2022 / volume 34 / number 2

ORTHOPAEDIC PHYSICAL THERAPY PRACTICE

The publication of the Academy of Orthopaedic Physical Therapy, APTA

FEATURE:
Management of Subacromial Shoulder Pain after Ultrasound-guided Needle Barbotage Combined with Subacromial Corticosteroid Injection: A Case Report

APTA American Physical Therapy Association

PHYSICAL THERAPY MANAGEMENT OF TENDINOPATHIES

Independent Study Course 32.1

Learning Objectives

Upon completion of this monograph series, the participant will be able to:

1. Understand typical biomechanical principles associated with normal tendon function and implications for dysfunction.
2. Understand the pathophysiological factors underpinning the development of tendinopathy in general, with special attention to Achilles, patellar, gluteal, and lateral elbow tendinopathy.
3. Explain the range of prognoses for common tendinopathies and clinical features that may influence outcomes.
4. Implement an evidence-based approach to select tests and measures and examination techniques to inform differential diagnosis of tendinopathies in general, with special attention to Achilles, patellar, gluteal, and lateral elbow tendinopathy.
5. Demonstrate an understanding of the evidence for various types of exercise treatments for patients with Achilles, patellar, gluteal, and lateral elbow tendinopathy.
6. Devise and implement evidence-based exercise progressions based on objective findings and scientific evidence for patients with Achilles, patellar, gluteal, and lateral elbow tendinopathy.
7. Develop an individualized, comprehensive, rehabilitative plan of care for Achilles, patellar, gluteal, and lateral elbow tendinopathy based on objective findings, symptom irritability, and activity considerations.

Editorial Staff

For Registration Fees and Additional Questions,

visit orthopt.org

Description

This course provides clinicians with an update on models of tendinopathy with special attention to differentiating between primary versus secondary tendinopathies and the features of acute versus chronic tendinopathies. Four common tendinopathies are then thoroughly discussed, each with its own monograph: Achilles, patellar, gluteal, and lateral elbow tendinopathy. Each monograph provides in-depth knowledge of general and tendon-specific principles of evaluation and management techniques/strategies. Through these monographs, the reader will appreciate that loading exercises, while important, are only one aspect of the successful management of individuals with tendinopathy. Finally, each monograph ends with 3 or 4 case scenarios selected to demonstrate the variety in presentation and management of this potentially complex and clinically challenging condition. Monographs are supplemented by extensive figures related to the educational and exercise components of the rehabilitation process.

Topics and Authors

Basic Science and Pathophysiology of Tendons
Alex Scott, PhD; Jonathan Rees, MSc, MRCP (UK), FFSEM (UK)

Lateral Elbow Tendinopathy
Leanne Bisset, PT, PhD, MPhty;
Brooke Coombes, PT, PhD, MPhty

Patellar Tendinopathy
Andrew Sprague, PT, PhD, DPT;
Terrence McHugh, PT, DPT, SCS, ATC;
Rick Joreitz, PT, DPT, SCS, ATC

Achilles Tendinopathy
Karin Gravare Silbernagel, PT, PhD, ATC;
Jennifer Zellers, PT, DPT, PhD

Gluteal Tendinopathy
Alison Grimaldi, PhD,
MPhty (Sports), BPhty

ACADEMY OF ORTHOPAEDIC PHYSICAL THERAPY

APTA American Physical Therapy Association

ORTHOPAEDIC
PHYSICAL THERAPY PRACTICE

The publication of the Academy of Orthopaedic Physical Therapy, APTA

In this issue

Regular features

OPTP Mission

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

Publication Staff

Managing Editor & Advertising
Sharon Klinski
Academy of Orthopaedic Physical Therapy
2920 East Ave So, Suite 200
La Crosse, Wisconsin 54601
800-444-3982 x 2020
608-788-3965 FAX
Email: sklinski@orthopt.org

Editor
John Heick, PT, DPT, PhD
Board-certified in Orthopaedics, Sports, and Neurology

Associate Editor
Rita Shapiro, PT, MA, DPT

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

ACADEMY OF ORTHOPAEDIC PHYSICAL THERAPY

DIRECTORY

2022 / volume 34 / number 2

BOARD OF DIRECTORS

PRESIDENT
Bob Rowe, PT, DPT, DMT, MHS
browe@orthopt.org
1st Term: 2022-2025

VICE PRESIDENT
Lori Michener, PT, PhD, SCS, ATC, FAPTA
lmichener@orthopt.org
2nd Term: 2020-2023

TREASURER
Judith Hess, PT, DHS, OCS, CMPT, CertDN
jhess@orthopt.org
1st Term: 2021-2024

DIRECTOR 1
Beth Collier, PT, DPT, OCS, FAAOMPT
bcollier@orthopt.org
1st Term: 2021-2024

DIRECTOR 2
Annette Karim, PT, DPT, PhD, OCS, FAAOMPT
akarim@orthopt.org
1st Term: 2022-2025

DIRECTOR 3
Janet L. Konecne, PT, DPT, PhD, OCS, CSCS
jkonecne@orthopt.org
1st Term: 2020-2023

DIRECTOR 4
Derrick Sueki, PT, DPT, PhD, GCPT, OCS, FAAOMPT
dsueki@orthopt.org
1st Term: 2021-2024

EDUCATION
Eric Folkins, PT, DPT
ericfolkins@yahoo.com
1st Term: 2022-2025

PRACTICE
James Spencer, PT, DPT, OCS, CSCS
jspencer@orthopt.org
2nd Term: 2020-2023

RESEARCH
Amee L Seitz, PT, DPT, PhD
aseitz@orthopt.org
1st Term: 2022-2025

OFFICE PERSONNEL

(608) 788-3982 or (800) 444-3982

Terri DeFlorian, Executive Director
x2040.....tdeflorian@orthopt.org
Tara Fredrickson, Assistant Executive Director
x2030.....tfred@orthopt.org
Joyce Brueggeman, Bookkeeper
x2090.....jbrueggeman@orthopt.org
Sharon Klinski, OP & ISC Managing Editor
x2020.....sklinski@orthopt.org
Namrita Sidhu, CPG Managing Editor
.....nsidhu@orthopt.org
Nichole Walleen, Acct Exec/Exec Asst
x2070.....nwalleen@orthopt.org

COMMITTEE CHAIRS

MEMBERSHIP CHAIR
Christine B. Mansfield, PT, DPT, OCS, ATC
Christine.mansfield@nationwidechildrens.org
1st Term: 2021-2024

Members: *Molly O'Rourke, Charles (Matt) Huey, Katie Scaff, Caroline Furtak*

EDUCATION CHAIR
Eric Folkins, PT, DPT
(see Board of Directors)

Members: *Brian Eckenrode, Gretchen Seif, Josh Halfpap, Kate Spencer, Lindsay Carroll, Kathleen Geist, Jason (Jay) Grimes*

AOM DIRECTOR
Keelan Enseki, PT, OCS, SCS
Term: 2019-2022

INDEPENDENT STUDY COURSE (ISC) EDITOR
Guy Simoneau, PT, PhD, FAPTA
guysimoneau@marquette.edu
1st Term: 2020-2023

ISC ASSOCIATE EDITOR
Dhinu Jayaseelan, PT, DPT
dhinuj@gwu.edu
1st Term: 2021 – 2024

