various objects of different weights, stand-to-floor transfers, as well as unilateral lifting and carrying to assist with carrying groceries.

OUTCOMES

At the initial visit, the patient's MLBPDQ score was 48% for disability (Table 3). After 10 visits, one month later, although the patient had met 5/6 of her initial goals for therapy with almost full return to independence with home and recreational activities; she reported via the MLBPDQ that she was 50% disabled (Table 3). When asked about the discrepancy between the MLBPDQ results and her subjective reports, the patient reported she had not truthfully answered as she was concerned that if she improved, she would be "kicked out of therapy" by her insurance company. Furthermore, functional G-codes were being used to report the patient's functional limitations, and to develop goals for her plan of care. The patient in this case report was aware of the reporting system and limitations of her insurance from previous physical therapy visits. She admitted that she felt as if too much improvement would result in removal from her receiving physical therapy earlier than planned. She was also aware that patients are discharged when they are not continuing to make progress, from her time as a health care provider.

After acknowledging the patient's concerns, she was informed about the use of outcome measures in physical therapy, including how outcome measures are used to assess progress. She was further educated that outcome measures play only a small role in the discharge process, and that other factors are included in this decision, such as if these findings matched the patient's subjective report and goals.

Following this discussion, the patient was asked to fill out the MLBPDQ based on her current status. This MLBPDQ score was calculated to be 24 points, a 50% reduction from the initial score (Tables 3 and 4). This was interpreted as a meaningful change in status when compared to the initial score as it exceeded recommendations for minimally clinically meaningful changes.

DISCUSSION

Outcome measures meet the needs of clinicians who measure the effectiveness of interventions for patients receiving physical therapy. The MLBPDQ has been recommended for use in detecting change in patients with LBP.[2-4] This case presents a possible limitation in the use and interpretation of outcome measures, such as the MLBPDQ for patients with LBP receiving physical therapy. The patient's perception of the purpose and interpretation of findings of the MLBPDQ in this case influenced her response. It is important to consider patient perceptions when using outcome measures. It may be beneficial, based on this single case study, for clinicians to provide the patient with information about the usefulness and purpose of the outcome measure being used. Physical therapists may consider including outcomes measures as part of the informed consent process so that patients understand progress toward goals. Previous research

Table 2. Intervention by Treatment Stage

Stage	Interventions
One	Active assist lumbar range of motion, supported strengthening (supine, sidelying), pelvic tilts, transfer training, patient education
Two	Standing strengthening activities, balance interventions, thoracic mobilizations (attempted, unsuccessful), patient education
Three	Training for heavy household activities, initiated walking program for recreation

Table 3. Modified Low Back Pain Disability Questionnaire (MLBPDQ)

Section	Pre-Discussion MLBPDQ	Post-Discussion MLBPDQ
Pain intensity	3 /5	1 /5
Personal care	2 /5	1 /5
Lifting	4 /5	3 /5
Walking	3 /5	1 /5
Sitting	2 /5	1 /5
Standing	3 /5	1 /5
Sleeping	2 /5	0 /5
Social life	2 /5	1 /5
Traveling	3 /5	2 /5
Employment/Homemaking	1 /5	1 /5
Total	50%	24%

Table 4. Outcome Measures for the Patient throughout the Episode of Care

Instrument	First Session	Final Session	Final Session After Discussion	Change	Minimally Clinically Important Difference
Oswestry Disability Index (0-100)	48%	50%	24%	50%	10-12[3]
Numeric Pain Rating Scale (0-10)	8/10 LBP	1/10 LBP		7 points	1.0-2.0[3]

indicates that physical therapists' process for providing informed consent may not be comprehensive.[5-7]

Accordingly, physical therapists may require additional education in collaborative-shared decision making around outcomes assessment. Patient education on the use and purpose of outcome measures is vital to ensure accuracy of reporting change. Furthermore, changes in outcome from standardized measures should be correlated with subjective and objective information when making decisions regarding patient progress.

CONCLUSION

The present health care environment emphasizes the use of patient-centered outcomes.[8] This case study identifies a limitation of the use of these measures in clinical practice from the patient's point of view. Although patient-reported outcomes are meant to be a self-report of a patient's health condition without interpretation of one's response by a health care provider,[9] clinicians may need to discuss how they use and interpret these measures with their patients in order to obtain an honest and meaningful response. As outcome measures are essential for determining an individual patient's response to care, limitations of these measures need to be addressed in order to improve patient management. Future research should consider patient perceptions on the use of outcome measures to be able to address these limitations throughout the episode of care. Considerations should also be made to determine the interpretation of their use by health care providers.

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Wooden Book Reviews

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Book Review Editor

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

Clinical Education in Physical Therapy: The Evolution from Student to Clinical Instructor and Beyond, Jones & Bartlett Learning, 2020, $90.95
ISBN: 9781284032284, 287 pages, Soft Cover

Author: Stern, Debra F., PT, DPT, DBA; Rosenthal, Rebecca, PT, DPT, JD

Description: This book prepares students and clinicians to be clinical instructors or site coordinators of clinical education. It covers topics such as the expectations of a clinical instructor in clinical education, varying models of education, how to establish clinical education goals, and elements of an affiliation agreement. **Purpose:** The authors' intent was to compile various resources for educational programs into one book that was easy to read. This is an organized body of information that prepares physical therapy students and clinicians to become clinical instructors. **Audience:** The book is written as a resource for developing didactic material for educating students to be clinical instructors, physical therapy students, and clinicians interested in becoming clinical instructors or site coordinators of clinical education. The authors have extensive experience in education and one author is a physical therapist as well as a lawyer. **Features:** This book begins by discussing the background behind the need for such a resource, given accreditation standards to prepare students to be clinical educators. Other topics include the expectations of a clinical instructor, teaching strategies, learning contracts, affiliation agreements, and models of clinical education. At times, the book seems rather basic, while at other times, it seems written on an intermediate level. However, given that the purpose is to prepare students to be clinical instructors and clinical instructors to be site coordinators of clinical education, the comprehension level appears warranted. Although it covers some elements of managing a student that is struggling, it could provide more practical advice for readers preparing to be clinical instructors of potentially struggling students. Some chapters have cases, which provide a basis for good discussion, especially in a classroom setting. **Assessment:** To my knowledge, there is no other resource that comprehensively and exclusively covers the topic of clinical education in physical therapy. This is a good resource for educators, students, and clinicians who are clinical instructors or site coordinators of clinical education.

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PRESIDENT'S MESSAGE

Rick Wickstrom, PT, DPT, CPE

OHSIG is moving forward! This is a great time to engage and make a difference in occupational health physical therapy:

- Last month, we launched our task force to update our Current Concepts document on Regulatory Compliance in Occupational Health: Regulatory Compliance with participation of OHSIG members Sean Begley, Drew Snyder, Gwen Simons, Richard Bunch, and Alison Helmetsie.
- We still need a couple more volunteers to help update our Current Concepts document for the Role of the Physical Therapist in Occupational Health. We plan to launch this task force this fall.
- Our mentorship program is proceeding under Caroline Furtak's leadership. Carolyn will continue to nurture this program as the Chair of our new Membership Committee.
- Our Work Rehab CPG Writing Team led by Lorena Payne is continuing to finalize this guideline. We are thrilled that Lorena will continue her outreach initiatives on behalf of the OHSIG as the Chair of our new Practice Committee.
- We are excited to welcome Cory Blickenstaff and Marc Campo to our leadership team. Cory is the owner of Forward Motion Physical Therapy, which is a private practice based in Vancouver, Washington. He will be serving as our AOPT OHSIG Communications Chair. Marc is Professor of Physical Therapy at Mercy College in Dobbs Ferry, New York. He will be serving as our AOPT OHSIG Research Vice Chair.
- Our Vice President, Brian Murphy, has re-scheduled a free webinar presentation for OHSIG members on "The Age of Exoskeletons" by Matthew Marino of Briotix Health on September 11th at Noon CST. This will be an inspiring and cutting-edge presentation!
- I am looking forward to participating in the AOPT Strategic Planning Meeting this October.

If you have any ideas or suggestions for us to consider, please reach out to me or any of our officers listed on the OHSIG web page: https://www.orthopt.org/content/special-interest-groups/occupational-health.

Finally, in this issue of *Orthopaedic Physical Therapy Practice*, the OHSIG is pleased to introduce an article that offers a fresh perspective about methods that distinguish anatomic impairment from occupational disability. It was a pleasure collaborating with Steve Allison to review the current status of diagnosis-based impairment rating and propose a simple model to quantify the severity of occupational disability after an injury or illness. Our proposed framework for matching validated worker abilities to job demands is relevant to a physical therapist's fundamental role of examining and alleviating participation barriers that limit work or other lifestyle activities. Enjoy!

Differentiating Between Anatomic Impairment and Occupational Disability

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The relationship between impairment and disability has long been a confusing and controversial topic. The International Classification of Functioning Disability and Health (ICF) defines impairment as a loss or abnormality in body structure or physiologic function; whereas disability is an umbrella term that is used to describe the negative aspects of impairments, activity limitations, and participation restrictions that result from having a health condition.[1]

AMA GUIDES TO EVALUATE PERMANENT IMPAIRMENT

The *AMA Guides to the Evaluation of Permanent Impairment* ("Guides"), is an established method for rating the severity of impairment in the United States, Canada, Australia, New Zealand, Hong Kong, Korea, The Netherlands, and South Africa. The first edition of *A Guide to the Evaluation of Permanent Impairment of the Extremities and Back* was published in 1958.[2] An impairment rating is typically done after an injured worker reaches a functional plateau in recovery (maximum medical improvement), in order to justify an award of disability benefits or other financial compensation.[3]

The most recent 6th edition of the Guides was introduced in 2007.[3] This revision was intended to address criticisms of previous versions by Spieler et al[4] that:

- the Guides fail to provide a comprehensive, valid, reliable, and evidence-based rating system,
- impairment ratings did not reflect perceived and actual loss of function, and
- ratings were more representative of "legal fiction than medical reality."

To address the criticism of inadequate attention to functional assessment, the 6th edition of the Guides incorporates use of standardized, orthopedic functional questionnaires to "subjectively" assess an individual's perceptions about of pain and function during activities of daily living (ADLs). This edition also adopted the ICF conceptual framework for disablement by applying a functional classification to impairment grids that is similar to the 0-4 ICF scale for capacity and performance qualifiers.

Unfortunately, the controversy about using impairment ratings as a basis for financial compensation after an injury has only escalated since release of *AMA Guides to the Evaluation of Permanent Impairment, 6th edition* in 2007. Numerous court challenges, legislative bills, Congressional hearings, debates, and publications have questioned whether the 6th edition of the Guides provides a more

reliable or valid rating of severity for given health conditions in workers' compensation systems.[5]

States have been slow to adopt the 6th edition of the Guides, citing complaints that the 6th edition is overly complex, lacks evidence-based methods, and rarely yields consistent ratings.[6] Since the Guides were first introduced, there has been limited research to assess for reliability[7-9] or validity.[7,10-11] Nitschke and colleagues[8] found poor intra- and interrater reliability for the AMA dual inclinometer range of motion method that is used to estimate impairment of subjects with chronic low back pain. Only two research studies have investigated the 5th edition (2001) and 6th edition (2007) of the Guides. Forst et al[9] compared impairment ratings for back injury cases and reported that the 6th edition produced lower impairment ratings and lower reliability correlations than the 5th edition. Busse et al[12] also found a substantial reduction in impairment ratings for the 6th edition, when compared to the 5th edition of the Guides.

AMA GUIDES WERE NOT INTENDED TO MEASURE OCCUPATIONAL DISABILITY

When an impairment results in work participation loss, this is referred to as occupational disability. Authors of the 6th edition of the Guides state that the Guides are not designed to be used as a direct estimate of work participation restrictions that relate to a specific job or occupation.[3] They define *impairment rating* as "consensus-derived percentage of loss of activity reflecting severity for a given health condition, and the degree of associated limitations in ADLs." Within this context, ADLs refer to basic self-care activities such as feeding, bathing, personal hygiene, and dressing. The Guides further note that most physicians are not trained in assessing the full array of human functional activities and participations that are required for comprehensive disability determinations.[3]

FUNCTIONAL CAPACITY EVALUATION

A content-valid functional capacity evaluation (FCE) may be used to provide a more valid measure of occupational disability. A best practices guideline for FCEs was published and adopted by the American Academy of Orthopaedic Physical Therapy of the American Physical Therapy Association on April 30, 2018.[13] The FCE guideline provides recommendations relative to the proper design, administration, and interpretation of FCEs and qualification standards for FCE examiners. This defines an FCE as a comprehensive performance-based medical assessment of an individual's physical and/or cognitive abilities to safely participate in work and other major life activities.

A CONCEPTUAL FRAMEWORK FOR MEASURING OCCUPATIONAL DISABILITY

To assess a worker's occupational physical disability, the worker's residual physical abilities may be compared to the physical demands of the job or occupation performed at the time of injury. This approach addresses a major criticism that an anatomical impairment rating derived with the Guides is not appropriate to quantify severity of loss in work participation after an injury or illness.

Different methods and job-match factors have been used by FCE examiners to quantify the severity of occupational disability. Job matching is preferred in the workers' compensation system to facilitate job accommodation and rehabilitation programs, whereas occupation matching is preferred to justify eligibility for Social Security or long-term disability benefits. Occupation matching is complex and controversial because only limited data exists about the physical demands and environmental conditions for occupations in the O*NET system that replaced the Dictionary of Occupational Titles (DOT) after its last update in 1991.

The Bureau of Labor Statistics (BLS) is conducting an Occupational Requirements Survey (ORS) to gather current data regarding physical demands; environmental conditions; education, training, and experience; as well as cognitive and mental requirements for jobs in the U.S. economy. This survey is conducted under an agreement with Social Security Administration to meet the needs for decisions in their disability programs. BLS has developed a data collection manual for ORS survey methods used to assess occupational requirements of jobs in order to populate a new Occupational Information System (OIS) to replace the DOT.[14]

Applying Worker-Job Match Factors to Assess Occupational Disability

To illustrate how permanent "anatomic" impairment as currently determined by the Guides relates to an injured worker's occupational disability for specific jobs, let's apply the job-match factors recommended for the ORS to the scenario of the injured worker with a full-thickness rotator cuff tear with loss of motion and chronic pain in their dominant right upper extremity.

According to the Guides 6th edition (Table 15-5, page 403), the upper extremity impairment based on this diagnosis could range from 1% to 13%, depending on how the examiner applies adjustment factors for functional history, physical examination, and clinical tests to identify the appropriate grade for an impairment class.[3] For the purpose of this example, let's assume the injured worker has a 10% right upper extremity impairment as a result of their rotator cuff injury with a mild loss of motion and chronic pain. Using Table 1-11, page 420, the 10% rating of impairment for the right upper extremity is converted to a 6% impairment of the whole person. When multiple diagnosis-based impairments exist, the examiner uses Appendix A Combined Values Chart on pages 604-606 to combine the results.

Calculating a 10% impairment of the right upper extremity or 6% impairment of the whole person does not determine whether the injured worker has an occupational disability that interferes with the ability to safely perform their specific job or occupation. This consensus-derived estimate of anatomical impairment was intended by the authors of the AMA Guides to reflect the severity of associated limitations in non-occupational activities of daily living (ADLs).[2] The physical demands of the job must be compared to the worker's functional abilities to analyze the severity of occupational disability after injury or illness. The percentage of occupational disability may be determined by calculating the number of unmatched physical factors as a percentage of all compared factors. This method of analysis yields different results for matching with a low physical demand occupation such as an office clerk job, compared to a medium demand occupation such as a construction electrician. In Table 1, the following equation was used to quantify occupational physical disability:

Physical Disability % = Number of unmatched physical factors (NOs) / Total factors * 50%

A 50% multiplier was applied in this proposed conceptual framework because the scenario presented in Table 1 only considered physical job match factors that relate to work participation

Table 1. Example of Worker-Job Match Analysis to Quantify Occupational Disability

Lift/Carry Factors	**Worker Ability**	**Office Clerk**	Match?	**Electrician**	Match?
Constant Lift/Carry	10 lb	0 lb	Yes	5 lb	NO
Frequent Lift/Carry	20 lb	1 lb	Yes	25 lb	NO
Occasional Lift/Carry	30 lb	10 lb	Yes	50 lb	NO
Work Posture Factors	**Worker Ability**	**Office Clerk**	Match?	**Electrician**	Match?
Climb Ladders	Occasional	Not present	Yes	Frequent	NO
Finger Manipulation	Constant	Frequent	Yes	Constant	Yes
Keyboarding	Constant	Constant	Yes	Not Present	Yes
Low Work Postures	Occasional	Not present	Yes	Frequent	NO
Reach Overhead	Occasional	Not present	Yes	Frequent	NO
Sitting	Constant	Constant	Yes	Occasional	Yes
Standing/Walking	Constant	Occasional	Yes	Constant	Yes
Occupational Physical Disability		0 NOs/10 * 50% = **0%**		5 NOs/10 * 50% = **25%**	

loss. A similar approach could be used to quantify occupational cognitive disability, when the worker suffers work participation loss due to medical conditions such as a traumatic brain injury. The worker's cognitive abilities could be matched to the cognitive demands of the job/occupation to quantify the functional impairment due to cognitive factors such as decision-making/reasoning, people interactions, spoken communication, and written communication.

As illustrated in Table 1, the injured worker has a 0% occupational disability as it relates to the physical demands for the *Office Clerk* job/occupation. In this example, the injured worker has retained the functional abilities to safely perform all required physical demands and therefore should experience no loss in wages as a result of the injury. In contrast, the injured worker has a 25% occupational disability as it relates to the physical demands for the *Electrician* job/occupation, because of being unable to safely meet 5 out of 10 physical demands.

RECOMMENDATIONS

There is clearly a significant difference in the severity of the injured worker's occupational disability when job loss occurs, even though the permanent right upper extremity "anatomic" impairment as derived by the Guides methodology remained static at 10% regardless of the type of work the injured worker performed.

The proposed job/occupation match method would use the results from a best practices FCE to provide a valid framework and standardized methodology for assessing the severity of an injured worker's occupational disability. This same function-based approach can also be used to assess an individual's loss in participation in common activities of daily living outside of work that is referred to as lifestyle disability.

One way to integrate with a future version of the AMA Guides would be to determine a whole person impairment based on a diagnosis-based method (eliminating the ROM method since functional measures obtained during an FCE will capture functional loss due to ROM loss) and combine (using the combined values chart) the diagnosis-based impairment value with a function-based impairment value based on a functional job match to quantify occupational disability, lifestyle disability, or some combination thereof.

For the example presented, the injured worker with a 10% diagnosis-based upper extremity impairment and 6% whole person impairment for full thickness rotator cuff tear would have a 25% function-based impairment for employment as an Electrician, based on consideration of occupational disability. The 6% diagnosis-based anatomical impairment of the whole person could be combined with the 25% functional impairment due to occupational physical disability to produce a total whole person impairment of 30% using the Appendix A Combined Values Chart.

If this same individual had 0% function-based impairment for employment as an Office Clerk, his or her impairment would be limited to the diagnosis-based method which in this example was 10% upper extremity or 6% whole person. This same methodology could be used to quantify ADLs disability outside of work as we have discussed before based on the results of an FCE by a qualified FCE examiner. This approach could be used to validate AMA methodology for anatomical impairment ratings, as well as to combine physical and cognitive participation losses in work and home/leisure activities.