ORTHOPAEDIC PRACTICE (OP) EDITOR
John Heick, PT, DPT, PhD, OCS, SCS, NCS
John.heick@nau.edu
2nd Term: 2022-2025

OP ASSOCIATE EDITOR
Rita Shapiro, PT, MA, DPT
Shapiro.rb@gmail.com
2nd Term: 2020-2023

PUBLIC RELATIONS CHAIR
AOPT Office

Members: *Tyrees M. Marcy, William Stokes*

RESEARCH CHAIR
Amee L. Seitz, PT, DPT, PhD
(see Board of Directors)

VICE CHAIR
Sean D. Rundell, PT, DPT, PhD
1st Term: 2022-2025

Members: *Matthew Ithurburn, Phillip Malloy, Alison Chang, Arie van Duijim, Samanaaz Khoja, John Fraser*

PTA Steering Committee
Jason Oliver, PTA
lsu73lsu73@yahoo.com

ORTHOPAEDIC SPECIALTY COUNCIL
Pamela Kikillus, PT, DHSc, OCS, FAAOMPT
pam_leerar@hotmail.com
Term: Expires 2022

Members: *Peter Sprague, Hillary Greenberger, Jimmy Kim, Paul-Neil Czujko*

PRACTICE CHAIR
James Spencer, PT, DPT, OCS, CSCS
(see Board of Directors)

Members: *Gretchen Johnson, Marcia Spoto, Stephanie Weyrauch, Matt Hyland, Gretchen Seif*

FINANCE CHAIR
Judith Hess, PT, DHS, OCS, CMPT, CertDN
(see Board of Directors)

Members: *Kyle Adams, Timothy Brinker, Matthew Lazinski, Theresa Marko*

AWARDS CHAIR
Murray E. Maitland, PT, PhD
1st Term: 2022-2025

Members: *Lisa Hoglund, Rosie Canizares, Amy McDevitt, Michael Ross*

NOMINATIONS CHAIR
Jason Tonley, PT, DPT
tonley00@aol.com
Term: 2022-2024

Members: *Paul Mintken, Caroline Brunst*

JOSPT
Clare L. Arden, PT, PhD
clare.arden@liu.se

EXECUTIVE DIRECTOR/PUBLISHER
Rob Bennet
robbennett@jospt.org

2022 HOUSE OF DELEGATES REPRESENTATIVES
James Spencer, PT, DPT, OCS, CSCS—Chief Delegate
Gretchen Seif, PT, DPT—Delegate

CLINICAL PRACTICE GUIDELINES EDITORS
RobRoy Martin, PT, PhD
martinr280@duq.edu
2nd Term: 2021-2024

Guy Simoneau, PT, PhD, FAPTA
guy.simoneau@marquette.edu
2nd Term: 2020-2023

Chris Carcia, PT, PhD
ccarcia@coloradomesa.edu
1st Term: 2021-2024

Special Interest Groups

OCCUPATIONAL HEALTH SIG
Rick Wickstrom, PT, DPT, CPE
rwickstrom@orthopt.org
2nd Term: 2022-2025

FOOT AND ANKLE SIG
Frank DiLiberto, PT, PhD
fdiliberto@orthopt.org
1st Term: 2022-2025

PERFORMING ARTS SIG
Laurel Abbruzzese, PT, EdD
labbruzzese@orthopt.org
1st Term: 2020-2023

PAIN SIG
Nancy Durban, PT, MS, DPT
ndurban@orthopt.org
1st Term: 2020-2023

IMAGING SIG
Bruno Steiner, PT, DPT, LMT, RMSK
bsteiner@orthopt.org
1st Term: 2022-2025

ORTHOPAEDIC RESIDENCY/FELLOWSHIP SIG
Molly Malloy, PT, DPT
mmalloy@orthopt.org
1st Term: 2022-2025

ANIMAL PHYSICAL THERAPY SIG
Francisco Maia, PT, DPT, CCRT
fmaia@orthopt.org
2nd Term: 2022-2025

Bob Rowe, PT, DPT, DMT, MHS

Buckle Up and Let's Get Going!

I would like to start my first President's message by stating how thankful, excited, and proud I am to be serving in this role. This is a bit of a homecoming for me, since my first step into professional service, at the national level was with the "Orthopaedic Section" in 2002 when I was appointed to the Practice Committee. I was appointed as Chair of the Practice Committee in 2004 and served in that role until 2010. Within that time, I served as the Section's Delegate to the APTA House of Delegates as well as the Sections representative to APTA State Government Affairs, APTA Federal Governmental Affairs, and APTA Reimbursement. Since completing that term, I have served in multiple other professional service roles that were extremely rewarding and I always believed that we were doing great work, which motivated me to want to do more. As I completed my term on the APTA Board, as a Director in December 2021, many assumed I would take a break for a while, but I felt strongly that I have a lot of gas left in my tank and there is still much work to be done. I am so thankful to the past AOPT Presidents for the work they have done to build the organizational, financial, and governance infrastructure of the AOPT to make it an incredibly strong association! This will allow us to focus our attention on being aggressively proactive with addressing some critical issues that we know are problematic for our AOPT members. I would like to specifically thank our immediate past AOPT President Joe Donnelly for his support and mentoring during the transition process. In our first Board meeting with my AOPT Board colleagues, I introduced the "Presidential Pillars" for my term. I will not go into details, but they are focused on items including payment policy, administrative burden, scope of practice, unwarranted variance in clinical practice, and being collaborative and building communities. Honestly, none of these can be considered new ideas, but where we have failed in the past is that individual groups have tried to take on these issues independently and have worked in silos, which has led to many failed attempts to make significant change over many years. This time we will build large collaborative and synergistic coalitions with our colleagues inside APTA such as other Academies/Sections and State Chapters as well as organizations outside of APTA. We will consider strategic priorities and take them on in a decisive manner with the resources and team necessary for success. As we move this agenda forward, we will be thoughtful and reflective to create strategic initiatives that will promote our success. To prepare for the upcoming challenges we face, you will see and hear about changes in some of the organizational structure including a few Bylaw changes that we will be bringing forward. The purpose for all of these changes will be to promote the initiatives I identified above. In order for us to be successful, we are going to have to be strategic, collaborative, relentless, and come with everything we got! We have to view this as if our professional practice depends on our actions, since the reality is it does. I believe we will succeed this time secondary to our commitment to collaboration as well as being focused on being strategic with our initiatives that are prioritized, staged, and sequenced.

I am happy to answer your questions and I thank you for your support as we move forward with improving the practice environment for each of you!

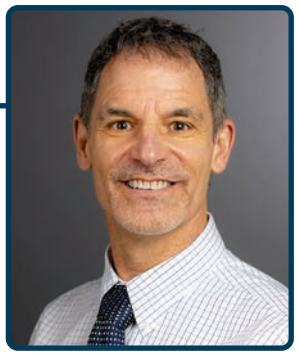
Best Regards,
Bob

Joseph Donnelly
Outgoing
President

Tara Jo Manal
Outgoing
Director

Christine McDonough
Outgoing
CPG Editor

Editor's Note



The COVID pandemic has no doubt changed everything! It has changed how we have been able to interact with everyone, how we travel or if we travel at all, it has changed how we perform physical therapy (such as telehealth), how we greet one another, and it has impacted our economy. It is therefore not surprising that it has also impacted our Academy. As you see in the historian report in this issue, we have lost members across all groups (PT, PTA, SPT, and SPTA). Even though we are the largest of all the Academies, physical therapists during these COVID times came across rough times. Some of us lost our jobs, some of us lost our friends, some of us lost our family members. (My dad died of COVID on Veteran's Day. He was a 20-year Navy non-commissioned officer who passed away a month after turning 80.)