In conclusion, it is evident that the AMA Guides methodology in its current form does not provide a fair or valid framework that reflects the severity of an injured worker's occupational disability. Therefore, diagnosis-based, anatomic impairment ratings should not be used in workers' compensation systems as the sole basis for awarding disability benefits or financial compensation to injured workers. Hopefully, future editions of the AMA Guides will incorporate an objective and function-based impairment methodology that will more accurately reflect the severity of an individual's functional impairments as they relate to work and other common activities of daily living.

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CSM

2019	2020	2021
National Student Conclave: October 31-November 2, 2019 Albuquerque, NM	CSM: February 12-15, 2020 Denver, CO AOM: April 3-4, 2020 Minneapolis, MN	CSM: February 24-27, 2021 Orlando, FL

President's Letter

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

Mission Statement

The mission of the Performing Arts Special Interest Group (PASIG) is to be the leading physical therapy resource to the performing arts community.

Vision Statement

Advancing knowledge and optimizing movement and health of the performing arts community through orthopaedic physical therapist practice through the following guiding principles:

- *Identity*
- *Quality*
- *Collaboration*

CSM 2020 will be my last as your PASIG President. As I look forward to the next part of the journey, I have good news: we have replenished our encumbered funds! We have a current balance of $4,893.40 from pre- and post-conference courses. We hope to continue to replenish and then provide another research scholarship. We have $2,059.31 of our 2019 non-rolling funds to date. As I look back on the past 6 years, I am glad for the work we have accomplished as a SIG, and count myself blessed to work alongside the outstanding, invested, active PASIG leadership team. We have met many of the goals we set out to do in support of our strategic plan. In terms of the guiding principles of identity, quality, and collaboration, we have funded a PASIG research grant, continue to provide student research awards, formed an active outreach committee, led the way in social media, connected and collaborated with other performing arts organizations, continue to provide monthly citation blasts and *OPTP* material, held pre and post-conference courses in addition to our main programming at CSM, and connected members with specific interests such as pre-professional dance screening and fellowship education. One of the unforgettable highlights of the past 2 terms has been the development of the Fellowship Taskforce and the creation of the *Performing Arts Description of Fellowship Practice*. From the creation of this document, we now have 4 Performing Arts Fellowships! The next section highlights these fellowships. Please consider your part in the shaping of our profession via Performing Arts Fellowships in the years to come. Congratulations to the founding faculty and fellows! Well done.

I reached out to the performing arts fellowships with frequently-asked questions and here is what they said:

The Performing Arts Fellowship at The Ohio State University Wexner Medical Center

American Board of Physical Therapy Residencies and Fellowship Education (ABPTRFE)-accreditation status: accredited

Q: Can you tell me about your fellowship?

The Performing Arts Fellowship at The Ohio State University Wexner Medical Center is a 12-month program that combines clinical mentoring, didactic coursework, research, and independent practice in order to develop expert performing arts clinicians. We partner with local professional performing arts companies and schools to provide a wide variety of performing arts experiences to our fellow, including dance, music, figure skating, and gymnastics. These combined experiences allow our fellows to develop their own expert practice in the clinic, onsite, and backstage. The Performing Arts Fellowship at The Ohio State University Wexner Medical Center achieved accreditation by the American Board of Physical Therapy Residency and Fellowship Education (ABPTRFE) in 2018.

OSU Performing Arts Fellowship Faculty

Q: What are the pre-requisites/experiences/credentials needed to apply?

Interested candidates must:

a. Be eligible for physical therapy licensure in the state of Ohio.
b. Have successfully completed an accredited orthopedic or sports residency program and/or a current specialist certification from the ABPTS in sports or orthopedics.
c. Have a background in one of the performing arts disciplines (dance, music, figure skating, and/or gymnastics).

Q: What is the next application deadline?

Our next application deadline is March 1, 2020. Interested candidates should reach out to our program director, Tiffany Marulli (Tiffany.Marulli@osumc.edu), with any questions.

Q: Can you provide contacts for current fellows and alums?

Tessa Kasmar – 2018 Program Graduate:
Tessa.Kasmar@osumc.edu
Morgan Alexander – 2019 Fellow-in-Training:
Morgan.Alexander@osumc.edu

Dr. Tessa Kasmar, DPT, 2018 program graduate & Dr. Morgan Alexander, DPT, 2019 Fellow-in-Training

Q: Can you provide a fellow's reflection of their experience to date?

Tessa Kasmar Reflection (2018 Fellowship Graduate): "Throughout my experiences in the Performing Arts Fellowship, I have been able to advance my ability to combine rehab goals with artistry in order to meet the needs of a variety of performing artists. I have improved my ability to provide education to performing artists on injury prevention and injury management as well as formulate relationships with performing arts groups in the community. My education from the fellowship has assisted me in becoming a sub-specialized clinician with a focus on the treatment and management of dancers across the lifespan and allowed me to become a mentor and faculty member for future fellows-in-training. I feel much more confident working with all performing artists and meeting the unique demands and aesthetics of their art."

Morgan Alexander Reflection (Current 2019 Fellow-in-Training): "To be The Ohio State University Performing Arts Medicine Fellow-in-Training has been a dream come true. It has been truly fulfilling to merge my background and passion for performing arts with my professional career. The faculty has extensive knowledge and years of experience in rehabilitation of the performing arts population that is unique and requires special considerations. This experience has truly been invaluable!"

The Columbia University Programs in Physical Therapy and West Side Dance Physical Therapy Performing Arts Physical Therapy Fellowship

ABPTRFE-accreditation status: candidate

Q: Can you tell me about your fellowship?

The mission of the CUIMC/WSDPT Performing Arts Physical Therapy Fellowship is to develop and graduate practitioners that will serve the profession and society as leaders in performing arts rehabilitation and wellness through teaching, administration and/or research; enhanced by advanced clinical reasoning skills, high ethical standards, and the highest standards of compassionate clinical care. The clinical fellowship program's goals and objectives are directed toward an in-depth mentored experience in the management of dancers and performing artists across the lifespan and are based on the Performing Arts Description of Fellowship Practice (DFP). This is achieved through professionally mentored patient care experiences and independent patient care, didactic education, mentored teaching opportunities, and participation in research.

The CUIMC/WSDPT Performing Arts Fellowship will provide a diverse and dynamic environment for post-graduate fellowship study, practice, and research, featuring opportunities to work with elite dancers from the world renowned, New York City Ballet (NYCB) and the School of American Ballet (SAB).

Q: Can you provide contacts for current fellows and alums?

New fellow will begin in September 2020

Q: What is the next application deadline?

April 1, 2020

Q: What are the pre-requisites/experiences/credentials needed to apply?

Qualified candidates will be experienced physical therapists meeting the following requirements:

1. Licensed or eligible for licensure in the state of New York.
2. A minimum of two years of clinical practice in orthopedics.
3. Eligible candidates should be board eligible or board certified in orthopedic or sports physical therapy.
4. Professional behaviors demonstrating interest in working with performing artists.

Q: What unique patient populations and practice settings do your fellows have exposure to?

New York City Ballet & School of American Ballet Theater as well as a private practice specializing in physical therapy for performing artists.

Q: What is a unique feature of your fellowship?

Hybrid model: Academic/Clinical Partnership Opportunity for mentored research, teaching, and clinical practice

Program Features:

160 hours of one-on-one mentorship with performing arts physical therapy specialists, consisting of:

- 120 hours at Westside Dance Physical Therapy
- 20 hours of event coverage at New York City Ballet
- 20 hours at School of American Ballet
- 840 hours of non-mentored clinical practice in performing arts physical therapy clinic (WSDPT)
- 150 hours of didactic curriculum provided by dance medicine professionals and Columbia faculty
- Research practicum and mentorship for a performing arts-based scholarly project to be disseminated to the professional community, eg, poster and/or platform presentation, publication in peer reviewed journal
- Teaching practicum and opportunity to teach and mentor entry level DPT students
- Community outreach with university dance programs and private studios

Q: How long is your fellowship?

10 months (Sept-June)

Q: Do you need to be a performing artist to be in the fellowship?

No, but should demonstrate a commitment/interest in working with performing artists

Questions may be addressed to the Fellowship's Director:

Laurel Daniels Abbruzzese, PT, EdD
Director, Performing Arts Physical Therapy Fellowship
Georgian Building, 3rd Fl.
617 W. 168th St.
New York, NY 10032
la110@cumc.columbia.edu

Harkness Center for Dance Injuries Performing Arts Fellowship
ABPTRFE-accreditation status: candidate

Q: Can you tell me about your fellowship?

As part of its 30th anniversary year, Harkness Center for Dance Injuries (HCDI) at NYU Langone Orthopedic Hospital is launching a Performing Arts Fellowship for orthopedic physical therapy specialists who wish to pursue advanced training in performing arts medicine. The HCDI has a long history of mentoring clinicians interested in specializing in dance medicine commencing with a mentorship program in the 90s. This program evolved into a residency program from 2015-2018 and is now transitioning to a fellowship program. This 12-month program provides the fellow with an intensive, individualized experience in performing arts physical therapy while working as part of the clinical team at the Harkness Center for Dance Injuries.

Q: What is the next application deadline?

September 30, 2019
Start date: January 2020

Q: What are the pre-requisites/experiences/credentials needed to apply?

- A doctor of physical therapy degree
- Current New York State physical therapy license
- Successful completion of an accredited orthopedic or sports residency program and/or possession of a current specialist certification from the ABPTS in orthopedic or sports
- A strong background in dance, figure skate, and/or musical performance and/or dance/music education

Q: What unique patient populations and practice settings do your fellows have exposure to?

- Dancers in New York City of all ages, styles and abilities including pediatric to geriatric, recreational to professional to retired
- Styles: musical theater, ballet, contemporary, tap, lyrical, figure skate, jazz, hip hop, aerial, circus, etc.