Throughout these difficult times, we have persevered, we have learned, and we have sought out new ways to work smarter. Those of us at *OP* have watched other Academies shut down programming events, shut down decisions that fit neatly into their strategic plan, and even decided to shut down their journal. At *OP*, we have pivoted. Before COVID caused so many changes, we polled our members about the idea of our journal going online and many of our members did not like this idea. We understand this reluctance, but we need to work smarter. When we look at the cost associated with continuing to print *OP*, the estimated cost for just 2022 was $81,550. Costs associated with paper shortages and shipping costs have gone up since COVID has rocked our country. These costs would be borne by members of the Academy. Therefore, last fall we decided to go online for *OP*. There are many benefits to our members with this shift in how *OP* is delivered. The House of Delegates brought forward a Go Green campaign in the early 2000s and most journals across Academies are delivered to their members online. We are now moving this way and feel that this makes us environmentally friendly with no carbon footprint. It also gives all members instant access to their issue. Online editions of the journal are searchable, making finding the article or item that you are looking for quick and efficient. Members can download each *OP* issue and save it in a file as opposed to having a stack of *OP*s that takes up space in your house. Perhaps your spouse will thank you for your neatness!

In this format, we anticipate that we will be able to accept more articles for each edition, thus providing more content for our members. We have also partnered with Jimmy McKay from PT Pintcast to offer video content in which we interview an author from the latest *OP* edition and discuss the edition with both editors. This provides our members with an in-depth discussion with the authors and editors to highlight portions of the issue that we think you will find important to your practice. Along these lines, we have discussed doing a similar approach for the SIG newsletters to bring you up to date information well before any print edition would be released. We want to provide current news from each of the SIGs so that our members can interact, respond, and enhance their learning. We feel that we have learned a lot from working during this pandemic, and our new approach will be a solid benefit to our members.

We welcome your comments and appreciate all that you do for your patients. You can reach me at John.Heick@nau.edu

Respectfully submitted,
John Heick, PT, PhD, DPT
Board-certified in Orthopaedics, Sports, and Neurology

Letter to Editor: *Orthopedic Physical Therapy Practice*

After reading "The Effects of Stretching versus Static and Dynamic Cupping on Lumbar Range of Motion: A Randomized Control Trial" in Volume 34, number 1 issue of *Orthopedic Physical Therapy Practice*, I was surprised that the authors did not recognize any utility in their findings. The hypothesis of this study was that static and dynamic cupping would result in superior outcomes to a lumbar stretching protocol including pelvic tilts, double knee to chest stretches, cat and camel stretches. However, as demonstrated in the Results section of the paper, although all 3 groups displayed improvements in lumbar flexion ROM, there was not a clinically significant difference between the cupping groups and the stretching group. Therefore, the authors concluded that "Static and dynamic cupping to lumbar paraspinal muscles was not more effective than stretching at increasing lumbar ROM".[1] Despite the accuracy of this statement, my reaction to this study was much more positive; this study shows that cupping can produce comparable results to stretching.

The reason that this is a significant finding is that there are numerous patients with a history of low back pain and lumbar ROM deficits who are not able to perform stretching. For example, in patients with a history of lumbar fusion surgery, stretching is not permitted for at least 8 to 12 weeks, depending on the surgery and physician's protocol.[2] These patients experience significant muscle tightness in lumbar paraspinals as they heal from surgery and without the ability to stretch, increased tightness develops. More importantly, as this tightness develops, these patients experience significant losses in lumbar ROM and ASLR. However, as "The Effects of Stretching versus Static and Dynamic Cupping on Lumbar Range of Motion: A Randomized Control Trial" has demonstrated, cupping can produce equivalent results to stretching and is therefore an intervention that would be indicated for this patient population.

Another patient who typically cannot perform lumbar stretching is an individual suffering from moderate or severe lumbar nerve root impingement.[3] In these patients, stretching can exacerbate symptoms or cause the compression to progress. Movements such as lumbar flexion, lateral flexion, and rotation will often increase the severity of the patient's condition. Furthermore, stretching can lead to more significant functional deficits and loss of strength or sensation. Alternatively, cupping can be utilized to decrease muscle tightness around the area of the nerve compression and help to alleviate symptoms and to promote recovery of mobility and function. Cupping can also improve circulation around the area of compromise and promote decreased inflammation and therefore a more rapid rate of healing.

Finally, patients who suffer a lumbar muscle strain are a group that cannot perform lumbar stretching because it can worsen the severity of their injury. Stretching can further strain the muscle due to the increased loading and can also increase the time needed by the patient to achieve full recovery. Unlike stretching, cupping does not place an increased load on the muscle fibers and is therefore a great treatment intervention for this population. In fact, Zhang et al 2017 demonstrated that cupping performed in conjunction with other manual therapy interventions and exercise resulted in clinically significant improvements in pain level and lumbar spine ROM.[4] This study supports the use of cupping and further substantiates the importance of the clinical finding that stretching and cupping have comparable results found in "The Effects of Stretching versus Static and Dynamic Cupping on Lumbar Range of Motion: A Randomized Control Trial".

As an orthopedic manual therapist, I use static and dynamic cupping very often in my clinical practice. I find that cupping is helpful in improving soft tissue flexibility, decreasing swelling, and promoting improved mobility at multiple joints. I have used it on all areas of the spine as well as extremities and peripheral joints. Cupping has also been shown to be effective in managing post-operative swelling, scarring, and mobility restrictions. There are multiple studies that demonstrate the clinical efficacy of cupping therapy. In a recent systematic review and meta-analysis, a high level of evidence demonstrated that cupping is effective in the treatment of chronic back pain in adults.[5]

Respectfully submitted,
Sean Altman, PT, DPT, CPT, Cert SMT, Cert DN, FMS, SFMA

REFERENCES

1. Cobb S, Maddox O, Seitz G, Arnot C. The effects of stretching versus static and dynamic cupping on lumbar range of motion: a randomized control trial. *Orthop Phys Ther Pract*. 2022;34(1):276-290.
2. Madera M, Brady J, Deily S, et al. The role of physical therapy and rehabilitation after lumbar fusion surgery for degenerative disease: a systematic review. *J Neurosurg Spine*. 2017;26(6):694-704. doi:10.3171/2016.10.SPINE16627
3. Berry JA, Elia C, Saini HS, Miulli DE. A review of lumbar radiculopathy, diagnosis, and treatment. *Cureus*. 2019;11(10):e5934. Published 2019 Oct 17. doi:10.7759/cureus.5934
4. Li H, Zhang H, Liu S, et al. Rehabilitation effect of exercise with soft tissue manipulation in patients with lumbar muscle strain. *Niger J Clin Pract*. 2017;20(5):629-633. doi:10.4103/njcp.njcp_126_16
5. Moura CC, Chaves ÉCL, Cardoso ACLR, Nogueira DA, Corrêa HP, Chianca TCM. Cupping therapy and chronic back pain: systematic review and meta-analysis. *Rev Lat Am Enfermagem*. 2018;26:e3094. doi:10.1590/1518-8345.2888.3094

2021 Historian Report

Tyler Shultz, PT, DPT, OCS

In so much as 2020 was a year marked by the unknown and constant challenges, 2021 was a year for adaptation and innovation. In the words of Academy President Joe Donnelly, the Academy "seized the opportunity to do things differently, and, perhaps doing things differently will allow for continued engagement and member involvement." The year 2021 should be remembered for many accomplishments, including celebrating APTA's 100th Anniversary and the implementation of a new strategic framework to guide the next 3 years of the Academy. Accomplishments of Academy leadership and governance support for the new strategic framework pillars (Diversity & Inclusion, Evidence to Best Practice, Positioning & Public Awareness, and Value & Payment). Updating bylaws, orientation programs, leadership coaching, and external partnerships all speak to the accomplishments of the Academy in 2021 and will drive an active organizational structure into 2022.