Q: What is a unique feature of your fellowship?

Harkness Center for Dance Injuries Performing Arts Fellowship provides:

- Over 150 hours of direct mentorship
- Over 200 hours of educational experiences
- Over 1,200 hours of clinical experience working directly with performing artists and the center also provides multiple opportunities in the following:
- Injury Prevention Assessments to NYC dancers
- On-site physical therapy services to Broadway theaters and dance companies,
- Injury prevention workshops
- Surgery observation
- Direct observation with our team of 5 dance medicine physicians
- Dance medicine research

Dr. David Weiss, MD, Harkness Center for Dance Injuries

Q: How long is your fellowship?

12 months: January-December 2020

Q: Do you need to be a performing artist to be in the fellowship?

You need to have a strong background in dance, figure skating, or musical performance and/or education/training

Q: Are there any other FAQs you encounter, with your answer.

This position is a salaried, fully benefitted position as a full-time employee of NYU Langone Health Center

Questions may be addressed to the Fellowship's Director:
Suzanne Semanson, PT, DPT, OCS, CMPT, RYT
Performing Arts Physical Therapy Fellowship Director,
Clinical Specialist
Board Certified Orthopedic Physical Therapist
Harkness Center for Dance Injuries
614 2nd Avenue, Floor 2, Suite G • New York, NY 10016
e: Suzanne.semanson@nyulangone.org
p: 212-598-6054 • f: 212-598-7613

Johns Hopkins Hospital Performing Arts Fellowship
ABPTRFE-accreditation status: candidate

Q: Can you tell me about your fellowship?

The Johns Hopkins Performing Arts Physical Therapy Fellowship is a clinical-based program for experienced physical therapists seeking to specialize in performing arts. The mission of this program is to provide a structured, comprehensive program of clinical, didactic and research experience to develop advanced clinical skills and management for rehabilitation of performing artists, such as dancers, musicians, vocal artists, aerialists and figure skaters.

Dr. Andrea Lasner, DPT (at the barre) and Fellowship Coordinator, Amanda Greene, PT, DPT, COMT

Q: How long is your fellowship?

The program is an 18 month-long program with salary and full-time benefits. Fellows receive 200 hours of one-on-one clinical mentoring and a minimum 150 hours of didactic curriculum provided by performing arts medicine professionals.

Q: What is a unique feature of your fellowship?

Upon completion of the fellowship, the fellow will contribute to the performing arts research initiative to increase the evidence-based care for the performing artist as primary investigator of a topic of their interest in addition to supporting other current research initiatives in the department.

Q: Can you provide information on current fellows and alums?

Our current fellow-in-training, Monique DeLuca, PT, DPT, OCS, has recently started the programming here at Johns Hopkins early August 2019.

The program will take a new fellow-in-training every 12 months, with 6-month overlap of the fellows-in-training until completing the 18th month.

Q: What is the next application deadline?

Application deadline (through RF-PTCAS): January 31, 2020

Interview: March 2020 (an interview is required; in person preferred)

Program start: August 2020

Q: Do you need to be a performing artist to be in the fellowship?

Prerequisites: applicants must meet two of the following criteria: (1) performing arts background, (2) completion of an accredited physical therapy residency program, or (3) certification as a clinical specialist. In addition, applicants must have a valid Maryland physical therapy license or be eligible to obtain one.

For further questions, please contact Fellowship Director, Andrea N. Lasner, DPT at alasner1@jhmi.edu

Visit us for more information: http://hopkinsmedicine.org/pmr/performing-arts-fellowship

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CSM APTA Combined Sections Meeting
February 12–15, 2020
DENVER, CO

We hope to see you there!
http://www.apta.org/CSM/Registration/

In 2019 the FASIG approved a "Lifetime Achievement Award" to be given out annually to an individual or individuals who have a sustained contribution to the field of Foot and Ankle Physical therapy. Our first two outstanding candidates were presented their awards at the 2019 Combined Sections Meeting in Washington, DC. Drs. Tom McPoil and Mark Cornwall graciously accepted this award and also volunteered to provide a 25-year history of the FASIG. We have the great fortune to provide that history here from two of the founding members of the SIG. We hope that this history is helpful and invigorating to our FASIG membership as we pave a path forward in 2020.

Current FASIG Leadership

HISTORY OF THE FOOT & ANKLE SPECIAL INTEREST GROUP

Mark Cornwall, PT, PhD, FAPTA, and Thomas McPoil, PT, PhD, FAPTA

While the Foot and Ankle Special Interest Group (FASIG) was officially recognized by the Orthopaedic Section, now the Academy of Orthopaedic Physical Therapy (AOPT) at the 1995 Combined Sections Meeting held in Reno, Nevada, the first discussions regarding the formation of the special interest group (SIG) were actually initiated 3 years earlier. In August 1992, several therapists attending a plantar pressure research meeting in Flagstaff, Arizona, met to discuss the possibility of developing a Physical Therapy Foot and Ankle Study Group. Gary Hunt, one of the physical therapists who attended the research meeting, had already been chairing several roundtable discussion sessions for the Orthopaedic Section at past Combined Section Meetings. Since the Orthopaedic Section had already expressed interest in developing several "special interest" groups based on the popularity of the roundtable discussions, the therapists decided to approach the Orthopaedic Section about the possibility of developing a FASIG.

It is important to note that the physical therapists who spent a tremendous amount of time and energy to get the FASIG "off-the-ground" at this early stage were Mark Cornwall, Steve Rieschl, Michael Mueller, Irene (McClay) Davis, Debbie Nawoczenski, Margo Orlin, Michael Wooden, Max McLeod, Scott Straker, Jean DeBettignies, Gary Hunt, Joe Tomaro, Jim Birke, Catherine Patla, and Tom McPoil. While the interest for a FASIG was determined through phone calls and letters to other therapists over the next few months, the roundtable discussions continued at the annual Combined Sections Meeting in February 1993.

The first "unofficial" meeting of the FASIG took place in June 1993 at the APTA National Meeting in Cincinnati, OH. Approximately 30 physical therapists found a vacant room at the convention center and spent an hour and a half discussing what the purposes and functions of the SIG would be. It is very important to emphasize that at this first meeting, not only were there members of the Orthopaedic Section, but also members from the Geriatric, Sports, and Pediatric Sections. The therapists who attended this meeting wanted to see a "true" intersectional SIG since interest in this area was so high in several sections. At that time, Orthopaedic Section President, Annette Iglarsh believed that an intersectional FASIG could be accomplished even if the FASIG was housed under the Orthopaedic Section. With that knowledge, the therapists in attendance at the meeting in Cincinnati as well as many other therapists around the country with an interest in the foot and ankle went about the process of obtaining 200 signatures from current Orthopaedic Section members so that a petition to form the FASIG could be presented to the Orthopaedic Section Board of Directors at the 1994 Combined Sections Meeting in New Orleans.

At New Orleans, even though over 500 signatures were obtained in support of the FASIG, the Board of Directors asked for more time to investigate how they would manage the development and finances of several new SIGs, in addition to the FASIG that had petitioned to be formed and officially recognized by the Orthopaedic Section. While this was a bit disappointing for all of those therapists who had worked so hard to get the necessary signatures, Orthopaedic Section Treasurer, Dorothy Santi and Executive Director, Terri DeFlorian developed a standardized set of bylaws as well as a budget for all future Orthopaedic Section SIGs. Once the General SIG bylaws and budget scheme were passed by the Board of Directors, the FASIG could then be recognized officially.

The first official FASIG business meeting was held at the 1995 Combined Sections Meeting in Reno, Nevada. Also at the meeting, the first formal FASIG education session was held and provided CSM attendees with 3 hours of foot and ankle programming.

Over the past 24 years, the FASIG has continued to play an important role for Orthopaedic and other Section members who have a special interest in the foot and ankle. In addition to sponsoring programming on the foot and ankle each year at CSM, the FASIG has also sponsored several preconference instructional courses prior to the annual CSM. In May 2000, the first FASIG sponsored research retreat was held in Annapolis, Maryland. The focus of this first research retreat was the understanding of static and dynamic evaluation of the foot and ankle. The retreat was organized by the research chair, Irene Davis. The results of the research retreat were published in the *Journal of Orthopaedic and Sports Physical Therapy (JOSPT)*.

In response to the Orthopaedic Section's desire to develop physical therapy based Clinical Practice Guidelines (CPG), the FASIG played an important role in developing the first Orthopaedic Section CPG on Chronic Plantar Heel Pain, which was published in *JOSPT* in 2008. Another important milestone for the FASIG was the development of foot and ankle curriculum. In 2015, fifteen clinicians and academics were assembled at APTA headquarters in Alexandria, Virginia. These individuals included Clarke Brown, Stephanie Albin, Joseph A. Brosky, Jr, Mark Cornwall, Mary Hastings, Judy Hess, Jeff Houck, Christopher Neville, Steven Paulseth, Steven Pettineo, Margaret, Suzy Powers, Stephen Reischl, Byron Russell, Nancy Shipe, and Lisa Selby-Silverstein. Their task was to develop a document that would guide physical therapy educators regarding the educational objectives for entry-level content related to the foot and ankle. This important document is available on the FASIG web site at https://www.orthopt.org/content/special-interest-groups/foot-ankle/curricular-guidelines.