MEMBERSHIP

Total Academy membership at the close of 2021 was 18,112 members, an increase of 0.35% from 2020. A 4-year, year-over-year membership comparison to APTA change is seen in **Figure 1** below. Prior to Covid-19, AOPT membership numbers had been relatively stable; however, financial constraints as a result of the pandemic impacted membership for both the APTA and AOPT in 2020. The 2021 membership numbers are favorable and indicate membership is stabilizing. Student membership continues to be significantly decreased and presents an opportunity for increased engagement. Total membership in the Academy (PT, PTA, SPT, SPTA members) represents 17.9% of overall APTA membership. This statistic has stayed relatively constant over the years. The Academy continues to be the largest in the APTA by a wide margin. The next largest section is the Academy of Sports Physical Therapy with 7,453 members.

LEADERSHIP (AS OF 12/31/2021)

Academy Leadership:

President: Joseph M. Donnelly, PT, DHSc, OCS, FAAOMPT (Hon.)
Vice President: Lori Michener, PT, PhD, ATC, SCS, FAPTA
Treasurer: Judith Hess, PT, DHS, OCS, CMPT
Director: Annette Karim, PT, DPT, PhD, OCS, FAAOMPT
Director: Beth Collier, PT, DPT, OCS, FAAOMPT
Director: Janet L. Konecne, PT, DPT, OCS, CSCS
Director: Derrick Sueki, PT, PhD, GCPT, OCS FAAOMPT

Academy Committees:

- Membership Chair: Christine Mansfield, PT, DPT, OCS, ATC
- Education Chair: Nancy Bloom, PT, DPT, MSOT
- *OPTP* Editor: John Heick, PT, PhD, OCS, NCS, SCS
- ISC Editor: Guy Simoneau, PT, PhD, FAPTA
- Research Chair: Dan White, PT, ScD, MSc, NCS
- Practice Chair: James Spencer, PT, DPT, OCS, CSCS
- Finance Chair: Judith Hess, PT, DHS, OCS, CMPT
- Nominating Chair: Stephanie DiStasi, PT, PhD
- Public Relations: AOPT office
- Awards Chair: Marie Corkery, PT DPT, MHS, FAAOMPT
- Physical Therapist Assistant Steering Committee Chair: Jason Oliver, PTA

Special Interest Groups (SIGs):

- Occupational Health SIG President: Rick Wickstrom, PT, DPT, CPE
- Foot and Ankle SIG President: Christopher Neville, PT, PhD
- Pain Management SIG President: Nancy Durban, PT, DPT, MS
- Performing Arts SIG President: Laurel Daniels Abbruzzese, PT, EdD
- Animal Rehabilitation SIG President: Francisco Maia, PT, DPT, CCRT
- Imaging SIG President: Charles Hazle, PT, PhD
- Residency/Fellowship SIG President: Matt Haberl, DPT, OCS, ATC, CSCS, FAAOMPT

Academy Staff:

- Terri DeFlorian, Executive Director
- Tara Fredrickson, Assistant Executive Director
- Sharon Klinski, *OPTP* & ISC Managing Editor
- Namrita Sidhu, CPG Managing Editor
- Nichole Walleen, Account Executive/ Executive Assistant
- Joyce Brueggeman, Bookkeeper

Centennial Scholars: The Academy sponsored the following individuals as APTA's Centennial Scholars, whose initiatives support the Academy's strategic framework:

- Mary Beth Geiser, PT, DPT, OCS, FAAOMPT
- Yusra Iftikhar, PT, DPT
- Zach Walston, PT, DPT, OCS

STANDARDS OF PRACTICE

The Academy has continued to make significant progress toward its vision of providing resources to optimize movement and musculoskeletal health. Part of the Academy's strategic framework is to promote the development and implementation of evidence to best practice. One initiative to achieve this is the publication of Clinical Practice Guidelines (CPGs) and continuing to develop advanced methods for providing educational

Figure 1. Yearly Comparison to APTA

	AOPT Members	AOPT YoY # Change	AOPT YoY % Change	APTA YoY % Change
2021	18,112	+ 63	+ 0.35%	+1.71%
2020	18,049	- 1,363	- 7.02%	- 4.82%
2019	19,412	+ 39	+ 0.2%	- 0.13%
2018	19,373	- 340	- 1.72%	+ 2.51%

content through the Independent Study Course (ISC) program. The Academy continued to make significant progress towards both initiatives in 2021. Additionally, the Academy continued to provide resources to membership to address the challenges of treating during the Covid-19 pandemic.

Currently, there are 17 CPG topics covered with 8 being on their second update since initial publication for a total of 25 publications. At the close of 2021, there are 6 CPGs in the revision stage and 7 are in the development stages. The following CPGs were added in 2021, and published in the *Journal of Orthopaedic and Sports Physical Therapy (JOSPT)*:

- *Clinical Guidance to Optimize Work Participation After Injury or Illness: The Role of Physical Therapists;* Daley et al. August 2021
- *Physical Therapy management of Older Adults with Hip Fracture.* McDonough et al. February 2021

The following CPG revisions were published in 2021:

- *Interventions for the Management of Acute and Chronic Low Back Pain: Revision 2021;* George et al. November 2021
- *Ankle Stability and Movement Coordination Impairments:* Lateral Ankle Ligament Sprains Revision; Martin et al. April 2021

The Independent Study Courses (ISCs) offered by the Academy have been transitioned to an online/online plus print system, available at orthoptlearn.org. Additionally, the ISCs continue to be an important contributor to the non-dues revenue of the Academy. Partly due to the need for learn-from-home continuing education, the ISC revenue continued to grow in 2021 due to the need to learn-from-home, the publication of *Current Concepts 5th ed.*, and the efforts of Academy staff.

EDUCATION AND PROFESSIONAL DEVELOPMENT

The Academy has continued to make progress toward education and professional development on several fronts. The Academy has continued to advance participation at Combined Sections Meeting (CSM), increased growth of Orthopaedic Residency and Fellowship education, and continued to develop the Mentorship Program.

The 2021 Combined Sections Meeting was held virtually over the Month of February. Despite the change in format, the Academy continued to sponsor numerous valuable educational sessions. The 2022 CSM was held with both in-person (San Antonio, TX) and virtual options available. The Academy looks forward to providing continued course sponsorship in the new virtual format.

Orthopaedic residency and fellowship education has continued to increase in 2021. The American Board of Physical Therapy Residency and Fellowship Education (ABPTRFE) recognized 134 accredited Orthopaedic Residency programs at the end 2021. Additionally, there are 15 candidate programs and 6 developing programs. The ABPTRFE recognizes 25 accredited Orthopaedic Manual Physical Therapy Fellowships, with 1 candidate program. There are 2 accredited and 2 candidate Spine Fellowship programs at the close of 2021.