(Continued on page 245)

President's Message

Carolyn McManus, MPT, MA

If you are interested in expanding your knowledge and expertise in the diagnosis and treatment of pain, it is not too early to start making your plans for CSM 2020 in Denver, Colorado! The Pain SIG will sponsor two exciting educational opportunities. A 2-day pre-conference course, *Translating Science into Clinical Practice: A Pain Systems Approach to Treating those in Pain*, will provide a comprehensive examination of pain diagnosis and treatment with presenters, Mark Shepherd, PT, DPT, OCS; Derrick Sueki, PT, PhD; Carol Courtney, PT, PhD; Katie McBee, PT, DPT, OCS; and Carolyn McManus, MPT, MA. In addition, an interprofessional panel will present the Pain SIG educational session on *The Role of Physical Therapy in Opioid Tapering*. Presenters Sarah Brook Wenger, PT, DPT; Sara Tomaszewski, PT, DPT; Travis Cos, PhD; and Rebecca Vlam, MSS, LCSW, will provide an overview of the opioid crisis, and discuss opioid use, tapering, side effects, withdrawal, tolerance, dependence, and misuse. A model for clinical reasoning and practical strategies to help patients self-manage their pain, health, and support a successful opioid taper will be provided. I hope you will join us for one or both of these cutting-edge, informative programs!

In addition to planning for CSM 2020, the Pain SIG Board has continued with our priority strategic plan initiatives. Pain SIG Practice Chair, Craig Wassinger, PT, PhD, has continued his involvement in the development of the Clinical Practice Guideline (CPG) for Patient Education/Counseling to Treat Pain. The initial findings from the extensive guideline development process will be presented at CSM 2020 and a full written summary is planned to be in review or published in 2020. Just another reason to put CSM 2020 on your calendar!

Public Relations Chair, Derrick Sueki, PT, PhD, has continued his efforts to advance our initiative to establish a Pain Specialty and Residency/Fellowship. The initial phase, requiring the development, administration and analysis of a practice survey to determine a need for a Pain Specialization Certification and Residency/Fellowship, is underway. To successfully address the needs within our profession, Derrick has brought together physical therapy leaders from both clinical and academic settings with an interest in pain from a range of specialties, including orthopaedics, pediatrics, geriatrics, and neurology. This work group met in October 2019 to set their agenda and move forward with action items.

As you may know, in June 2018, the APTA House of Delegates passed a motion to endorse and promote the integration of the Interprofessional Pain Competencies and International Association for the Study of Pain (IASP) Physical Therapy Curriculum Guidelines into education, practice, and research initiatives, where feasible. There is now both interest and momentum to integrate the Pain Competencies and IASP Guidelines into DPT curriculum. Vice President and Education Chair, Mark Shepherd, DPT, OCS, is leading the Pain SIG activities in partnership with the APTA to work towards this goal. Stay tuned for updates!

I would now like to introduce you to PSIG member, Nancy Robnett Durban, PT, MS, DPT. Nancy received a Bachelor of Science degree in Physical Therapy from The Ohio State University, an Advanced Masters Physical Therapy degree in Orthopedics and Biomechanics from Virginia Commonwealth University, and a transitional Doctorate degree of Physical Therapy from the University of Montana. Nancy is a physical therapist at Cincinnati Children's Hospital and Medical Center in Cincinnati, Ohio, where she serves as the primary physical therapist and clinical coordinator in their Interdisciplinary Pediatric Chronic Pain Program. She is an adjunct professor at the University of Cincinnati Physical Therapy program where she teaches pain science in Pain Management and Treatment class. She is an Ohio Physical Therapy Association Delegate to the APTA House of Delegates and a member of the APTA Media Corps. Nancy is the past Vice President and Education Chair of the Pain SIG.

Pediatric Amplified Musculoskeletal Pain Syndrome

Nancy Robnett Durban, PT, MS, DPT

The purpose of this clinical commentary is to provide clarification on Pediatric Chronic Pain, specifically, Amplified Musculoskeletal Pain Syndromes (AMPS) and to look at the future of chronic pain.

PEDIATRIC CHRONIC PAIN

Pediatric chronic pain syndromes include benign limb pain of childhood, benign joint hypermobility, overuse syndromes, skeletal defects, back pain,[1] idiopathic pain (local and diffuse), chronic headaches, functional abdominal pain,[2] juvenile onset fibromyalgia,[3] complex regional pain syndrome (CRPS) type I and type II,[4] or pediatric chronic musculoskeletal pain (PCMP).[5] When the primary pain sensations associated with these conditions persist and intensify over time, they are considered to be amplified. There are two classifications under the umbrella of AMPS: pain which is localized and pain which is diffuse or widely spread.[1] Some would include complex regional pain syndrome (CRPS) type I and type II under the classification of localized AMPS,[1] as well as a number of other conditions. The clinical diagnosis of CRPS is based on the Budapest Criteria and the International Association for the Study of Pain Criteria.[6] Diffuse AMPS syndromes include juvenile fibromyalgia (JFM) or chronic widespread pain (CWP)[1] and PCMP.[5] The clinical diagnosis of JFM, CWP, and PCMP is symptom based and includes widespread pain in muscles or joints that has lasted longer than 3 months, and is accompanied by poor sleep, chronic fatigue, painful tender points, and often complicated psychosocial factors.[1,7,8]

AMPLIFIED MUSCULOSKELETAL PAIN

Amplified Musculoskeletal Pain is the name applied to conditions in which normal body sensations, even non painful sensations and "normal" types of acute pain, are intensified and result in pain perception. This pain can be severe and unrelenting.[9] The patient is not "amplifying" their symptoms in a volitional way, rather the

sensations are amplified in the central nervous system. The pain is constant and may vary in intensity, and is commonly referred to as being "out of proportion" to any known injury or pathology. Functional pain disorder is used to imply there is a disorder in the function of an organ or a tissue. Neil Schecter in his Viewpoint commentary[10] pointed out that "functional" pain can infer that the pain is of psychological origin. If "functional" is taken at face value it could imply that the pain is useful when in fact it is quite the opposite. When patients with amplified pain come into our clinics, they are anything but functional. For example, a patient can have functional behaviors not neurologically explained or gait problems as a result of the patient's perception of pain but, they truly do not have a functional neurological or functional gait disorder. Dr. Schecter goes on in his commentary to propose "primary pain disorders" as a term under which other syndromes such as AMPS can be categorized.[10] The International Association for the Study of Pain collaborated with the World Health Organization in developing the ICD-11 classification of chronic pain. Chronic pain syndromes are categorized into chronic primary and chronic secondary domains.[11] The chronic primary pain is defined as, "pain in one or more anatomical regions that persists or recurs for longer than 3 months and is associated with significant emotional distress or functional disability and that cannot be better accounted for by another chronic pain condition."[12,13]

It can be easily confusing for a clinician when complex pain diagnoses include peripheral, central, and sometimes sympathetic pain and fall under one umbrella term. Whether that term is amplified pain, functional pain, or primary pain disorder, patients can present with altered sensitization, peripherally and centrally. In the past this was referred to as central sensitization and is now referred to as nociplastic pain. The International Association for the Study of Pain defines nociplastic pain as "pain that arises from altered nociception despite no clear evidence of actual or threatened tissue damage causing the activation of peripheral nociceptors or evidence for disease or lesion of the somatosensory system causing the pain." The ICD-11 classifications of chronic pain and the definitions of chronic primary pain, shed light on better organization of chronic pain which in turn can help clarify under which umbrella or domain the chronic pain falls. Differential diagnosis will help to determine between primary and secondary pain conditions and guide treatment.[13]

CLINICAL IMPLICATIONS

Sharp et al[14] classifies central sensitization or nociplastic pain as that which has the following criteria: "pain that is disproportionate to the nature and extent of the injury or pathology; non-mechanical, unpredictable pattern, provocation to multiple/non-specific aggregating/easing factors; strong association with maladaptive psychosocial factors; diffuse/non-anatomic areas of pain/tenderness on palpation." Amplified Musculoskeletal Pain Syndrome is considered nociplastic pain. We know that these patients with a primary pain disorder of Amplified Musculoskeletal Pain are complicated and multifaceted. Treatment needs to reflect and address the complexity of these patients. Total or complete mitigation of pain may not be possible but, complete return to function and self-management should be the goal of treatment.[2] When treating pediatric patients with complex pain, the best practice includes the interdisciplinary approach.[1-3,5,15] The interdisciplinary team includes, but is not limited to, the pain physician (most often anesthesiologist, but also rehabilitation physician, neurologist, internist or rheumatologist), psychologist, physical therapist, occupational therapist, social worker, and nurse practitioner. Regular communication between all team members is vital since the patient is at the center of care and all are working towards the common goal of restoration of function. The basic biopsychosocial model of care has to be applied for success to be achieved. We cannot just focus on the biology, the anatomical/physiological aspect or the "tissue issue" of our patient. We have to treat the patient holistically and address psychological problems affecting pain. Clinical reasoning is not straight forward when working with pediatric patients with AMPS. The simple thought process of information collection, identifying red flags, evaluating pain mechanisms, assessing tissue mechanics, asking about function and participation and identifying psychosocial barriers (yellow flags) is complex. Mechanisms based classification of pain can help focus physical therapy treatment.[14] The goal of treatment is return of function; physically and psychosocially. A graded treatment approach is applied to all interventions. Best practice includes cognitive behavioral therapy, mindfulness, yoga, graded motor imagery (laterality, visualization, mirror therapy including desensitization), aquatics, progressive functional exercise, massage, graded progressive cardiovascular conditioning, TENS, education, self-management, biofeedback, meditation, sleep hygiene, nutrition management, hydration, alternative medicine, positive self-talk, music therapy, pet therapy, and virtual reality systems.[1-5,9,14]

THE FUTURE

The future of treating chronic pain is getting brighter. There is a much better understanding on how to approach treating and managing pediatric patients with chronic pain. The ICD-11 codes have a recognized pain and chronic pain as a global health concern.[13,16] This identifies the human right for health care systems to provide care for those in pain. These codes will help clinical practice and research in the future. A Point of View article by George and Bishop,[15] stimulates thought provoking speculative hypotheses for the treatment of chronic pain by "musculoskeletal-focused" physical therapists. These authors discuss brain-derived neurotrophic factor (BDNF), the roles of plasticity and automaticity, the future of emerging therapies such as transcranial magnetic stimulation, acute intermittent bouts of hypoxia in addition to aerobic exercise and the need for further research. The authors further state, "It is a reasonable hypothesis that using interventions shown to impact BDNF signaling in combination with established approaches may enhance the potential for plasticity in the nervous system such that chronic pain is less likely to develop." This concept will be exciting to follow in the future. Additionally, it must be considered that the future of pain management treatment may include more telemedicine appointments.