The Membership Committee continued to sponsor the Mentorship Program in 2021 that again matched 15 students. Areas of mentoring include research, academics/teaching, manual therapy, leadership, and private practice. The program is led by Christine Mansfield, PT, DPT, OCS, ATC, Membership Chair.

GRANTS FUNDING

The Academy continues to support grant funding related to advocacy, residency and fellowship development, and small grants for researchers investigating orthopaedic practice issues. $5,000 was awarded to the Colorado Chapter to support advocacy efforts. There will be five $5,000 grants available in 2022. The projected funding for grant efforts by the Academy exceeds $40,000 yearly. The AOPT is awarding 2 New Investigator grants and 1 Unrestricted grant totaling $72,996.00 in 2022.

AWARDS PROGRAM

Award	2021 Recipient
Outstanding PT Student	Ashley Lea, SPT, MS, LAT/ATC Duke University
Outstanding PTA Student	Mason Delili, SPTA Somerset Community College
James A. Gould Excellence in Teaching Orthopaedic Physical Therapy	John Heick, PT, PhD, DPT Northern Arizona University
Rose Excellence in Research	Jason Falvey, PT, DPT, PhD, GCS University of Colorado
Richard W. Bowling - Richard E. Erhard Orthopaedic Clinical Practice	Michael F. Tollan, PT, DPT, OCS, FAAOMPT Olympic Sports & Spine
Paris Distinguished Service	*Not awarded in 2021*

SUMMARY

The Academy has made significant strides this year by implementing new strategic framework to guide operations for the next 3 years. The decline in Academy membership experienced in 2020 has stabilized and is not off pace from what the APTA overall membership has experienced over the same timeframe. There continues to be a lot to look forward to in 2022.

Management of Subacromial Shoulder Pain after Ultrasound-guided Needle Barbotage Combined with Subacromial Corticosteroid Injection: A Case Report

Tanner Holden, PT, DPT
Jeffrey O'Laughlin, PT, DPT
Jyotsna Gupta, PT, PhD
Michael Gross, PT, PhD

University of North Carolina at Chapel Hill, Chapel Hill, NC

ABSTRACT

Background and Purpose: Calcific tendinopathy of the rotator cuff is a painful condition commonly treated with ultrasound-guided needle barbotage (UGNB) and corticosteroid injections. The purpose of this case report is to detail management of persistent subacromial shoulder pain syndrome (SSPS) following UGNB and corticosteroid injection. **Methods:** The patient was a 59-year-old male with persistent shoulder pain and loss of function following UGNB and corticosteroid injection. Evaluation findings were consistent with SSPS and high tissue irritability. Treatment included exercise and manual therapy. **Clinical Findings:** Following 8 physical therapy sessions with manual therapy and progressive exercise, the patient regained full pain-free movement and returned to recreational activities. **Clinical Relevance:** This case report demonstrates the effectiveness of progressive exercise, combined with manual therapy and education in the treatment of an individual with calcific tendinopathy. **Conclusion:** Progressive resistance exercises and manual therapy may improve shoulder pain and function following UGNB and corticosteroid injection for individuals with SSPS and calcific tendinopathy.

Key Words: exercise parameters, progressive exercise, tissue irritability

BACKGROUND

Calcific tendinopathy of the rotator cuff is a common cause of disability in patients with shoulder pain. This condition commonly affects more women than men with incidence rates peaking in the fourth and fifth decades.[1] The prevalence of calcific tendinopathy in asymptomatic individuals is between 2.7 and 20% and up to 42.5% in patients with shoulder pain.[2,3] A diagnosis of calcific tendinopathy is made through radiographic imaging. The clinical signs and symptoms are similar to subacromial impingement, a pathoanatomic diagnosis included in the broad category of subacromial shoulder pain (SSP).[1,2] Subacromial shoulder pain syndrome (SSPS) is the preferred term over subacromial impingement as it reflects lack of direct evidence for Neer's subacromial impingement model.[4–6]

The pathogenesis of calcific tendinopathy is controversial. Tissue ischemia, metabolic disturbances, and fibrocartilaginous changes of tendon tissue have been suggested as contributors to calcification formation.[1] Calcific tendinopathy occurs as the result of a cell-mediated process rather than tendon degeneration. Uhthoff and Loehr[1] described 3 distinct stages of calcific tendinopathy: pre-calcific, calcific, and post-calcific. The pre-calcific stage involves fibrocartilaginous metaplasia in hypo-vascular areas of the tendon. The supraspinatus tendon is most frequently the site of calcific deposits. The calcific stage has 3 sub-stages. The formative substage involves deposition of calcium crystals into matrix vesicles. The resting substage involves fibro-collagenous encircling of the calcification site. The resorptive substage is characterized by spontaneous resorption of calcifications. The post-calcific stage is typified by the remodeling of fibroblasts and new vascular ingrowth that facilitates collagen production and scar tissue maturation. Patients in the resorptive sub-stage typically report insidious onset of severe shoulder pain. Pain can be present to varying degrees in all stages of the disease.[1] Hackett et al[7] suggest inflammation, neovascularization, and neoinnervation as mechanisms for severe shoulder pain in individuals with calcific tendinopathy.

Calcific tendinopathy is typically a self-limiting condition that responds well to conservative interventions.[8–11] Conservative management includes physical therapy, nonsteroidal anti-inflammatory drugs, subacromial corticosteroid injection, extracorporeal shockwave therapy, and ultrasound-guided needle barbotage (UGNB).[11–13] Farin et al[14] described the UGNB procedure for calcific tendinopathy of the rotator cuff. Calcific deposits are punctured with a needle, saline solution is injected, and deposits are aspirated under ultrasound guidance.[14] The success rate of the procedure is approximately 70%.[9] A recent meta-analysis[11] found significant improvements in pain intensity, patient-reported outcomes, and calcium deposit size at 2-year follow-up after UGNB and subacromial corticosteroid injection. Despite these outcomes, up to 42% of patients experience persistent shoulder pain and disability years after the procedures.[8]

Few authors have detailed physical therapy management of calcific tendinopathy after UGNB combined with subacromial corticosteroid injection and to date, no investigators have provided an adequate description of treatment parameters. Abate et al[13] evaluated efficacy of a rehabilitation program after UGNB and corticosteroid injection. Those who participated in a supervised rehabilitation program reported significantly greater improvements on the outcomes of pain, self-reported function, and treatment satisfaction at 6-week follow-up than control group subjects.[13] These findings suggest a role for structured rehabilitation after these procedures. The purpose of this case study is to detail the management of a patient with calcific tendinopathy who had persistent SSPS following UGNB combined with corticosteroid injection.

CASE DESCRIPTION

Patient History

The patient was a 59-year-old right hand dominant male referred to physical therapy for left shoulder pain and loss of function that began 6 weeks prior to the initial evaluation. His job duties as a facility operations manager were primarily administrative in nature but he was active in mountain biking, kayaking, and home construction projects. He reported progressive worsening lateral left shoulder pain of insidious onset that limited left shoulder function. He reported pain with active motion in all directions that was most noticeable when he reached laterally, overhead, and behind his back to reach his wallet. He also reported loss of sleep due to left shoulder pain that prompted him

to seek medical attention. His physician ordered radiographs of the left shoulder that revealed hydroxyapatite deposition in the supraspinatus tendon. The physician diagnosed the condition as calcific tendinopathy of the supraspinatus tendon. The patient was referred to orthopedic surgery and underwent UGNB and subacromial corticosteroid injection. He was referred to physical therapy and advised to follow-up as needed with the orthopedist. He presented for a physical therapy evaluation 1 week after the procedures.

At the physical therapy evaluation, the patient reported no pain relief following UGNB and corticosteroid injection. He reported 3/10 resting pain on the 11-point Numeric Pain Rating Scale (NPRS). He localized his pain to the lateral aspect of the left shoulder. The pain would immediately increase to 7-8/10 with active motion of the shoulder. He reported a constant dull ache at rest progressing to a sharp pain at the middle and end ranges of active shoulder flexion, abduction, and scaption. The pain was worse when he moved the left shoulder after short periods of rest in any position. The sharp pain would decrease within 2 minutes if he elevated the shoulder repeatedly, however, a severe dull ache would remain. Sleep duration was limited to less than 2 consecutive hours due to left shoulder pain. The patient reported no previous history of left shoulder pain or trauma. No other red flags, such as nausea, unexplained weight changes, shortness of breath, or cancer history were identified. No yellow flags were identified. The patient's goals were to sleep without pain and return to his recreational activities without pain. After the subjective examination, differential diagnoses included calcific tendinopathy, SSPS, adhesive capsulitis, and cervical spine referred pain from C5-6 levels. The physical examination was designed to test competing diagnoses, identify functional impairments, and determine tissue irritability.

Self-report Outcome Measures

The Shoulder Pain and Disability Index (SPADI) and NPRS were the primary outcome measures used. The SPADI is a 13-item outcome assessment tool that has excellent reliability (ICC = 0.89).[15] The SPADI has a 5-item pain subscale and an 8-item disability subscale. The scores range from 0% to 100% with 100% indicating the most pain and disability. The minimal detectable change value for the total SPADI score is 18 points while the minimal clinically important difference for total scores ranges from 8 to 13 points.[15] The patient's initial SPADI pain and disability scores were 68% and 47.5%, respectively. The patient's total SPADI score was 55%. The NPRS ranges from 0 to 10 with 10 indicating "worst imaginable pain". The minimal clinical important difference of the NPRS is 1.1 for people with shoulder pain.[16]

Physical Examination

Visual inspection of the left shoulder was unremarkable. The patient had full cervical active range of motion (ROM) in all directions. Spurling's test was performed by applying overpressure into combined left cervical lateral flexion, rotation, and extension. None of these procedures reproduced the patient's familiar symptoms.

No abnormal scapular mechanics were observed at rest or with movement. The patient's right shoulder active ROM was full and nonpainful. Active ROM of the left shoulder was painful and limited compared to the right (**Table 1**). During assessment of flexion and abduction active ROM of the left shoulder, the patient reported sharp pain during the initial (0-15°), mid-range (80-110°), and end-range (160°) of elevation. His pain would return to the baseline pain level of 3/10 when he was not moving the shoulder within those ranges. The scapular assistance test was performed to determine if the patient's symptoms could be modified during active left shoulder elevation.[17] This test was positive as it resulted in a 2-point reduction in pain throughout shoulder elevation. Passive ROM of the left shoulder was equal to the right, but painful at end-range. Manual muscle testing of the left shoulder indicated the ability to resist a moderate amount of force for flexion, abduction, and external rotation. The patient yielded due to pain as the resistance increased. The therapist graded these muscle groups as 4/5 and considered these grades as weak and painful.

Glenohumeral accessory joint mobility was normal bilaterally, however, the patient reported pain with posterior and inferior glides of the left humeral head. He was tender to palpation immediately distal to the anterior and lateral aspect of the acromion on the left shoulder. At the end of the examination, he reported a 1-point increase in his resting pain level from 3/10 to 4/10. Periscapular manual muscle testing and special tests for the left shoulder were deferred given the severity and irritability of the patient's symptoms.

CLINICAL IMPRESSION

After the subjective and objective examinations, SSPS and calcific tendinopathy of the supraspinatus tendon were the working diagnoses. Findings such as pain and weakness with resisted muscle testing of the rotator cuff and middle to end-range pain during active left shoulder elevation supported the diagnoses.[18] A diagnosis of referred pain from the cervical spine was unlikely since the patient had full cervical active ROM and no reproduction of his chief complaint with overpressure in maximal cervical closing. Adhesive capsulitis was also unlikely given the patient demonstrated full passive ROM and normal accessory joint mobility.[18]

The patient's presentation was consistent with the rehabilitation classification of high irritability based on the reported intensity of pain with movement, consistent night pain limiting sleep, and moderate self-reported disability on the SPADI.[18] The high level of pain was characteristic of the resorptive substage of calcific tendinopathy.[1] Pain reduction during the scapular assistance test was considered a positive prognostic indicator for improving pain and disability.[19]

INTERVENTIONS

With working diagnoses of SSPS and calcific tendinopathy, physical therapy management was deemed appropriate. Treatment consisted of education, manual therapy, and therapeutic exercise. Patient education included the natural course of calcific tendinopathy and the potential mechanism for persistent pain after removal of calcific deposits,[7] prognosis,[8,19] and treatment expectations (**Table 2**). The scapular assistance maneuver and short bouts of anterior-to-posterior glides of the glenohumeral joint were used to decrease pain and enhance the patient's ability to participate in exercise.

In general, physical therapy management was guided by tissue irritability. Tissue irritability was determined as high, moderate, or low based on history and examination findings.[18,20] Maximal pain was set at 5/10 during exercise and daily activities. This level of pain was agreed upon by the physical therapist and patient as an acceptable level of pain. Pain was allowed to reach this point as long as symptoms subsided to baseline by the following morning and did not result in further limitation of daily activities. When pain surpassed 5/10 on the NPRS, the ROM or resistance was modified. As symptom irritability decreased, exercises were modified to load the shoulder complex throughout the full range of shoulder elevation.

Passive, active-assisted, and resisted movements were used to improve pain-free left shoulder active ROM (**Table 3**). The patient

Table 1. Physical Examination Findings

	Evaluation			Discharge			
NPRS	Quality: deep dull ache, sharp throughout initial, middle, and end ranges of elevation			Quality: occasional soreness at end range elevation			
	Current: 3/10			Current: 0/10			
	Best: 2/10			Best: 0/10			
	Worst: 8/10			Worst: 1/10 at end range elevation			
SPADI	Pain: 68% (34/50)			Pain: 8% (4/50)			
	Disability: 47.5% (38/80)			Disability: 3% (2/80)			
	Total: 55% (72/130)			Total: 5% (6/130)			
Shoulder Active and Passive ROM		Right	Left		Right	Left	
	Flexion	170/170	160*/170*	Flexion	170/170	170/170	
	Abduction	170/170	160*/170*	Abduction	170/170	170/170	
	Functional ER	T3	T1*	Functional ER	T3	T3	
	Functional IR	T10	L5*	Functional IR	T10	T8	
	ER at 0°	60	60*	ER at 0°	60	60	
	ER at 90°	80	NT	ER at 90°	80	70	
	IR at 90°	60	NT	IR at 90°	60	60	
	*pain			*pain			
Strength	Manual Muscle Testing			Single arm repetitions to fatigue			
		Right	Left		Right	Left	LSI
	Flexion	5	4*	Overhead press – 25 lbs	31	28	90%
	Abduction	5	4*	Bent over row – 25 lbs	29	26	90%
	ER at 0°	5	4*	Kettlebell snatch – 20 lbs	22	19	86%
	IR at 0°	5	5				
	Elbow flexion	5	5	Manual Muscle Testing: 5/5 and nonpainful in all directions			
	ER at 90°	5	NT				
	IR at 90°	5	NT				
	Protraction/upward rotation	5	NT				
	Middle trapezius	5	NT				
	Lower trapezius	5	NT				
	*pain						