SUMMARY

Our comprehension of the biological and neurological complexities of Amplified Musculoskeletal Pain in the pediatric population is advancing. These patients can present with a multitude of pathophysiological signs and symptoms in such a way that no two patients are exactly the same. All this further complicated by the developmental processes of the pediatric patient, parental interaction and the educational system. What remains challenging is that there is no one comprehensive guideline for treatment. There is strong evidence that the interdisciplinary approach is needed to address the complexities of this patient population. As a profes-

sion, we are realizing the need to stretch beyond the biomedical model and to embrace a biopsychosocial pain model with the potential to more effectively address the multiplicity of factors that impact Amplified Musculoskeletal Pain.

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FOOT & ANKLE SIG

(Continued from page 242)

As the FASIG begins its 25th year, it continues to serve as an important and valuable resource for the Academy of Orthopaedic Physical Therapy members with a clinical and research interest in the foot and ankle.

Podcast by Christopher Neville, PT, PhD

Move Forward Radio: Foot Health: Avoiding Pain and Injury is available on APTA's Recent Podcasts (http://www.apta.org/Podcasts/).

Explore this and many other options today!

Social Media Changes

The AOPT recently changed its policy pertaining to social media outlets for the SIGs. Individual SIGs no longer have individual Twitter accounts, but rather operate within the AOPT's Twitter account: @OrthopaedicAPTA. Content specific for the Imaging SIG, however, is identifiable by looking for #PTImgSIG. We are still adapting to this change, but please consider looking for the Imaging SIG's hashtag for our specific information.

Scholarship

Hopefully, this does not arrive too late for you in getting the word out or your application submitted. The Imaging SIG is again making a scholarship to CSM available for those with accepted abstracts/proposals. This will be the third occasion on which a $500 scholarship will be awarded to encourage research toward imaging in physical therapy practice. Look on the AOPT's web site, then go to the Imaging SIG's pages to find the listing for the scholarship on the left side list. This will continue to be an annual event.

Webinars—Technical Content and Advocacy

In a joint effort with the Foot and Ankle SIG, our webinar series with the American Institute for Ultrasound in Medicine continues. On Thursday, December 5, at 1:00 – 2:00 p.m. EST, Karin Grävare Silbernagel, PT, ATC, PhD, will be presenting "Optimizing Treatment of Achilles Tendon Injuries Using Ultrasound Imaging." Please go to aium.org and look for "CME Center" at the top of the page and then select "Webinar Series" from the drop down menu to find the listing for this webinar. If you are unable to attend live, recordings of this and prior webinars are available on aium.org or also on AIUM's youtube channel. There is no cost to view the webinars.

By the time you read this, the webinar will have happened, but the recording is still available on the AOPT's website. Evan Nelson, Connie Kittleson, and Kip Schick presented "Strategies to Implement Direct Imaging Referral in PT Clinical Practice: The Wisconsin Experience" on Wednesday, October 2nd at 12:00 p.m. EDT. This team has put together a strong presentation highlighting the experience and insights of establishing radiography referral privileges as part of physical therapist practice in Wisconsin.

APTA Study on Imaging Referral Legal Authority

APTA will soon be releasing the results of its study of practice acts and associated legal language across all the jurisdictions in the United Stes. As of this writing, data on 25 states have been compiled and the remainder are underway. This study analyzes not only the physical therapy practice act in each state, but also other practice acts which could interact with the physical therapy practice acts as well as any other associated statutory or administrative language, regulatory board opinions, attorney general opinions, and case law. Details on publication of this information will be forthcoming.

Elections

During November, the Imaging SIG will be voting for a member of the Nominating Committee. Within the structure of all SIGs, these are 3-year terms with the final year serving as Chair. Please learn about the candidates and vote. Serving on this committee is a pathway to future leadership potential for the SIG as well as getting to know those members of the SIG and understanding its function. Elections for Vice President and President of the SIG will be coming in subsequent years. Now is the time to start building toward leadership roles or encouraging others to do the same.

Strategic Plan

Practice:

The survey to gather information on imaging content in residencies is in process, but will require time to complete. Another information gathering project is also underway, but this time from an advocacy perspective. The Imaging SIG will soon be contacting components to determine the prioritization of acquiring imaging referral privileges within those jurisdictions, if not already existing. While taking a few months to gather and distill, this data will potentially be very informative as to provide insights as what jurisdictions are prioritizing imaging referral as well as possibly revealing trends occurring nationally as we continue to move on a path of widespread imaging referral privileges.

Research:

George Beneck and the Research Committee have compiled some excellent work that will lead to advancement of imaging in physical therapy practice. If you go to the AOPT website and then next go to the Imaging SIG pages, you will see an item on the left side of the page referring to mentors. The Research Imaging Mentor webpage is now available for viewing. Thanks to the help from Greg Dedrick, Murray Maitland, Meg Sions, Lena Volland, and Matt Wyland, 20 expert mentors were identified and their availability for mentoring is posted. The link is below.

https://www.orthopt.org/content/special-interest-groups/imaging/imaging-sig-mentors

In addition to providing resources for those interested in pursuing research in imaging, these mentors will also collaborate with the Academy of Orthopaedic Physical Therapy's Research Committee. The Imaging SIG's Research Committee's members, Daryl Lawson, Greg Dedrick and Matt Wyland, identified 6 new imaging researchers available to assist in reviewing imaging-related abstracts for CSM. This availability for reviewers fills a longstanding need for the lack of such experts in the review process.

ORF-SIG Members,

Oh, how time flies…It is hard to believe that our Annual Combined Sections Meeting is right around the corner! Because schedules fill in quickly, I did want to let you know of some important meetings coming up!

- 2/12/19 ORF-SIG Sponsored Preconference Course: *Beyond the Basics—Design and Implementation of Best Practice in Residency and Fellowship Education*
- 2/12/20 5:15-6:45 p.m. (Tentative) Ortho Res/Fellowship Career Fair
- 2/12/20 7:00-8:30 a.m. AOPT Special Interest Group Meet and Greet
- 2/15/20: 7 a.m.: ORF-SIG Business Meeting

The ORF-SIG continues to be very active in creating a Community of Excellence in Physical Therapy Residency and Fellowship Education. Some of you may have noticed a slight change in the nomenclature for what was previously labeled at "Work Groups" or "Task Forces." The change is to be consistent across all AOPT Special interest Groups and our Rules of Order. Outside of the name change these individuals will still serve as your Community of Resources in the development of Excellence! Please be sure to get involved with one of our Committees or Subcommittees.

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

Thank you to all our members for their hard work. We look forward to great things in 2019!

Matt Haberl,
President, ORF-SIG

Here are the latest updates from our working committees:

Research Committee:

Members of the ORF-SIG Research Committee and Academy of Education Residency and Fellowship Special Interest Group (RFE-SIG) discussed the development of a shared research collaboration among all residency and fellowship programs. Members of the RFE-SIG developed a framework and key initiatives to foster the development of research in all areas of residency and fellowship education. Goals of the research collaboration would include (1) assisting with the dissemination of research projects, developing research questions, and identifying those individuals interested in collaboration; (2) identifying resources and funding opportunities for collaborators; (3) each SIG could serve as a platform to disseminate information about developing and ongoing research projects through a shared online platform; and (4) surveying SIG members to identify what platform would be the most beneficial to share ideas for individuals with similar research interests.

***OPTP* Quarterly Submissions:**

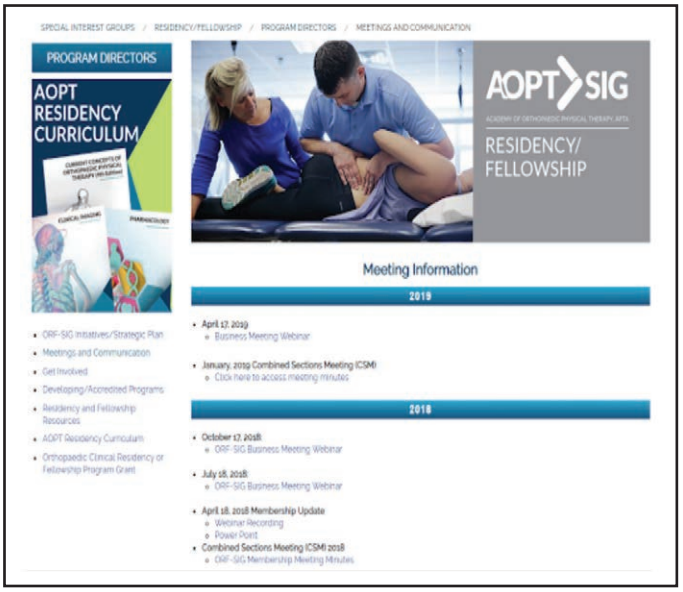
The ORF-SIG will continue to accept case reports, resident/fellowship research, etc. to be highlighted in future *Orthopaedic Physical Therapy Practice*. Take this opportunity to highlight your programs participants work!

Membership Committee:
Residency and Fellowship Career Fair at CSM 2020

We are proud to assist our members by bringing back the **Residency and Fellowship Career Fair** at CSM in Denver, CO. This Career Fair was previously hosted by the ABPTRFE and included all specialties and subspecialties. This career fair will be specific to orthopaedic residency and fellowship programs hosted on **Wednesday, February 12, 2019 from 5:45-6:45 p.m.** We look forward to meeting with the aspiring orthopaedic residents and fellows. To find out more information, please contact Tara Fredrickson at tfred@orthopt.org.