Abbreviations: ER, external rotation; IR, Internal Rotation; LSI, Limb Symmetry Index; NT, not tested; NPRS, Numeric Pain Rating Scale; ROM, range of motion; SPADI, Shoulder Pain and Disability Index

Table 2. Patient Education

1. "Why does my shoulder hurt?"
    a. Calcific tendinopathy disease process and natural history.[1] Resorptive stage of calcific tendinopathy associated with high pain levels1 due to increased inflammation, neovascularization, and neoinnervation in the tissues around the calcific deposits.[7] The calcific deposits were removed, but the tissues remain sensitive to loading.
2. "What can I do about the pain and loss of function?"
    a. Modify and temporarily avoid activities that increase your pain significantly such as sleeping on the left shoulder while the tissues are irritable, then gradually reintroduce activities.[20]
    b. Protect and gradually load the healing tissues with progressive resistance exercise.[29,30]
3. Prognosis and reassurance
    a. Structured rehabilitation is effective for patients with this condition.[13,25,26]
    b. Absence of negative prognostic factors including female gender, dominant arm involvement, and longer duration of symptoms.[8]
    c. Presence of positive prognostic factors physical therapy management including the absence of a major operation, absence of pain in the right shoulder, and positive response to the scapular assistance test.[19]
4. Treatment expectations
    a. Some level of pain and discomfort is normal to experience during resistance exercise. Pain during exercise does not mean that tissue damage is occurring. Pain reflects tissue irritability and sensitivity to loading.
5. Pain intensity during exercise
    a. <5/10 → continue exercise
    b. >5/10 → modify exercise range of motion or resistance
6. Perceived difficulty of exercise
    a. Easy → add load or increase repetitions
    b. Moderately difficult → continue with current volume and intensity
    c. Hard → continue with current volume and intensity

Table 3. Exercise Interventions Based on Tissue Irritability

Goal	High Irritability	Moderate Irritability	Low Irritability
Pain Free Shoulder Elevation	Shoulder elevation (active assisted ROM)	Shoulder elevation (active assisted ROM with active eccentric lowering)	Shoulder elevation (active ROM)
	Table step back	Wall press step back	Single arm wall slide
		Single arm wall slide	
Pain Free Functional Internal Rotation (Reaching Behind Back)		Assisted functional internal rotation walkout*	Resisted functional internal rotation*
Home Exercise Program Parameters Based on Tissue Irritability			
Frequency	3 times per day	3 times per day	As needed
Volume	20 repetitions	30 repetitions	30-40 repetitions
Intensity	<5/10 pain	<3/10 pain; end range 3-5 sec holds	<3/10 pain
Goal	**High Irritability**	**Moderate Irritability**	**Low Irritability**
Shoulder Strength and Load Tolerance	Lateral raise to 100°	Lateral raise – 3-5 lbs	Lateral raise – 5-10 lbs
	Bilateral isometric external rotation* - 10-30 sec holds	Bilateral isometric external rotation with shoulder flexion to 90°*	Face pull*
	Table plank with plus – 30 second to 2-minute holds	Floor plank wth plus – 30 second to 2-minute holds	Floor push-up with alternating shoulder flexion
		Floor push-up plus	
		Prone row – 5-10 lbs	Single arm bent over row – 15-25 lbs
			Face pull into overhead press*
			Overhead press – 5-25 lbs
			Single arm clean and press – 10-25 lbs
			Single arm snatch – 10-25 lbs
Home Exercise Program Parameters Based on Tissue Irritability			
Frequency	3 times per week	3 times per week	3 times per week
Volume	1-2 sets of 10-20 repetitions	2-3 sets of 15-30 repetitions	3 sets of 15-30 repetitions
Intensity	<5/10 pain; moderate difficulty	<5/10 pain; moderate difficulty	<3/10 pain; moderate-hard difficulty
Rest	1 minute	30 seconds to 1 minute	30 seconds

*elastic resistance
See Appendix 1 for visual of exercises

performed passive and active-assisted exercises for left shoulder elevation throughout the duration of treatment to enable self-management of left shoulder pain after periods of not moving the left shoulder. Exercise selection (**Appendix 1**) was guided by the patient's activity goals and electromyographic studies.[21–23] Exercise progression variables such as volume and intensity were adjusted to increase the physical capacity of the left shoulder. Intensity of resistive exercise was classified based on patient report of the exercise being easy, moderately difficult, or hard. A range from moderate to hard self-reported difficulty was desired. The patient completed a home exercise program composed of up to 4 exercises throughout the duration of treatment. A program of 4 exercises was given to the patient to maintain gains made during treatment (**Table 4, Figures 1-4**).

OUTCOMES

The patient was seen for 8 visits over a period of 8 weeks. At discharge, the patient reported improvements on the SPADI with scores of 8% and 3% for pain and disability, respectively. He demonstrated improvements on all impairments identified during the initial evaluation (**Table 1**). Left shoulder active ROM was full and non-painful in all directions. He demonstrated 5/5 muscle

Table 4. Final Self-Management Home Exercise Program

Exercise	Volume and Load Parameters
Lateral Raise to 100°	3x20 – 10 lbs
Dumbbell Overhead Press	3x20 – 25 lbs
Shoulder-width Floor Push-up	3x20 – Bodyweight
Face Pull	3x20 – Black Theraband (10.2 pounds of resistance at 200% elongation)
Exercise Parameters	
Frequency	3 times per week on nonconsecutive days
Intensity	Pain: A low level of discomfort (<3/10) is acceptable during exercise and up to 24 hours after, pain should resolve by the next morning and not limit daily activities.
	Effort: The last 3-5 repetitions of each set should feel moderately difficult. Options for progressing intensity if exercises feel easy are: • Add 1-2 repetitions to each set per week • Add 1-2 second hold to each repetition
Time	15-20 minutes per session; 30 second to 1-minute rest intervals
Type	Circuit-based design including lateral raising, horizontal pressing, vertical pressing, and pull movements

Figure 1. Lateral Dumbbell Raise

Figure 2. Dumbbell Overhead Press

strength for all resisted movements of the left upper extremity. He was able to perform loaded single arm movements for maximal repetitions. The limb symmetry index for the overhead press, bent over row, and kettlebell snatch ranged from 86-90%. The limb symmetry index represents performance of the injured limb compared with the uninjured limb and is expressed as a percentage.[24] Values closer to 100% indicate similar performance between limbs.

The patient reported steady improvements in sleep duration throughout treatment and had resumed his normal schedule of 7 hours of uninterrupted sleep by the 6th visit. He had returned to kayaking, mountain biking, and had completed a cabinet installation project without being limited by symptoms by the 7th visit. The patient reported satisfaction with his shoulder function at the 8th visit and elected to transition to self-management. He was advised to continue performing his exercise program 3 times per week for 4 additional weeks and then follow-up with our clinic. At the 4-week follow-up, the patient reported occasional 1/10 pain on the NPRS in the left shoulder after strenuous physical activity that would resolve by the following morning. He reported further improvements in shoulder function and satisfaction with his outcome. He discontinued the formal exercise program and was instructed to follow-up as needed. No follow-up radiographs were indicated based on the patient's symptom resolution and success in reaching his goals.