A New Face Lift! ORF-SIG Website

Thank you to Matt Stark and Bob Schroedter for giving our website a new face lift. Surfers of the web will now be able to better choose which wave best fits them with a more condensed experience. Upon arrival individuals will choose what path best fits them either a **Program Director/Faculty** or **Resident/Fellow**.



All individuals will also find easy navigation with clear links to our meeting information, webinars, and ways to get involved with our committees. **Program Directors and Faculty** will find information related to Developing/Accredited Program information,

additional R/F Resources, and information regarding the AOPT Curriculum and Grant.

Residents/Fellows will be provided with information on how to choose a program, the process for applying, and available programs. We will continue to grow this site to the needs of our members!

The website will provide a location for key information where we will still use Our Facebook Group as a place for mass communication and more immediate information sharing. The Facebook Group will be limited to members only so **Become a Member Today**!

- https://www.facebook.com/groups/741598362644243/

Member Make Up

We are in the process of reviewing all our member demographics so that we can better serve you. For current members, please keep an eye out for a survey trying to understand your background and what else the ORF-SIG can do for you.

In 2020, we will be creating more resources available to members only built around mentorship, your orthopaedic curriculum, webinars, and more! Help us achieve 100% Orthopaedic Residency and Fellowship Program Director involvement!

Communication Committee:

ABPTRFE New Substantive Changes Policies and Procedures

In June 2018, the ABPTRFE released their new Policies and Procedures (P&P) connected to the Quality Standards. In November 2018, complimentary documents to the P&P were released including Substantive Changes documents. To address new policies that would significantly impact the sustainability of residency and fellowship programs, the ORF-SIG and AAOMPT Program Director's Special Interest Group sent a survey out to programs. Particularly, the addition of policy 13.4 and the requirement of additional site visits for programs adding >3 clinical sites in one year was surveyed.

Following discussion at the 2019 Combined Sections Meeting in Washington, DC, the ABPTRFE placed a Proviso on policy 13.4 which was later clarified to only 13.4.2 until a key stakeholders meeting could occur.

With the assistance of APTA leadership a key stakeholder meeting was held at APTA headquarters on April 29th regarding Policy 13.4.2. Approximately 50 stakeholders participated, including residency and fellowship program directors and faculty, ABPTRFE Board members, APTA leadership, and the AAOMPT President. In June, ABPTRFE released the findings and recommendations from the newly established Standards Committee following their initial meeting. The Committee provided 5 recommendations to the ABPTRFE including:

- Standardization of Mentors
- Random Site Visits
- Virtual Site Visits
- PD responsible for oversight
- Type of education being provided

The complete description of these findings can be found in the June ABPTRFE Newsletter. The ABPTRFE will be further reviewing these recommendations at their September meeting. At this time, no further changes have occurred regarding the Proviso and current suspension of policy 13.4.2. AOPT leadership and the ORF-SIG continue to evaluate these policies and procedures and how they will impact post professional development in the physical therapy profession.

ABPTRFE Communication

Please make sure to sign up on the APTA HUB to receive ongoing communication from the ABPTRFE. We encourage all programs to **contact ABPTRFE** in addition to the **ORF-SIG** with any specific questions or concerns. Directions how to sign in and receive weekly emails regarding posts to the APTA HUB visit our website for directions.

- https://www.orthopt.org/content/special-interest-groups/residency-fellowship/program-directors/residency-and-fellowship-resources

Practice/Reimbursement Committee:

The Practice committee is currently creating a survey to send to residency/fellowship programs to learn more about how mentoring is being implemented. Plans to send out a survey in the Fall 2019 to capture residency/fellowship mentoring patterns, including novel delivery of mentorship that might be of benefit for members of the ORF- SIG and greater residency and fellowship community as they evaluate mentoring in their programs.

Applicant Sharing Subcommittee:

To identify developmental changes in residency and fellowship education that are impacting programs and their participants, it was brought to our attention that some programs were turning away applicants due to lack of space in their programs while other programs were unable to fill their spots. Given these struggles, the ORF-SIG has been evaluating possible ways programs could either share participant information with other programs or for programs to share with participants turned away information regarding programs still seeing candidates.

Communication with Ryan Bannister and RF-PTCAS has identified some barriers due to information sharing and confidentiality. The ORF-SIG will continue to explore other avenues to ensure programs can have ongoing full enrollment for their programs.

ACAPT Subcommittee:

In 2018, the Clinical Education Special Interest Group released a white paper presented by a partnership of several DPT programs about DPT students in their terminal affiliation requesting time off for residency interviews. The controversial paper outlined challenges and barriers DPT programs encountered with clinical sites and advocated for students to focus on their terminal experiences. Given these new perspectives the ORF-SIG is working with ACAPT to publish recommendations for both residency directors as well as education of prospective residents by setting expectations of DPT students while in the professional program, helping DPT students/potential residents identify a single area of residency practice to pursue, and educating Directors of Clinical Education (DCEs) and clinical instructors (CIs) regarding the perspectives of residency programs. We look forward to completing this work.

Academy of Education Residency and Fellowship Special Interest Group:

The Residency and Fellowship Education SIG (Academy of Physical Therapy Education) is interested in developing a mentor-

ing program for Residency/Fellowship Directors & Coordinators with the goal of pairing experienced program directors or coordinators with newer program directors or coordinators to foster support, feedback, and guidance throughout the year. For more information, contact Christina Gomez at cgomezpt@gmail.com.

Program Director Administration Survey Results:

The ORF-SIG surveyed residency and fellowship Program Directors and Coordinators nationwide to collect feedback regarding the diverse roles, needs, and time requirements consistent with the administrative obligations within current programs. Eleven fellowship Program Directors and 59 residency Program Directors responded to the survey. The distribution of fellowship and residency practice areas that participated in the survey are provided (Figure 1).

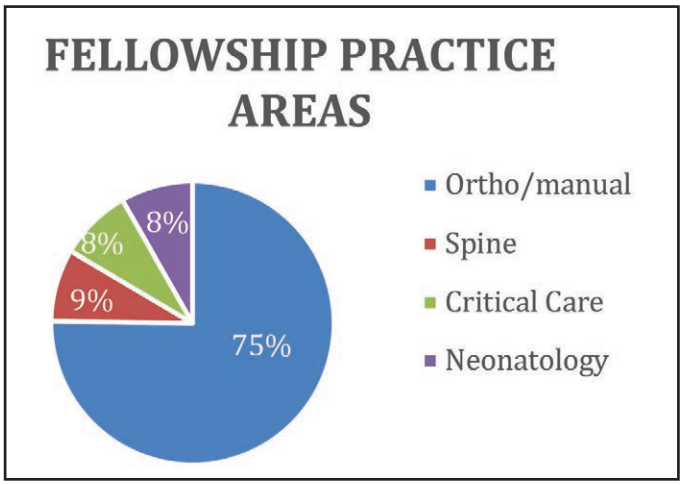
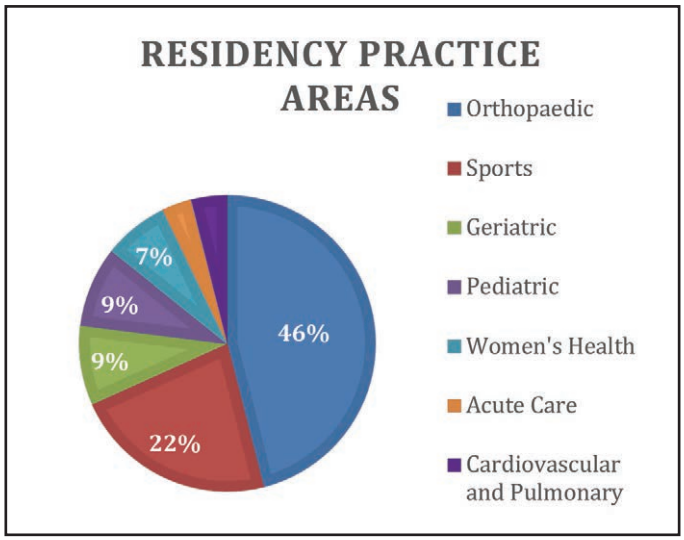


Figure 1. Practice areas.

Fellowship programs: Approximately 50% of surveyed fellowship programs accept 1 to 5 fellows and 40% accept 12 to 16 fellows per year with an average of 27 active and 15 in-active clinical sites per year. Thirty-six percent of programs reported that their clinical sites do vary year to year. The median number of clinical faculty per fellowship program is 14 with a range from 5 to 30 fellowship faculty members within an individual program. Forty percent of fellowship programs who responded to the survey have added a Program Coordinator to assist with administrative tasks. The most reported administrative tasks that required the most dedicated time per week included the following: ABPTRFE/IFOMPT reporting and maintaining accreditation standards, clinical mentoring with fellows-in-training (FIT) and faculty, admissions and recruitment, coordination of fellowship coursework/curriculum, and communication with faculty, mentors, and fellows (Table 1). An itemization of the weekly tasks provided by various fellowship practice models is provided (Table 2). There was a greater variation in the oversight of clinical mentors and hours dedicated to teaching among hospital, academic, and private practice models that participated in the survey.



Residency programs: Approximately 92% of surveyed residency programs accept 1 to 5 residents per year and have an average of 5 active and 3 in-active clinical sites per year. Nineteen percent of programs reported that their clinical sites do vary from year to year. The median number of clinical faculty per residency program is 9 with a range from 2 to 35 residency faculty members within an individual program. Forty-two percent of residency programs who responded to the survey have added a Program Coordinator to assist with administrative tasks. An itemization of the weekly tasks provided by residency programs is provided (Table 3). A comparison of weekly mentoring hours was higher among hospital and academic settings compared to a greater number of hours dedicated to teaching/didactic instruction in private practice settings (Table 4).

Residency programs identified difficulties in the provision of administrative tasks to include a significant time commitment, financial constraints of nonproductive time without passing the expense onto the current residents, and a lack of budgetary and administrative support from the primary residency institution. Many respondents reported that the Program Director performs the aforementioned duties while maintaining a full caseload, maintaining productivity standards, and do not have sufficient administrative time allotted from the primary residency institution. Other concerns from programs highlighted the difficulty keeping up with

Table 1. Fellowship Program Director/Coordinator Responses (n=11)

Question	Mean
How many hours a week do you estimate your faculty spend completing fellowship tasks?	11
How many clinical mentors do you oversee?	26
How many hours per week do you estimate your mentors spend completing fellowship tasks?	10
As a Program Director, how many fellowship programs do you oversee administratively?	1
As a Program Director, how many hours do you spend on the following activities?	
Teaching/Didactic Curriculum (per year)	430
Clinical Mentoring (per week)	7
Participant Admissions (per week)	5
Participant Communication/Reviews (per week)	6
Faculty/Mentorship Communication (per week)	7
Review of ABPTRFE Requirements (per week)	6
Budget Planning (per week)	4
Grading Exams, Developing Curriculum (per week)	4

Table 2. Comparison of Responses Among Fellowship Programs

Question	Hospital/Clinic (n=6)	Academic Institution (n=1)	Other/Private Practice (n=3)
		Mean	
How many hours a week do you estimate your faculty spend completing fellowship tasks?	11	9	11
How many clinical mentors do you oversee?	21	8	44
How many hours per week do you estimate your mentors spend completing fellowship tasks?	8	4	7
As a Program Director, how many hours do you spend on the following activities?			
Teaching/Didactic Curriculum (per year)	361	8	786
Clinical Mentoring (per week)	7	1	11
Participant Admissions (per week)	6	1	3
Participant Communication/Reviews (per week)	5	2	8
Faculty/Mentorship Communication (per week)	6	2	11
Review of ABPTRFE Requirements (per week)	6	2	5
Budget Planning (per week)	5	1	2
How much time does the Program Coordinator spend on Fellowship tasks per week?	8	N/A	N/A

Table 3. Residency Program Director/Coordinator Responses (n=59)

Question	Mean
How many hours a week do you estimate your faculty spend completing residency tasks?	4
How many clinical mentors do you oversee?	7
How many hours per week do you estimate your mentors spend completing residency tasks?	4
As a Program Director, how many residency programs do you oversee administratively?	2
As a Program Director, how many hours do you spend on the following activities?	
Teaching/Didactic Curriculum (per year)	70
Clinical Mentoring (per week)	20
Participant Admissions (per week)	5
Participant Communication/Reviews (per week)	6
Faculty/Mentorship Communication (per week)	2
Review of ABPTRFE Requirements (per week)	2
Budget Planning (per week)	1
Grading Exams, Developing Curriculum (per week)	2
How much time does the Program Coordinator spend on residency tasks per week?	6

Table 4. Comparison of Responses Across Residency Programs

Question	Hospital/Clinic Settings (n=33)	Academic Institution (n=18)	Private Practice (n=4)
		Mean	
How many hours a week do you estimate your faculty spend completing residency tasks?	4	4	4
How many clinical mentors do you oversee?	8	7	6
How many hours per week do you estimate your mentors spend completing residency tasks?	4	4	4
As a Program Director, how many hours do you spend on the following activities			
Teaching/Didactic Curriculum (per year)	63	68	161
Clinical Mentoring (per week)	25 (range 1-191)	13	3.25
Participant Admissions (per week)	2	1	1
Participant Communication/Reviews (per week)	2	2	2
Faculty/Mentorship Communication (per week)	2	2	2
Review of ABPTRFE Requirements (per week)	2	2	1
Budget Planning (per week)	1.5	1	1
How much time does the Prog. Coordinator spend on residency tasks per week?	5	5	4

(Continued on page 252)

Letter From the President

Jenna Encheff, PT, PhD, CMPT, CERP

The ARSIG continues to work toward several goals as outlined on our strategic plan. The most recent accomplishment is establishment of a "Frequently Asked Questions" page on the ARSIG website. I would estimate that I receive approximately 2 to 3 emails a week requesting information on the ARSIG, and most people who email are seeking to find information on whether or not the practice of animal physical therapy is legal in their respective states. Very few state Physical Therapy Practice Acts specifically address animal physical therapy. One must also keep in mind that is it important to reference each state's Veterinary Practice Act, as well, to determine what scope, if any, non-veterinarians may have in the treatment or rehabilitation of animals, and if allowable, what level of supervision may be needed.

Unfortunately, the vast majority of state PT Practice Acts do not mention animal physical therapy at all or are vague in the language of who (or what) physical therapists can treat. The terms "human" or "person," written in a state's PT Practice Act indicates that patients are humans only, and therefore, practice on animals is outside the legal scope of a physical therapist in that state. The terms "patient," "individual," and "client" do not necessarily exclude animals but do not definitively include them, and the therapist wishing to treat animals in those states is left in a gray area. If a state Veterinary Practice Act limits the scope of treatment of animals to veterinary professionals only, or only under direct supervision of a veterinarian—that adds another layer of confusion.

It is very hard as ARSIG president to answer any of the emails I get requesting information regarding a particular state, and I typically refer the writer back to the Practice Acts…which I admit is probably very frustrating for them. However, it is not within the purview of the ARSIG to interpret any state's Practice Act. This confusion and frustration and limitations on the practice of physical therapy on animals is exactly why the completion of the Animal Rehabilitation Practice Analysis and Standards of Clinical Practice, the continued work towards the goals of the ARSIG as outlined in our strategic plan, and the investment, support, and help from our members is so vital in helping to advance our belief that properly trained physical therapists can and should be allowed to provide rehabilitation to those animals in need of therapeutic intervention to help them return to the highest level of function they can. Just like our human patients.

Frequently Asked Questions

Below are a few of the FAQs that can now be found on the ARSIG website. For the entire list, please access the website.

1. **Can Physical Therapists treat animals in my state?**
   a. **You will need to access your state's PT and Veterinary Practice Acts in order to determine this. Currently, the only states that specifically address and allow physical therapists to practice on animals are: CO, NE, and NH.** In these states, specific criteria are outlined in the Physical Therapy and Veterinary Practice Acts of the state. In these states, PTs can practice with animals and use their PT credentials.
   b. In other states, animal rehabilitation provided by PTs is in the Veterinary Practice Acts and is under scope of practice of veterinarians. These states are FL, GA, IL, ME, and MI. Practice by PTs regarding supervision by veterinarians and requirement to practice in the veterinarian's practice location or elsewhere, is specified in the Veterinary Practice Act. These specifics are clearer for the Veterinary Practice Act in some states than in others. However, you must also check the PT practice act in those states as you may not be able to practice on animals as a *physical therapist* (ie, use your credentials) in a state.
   c. In some states, the Veterinary Practice Act states that PTs can practice under the area of complementary, alternative, or integrative therapy. These states are MS, OK, TN, and VA. However, you must also check the PT practice act in those states as you may not be able to practice on animals as a *physical therapist* (ie, use your credentials) in a state.
   d. In most states the practice acts are not definitive. Interpretation of the Practice Acts is not always clear, and it is your responsibility to ensure you are not practicing outside of your scope in your state. *Doing so could result in a Cease and Desist mandate from the veterinary profession and potential jeopardy to your PT license.*
   e. **Physical Therapy Practice Acts by State**
   http://www.apta.org/Licensure/StatePracticeActs/
   Veterinary Practice Acts
   https://rehabvets.org/state-practice-acts.lasso/
   and choose State Practice Acts - Professionals or go to your search engine of choice and enter the state of interest and "veterinary practice act."
2. **What animals are typically treated by Physical Therapists if allowed?**
   a. The most common species is canine, however, equine and feline are often referred for services, as well. It is not unheard of for animals such as donkeys, cows, goats, etc to be referred for rehabilitation.
3. **Where is Animal Rehabilitation typically provided?**
   a. Veterinary hospitals or clinics with a rehabilitation practice.
   b. Patient/client's homes/barns, with varying levels of supervision/medical clearance from a veterinarian.
      i. Supervision can range from onsite and directly supervised by a veterinarian to offsite with permission of the veterinarian depending on each state's PT and Vet Practice Acts.
   c. Private clinics or settings.
4. **Is there malpractice insurance available for Physical Therapists who are treating animals?**
   a. HPSO MAY provide coverage for PTs in states that have language in their practice acts that specifically address animal rehab, ie, CO, NE, NH.
   b. Physical Therapists working in veterinary clinics MAY be

covered under their employer's insurance.
Do not assume you are covered by personal liability insurance or business insurance. It is your responsibility to determine if you are covered for treatment of animals that typically depends on the practice acts of your state.

If YOU have a question regarding animal physical therapy that is not addressed on the website, don't hesitate to contact an ARSIG officer—we are here to help.

ORTHOPAEDIC RESIDENCY/FELLOWSHIP SIG

(Continued from page 250)

the updated guidelines and changes from ABPTRFE that have delayed programs' initiative to making improvements to the programs in the event the guidelines are promptly changed.

A strategic goal of the ORF-SIG is to identify processes in residency and fellowship education that are impacting programs and their participants and to serve as a liaison among programs, AOPT, and ABPTRFE. The Orthopaedic Residency and Fellowship Special Interest Group would like to thank all of the individuals who participated in survey and provided information about their respective programs to share with members and stakeholders that will positively impact the growth of residency and fellowship education.

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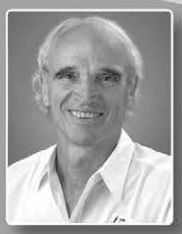

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