DISCUSSION

This case study describes the management of a patient who presented with SSPS after UGNB combined with a corticosteroid injection. Ultrasound-guided needle barbotage is an effective treatment for most cases of calcific tendinopathy.[8–10] The patient's persistent shoulder pain and loss of function after the procedure is an important point for medical and rehabilitation professionals. Facilitating the removal of calcifications may not be sufficient in isolation to achieve optimal outcomes.[13]

Two previous case studies have reported on the physical therapy management of patients with calcific tendinopathy.[25,26] In the study by Wainner and Hasz,[26] the patient had ongoing shoulder pain following a vaccination. An incidental finding of calcific tendinopathy was noted on follow-up radiographs. The patient underwent UGNB and then participated in a short course of physical therapy but was unable to con-

Figure 3. Shoulder-width Push-up

Figure 4. Face Pull

tinue therapy due to work restrictions. The authors had no follow-up to determine if the patient regained full shoulder strength or returned to his work activities without limitations. Scibek and Carcia[25] treated a patient who presented with acute shoulder pain after forceful abduction and external rotation of the shoulder with radiographic findings of calcific tendinopathy.[25] The patient was successfully treated with a combination of superficial modalities, medication, and exercise. In both studies,[25,26] the description of exercise parameters used was poor or not present altogether. Other authors who have examined the efficacy of physical therapy management of calcific tendinopathy have only partly described exercise parameters or progression.[12,13] Missing details on treatment parameters limits the applicability of the interventions and leaves clinicians with little guidance as to how to implement exercise to achieve optimal outcomes.

Several investigators[27–29] agree that progressive shoulder strengthening is effective for managing SSPS.[27–29] Exercise parameters for patients with shoulder pain have been given considerable attention recently.[30–32] Littlewood et al[30] reported that the optimal dose of resistance exercise for patients with rotator cuff tendinopathy is unclear with regards to frequency, volume, and resistance level. Their findings suggested the following: 3 sets are preferred to fewer sets, higher doses are superior to lower doses, and programs should demonstrate clinically significant outcomes by 3 months.[30] Malliaras et al[31] suggested that exercise programs that progressively increase load and use higher volume might be superior to lower dose programs for improving function.[31] Exercise parameters consistent with the current best evidence recommendations[28,30–32] were used in this case study, with increases in load and volume over time being key features of the patient's regimen and successful outcome.

The mechanisms of pain reduction during and following exercise include multiple physiological processes, psychosocial factors, and contextual factors that are not completely understood.[33] Current evidence is unclear as to whether pushing through pain or avoiding pain during exercise results in better outcomes.[30] The patient in the current study was amenable to experience pain during exercise after discussion with the lead author and normalization of the pain response to exercise. Agreement between the lead author and the patient on treatment expectations regarding pain[34] likely contributed to his adherence to the program and successful outcome.

Pieters et al[28] reported that manual therapy combined with exercise resulted in further improvements in function and pain in the short-term compared with exercise alone. The authors reported uncertainty about the optimal type, dose, and duration of exercise or manual therapy for patients with SSPS. In the current case study, we used short bouts of glenohumeral joint mobilizations when the patient's symptoms were highly irritable, and this appeared to enable better tolerance for exercise. Similarly, the scapular assistance test was useful as an active-assisted ROM technique for decreasing the patient's pain throughout the range of shoulder elevation. The mechanisms behind the effectiveness of the scapular assistance test for reducing shoulder pain are unclear, although, a positive test may have a role in predicting better clinical outcomes compared to a negative test.[19] The lead author of this study hypothesized that pain reduction during the scapular assistance maneuver occurred as a result of both a reduction of load on the rotator cuff throughout shoulder elevation and the contextual factors of the patient encounter.[35,36]

This case study has several limitations including no control group and no long-term follow-up. The influence of the natural history of calcific tendinopathy and SSPS cannot be ignored. The patient presented 1 week after UGNB and corticosteroid injection. With time, he may have improved without the need for physical therapy. Given the patient's high self-reported disability and pain after the procedures, he likely would have had difficulty returning to his desired activities without physical therapy intervention.

CLINICAL APPLICATION

This case report describes the management of a patient who presented to physical therapy with SSPS and calcific tendinopathy of the left shoulder. After UGNB and corticosteroid injection, patients with SSPS and calcific tendinopathy may continue to present with high levels of pain and loss of shoulder function. Appropriately dosed exercise regimens guided by tissue irritability, activity goals, and agreement on treatment expectations should be implemented to assist patients in returning to their desired activities.

REFERENCES

1. Uhthoff HK, Loehr JW. Calcific tendinopathy of the rotator cuff: pathogenesis,

(Continued on page 80)

Appendix 1. Exercise Interventions Used in this Case Report

Table Step Back

Wall Press

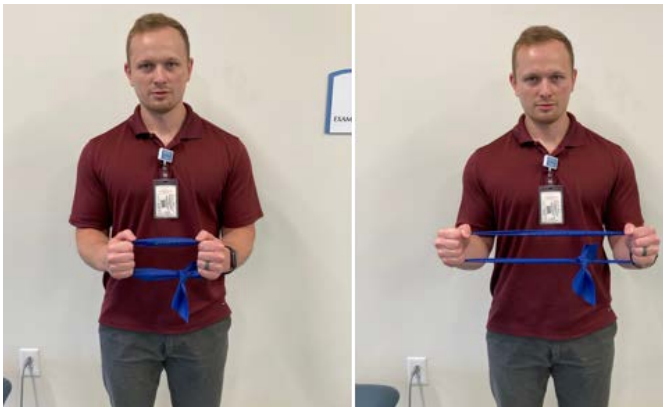
Active-assisted ROM Shoulder Elevation

Single Arm Wall Slide

Functional Internal Rotation Walkout

Resisted Functional Internal Rotation

Bilateral Isometric External Rotation



Bilateral Isometric External Rotation with Shoulder Flexion to 90°

Appendix 1. Exercise Interventions Used in this Case Report *(Continued from page 78)*

Table Plank with Plus

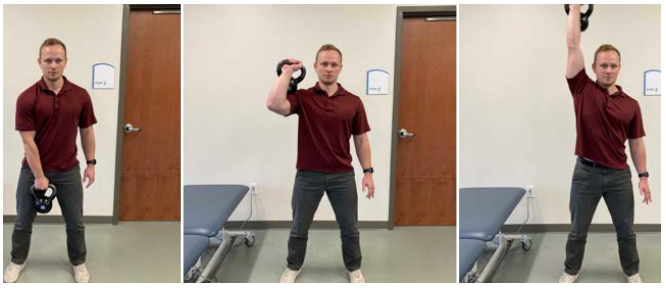
Floor Push-up with Alternating Shoulder Flexion

Prone Row

Single Arm Bent Over Row

Face Pull into Overhead Press

Single Arm Clean and Press



Single Arm Snatch

(Continued from page 77)

diagnosis, and management. *J Am Acad Orthop Surg*. 1997;5(4):183-191. doi:10.5435/00124635-199707000-00001

2. Louwerens JKG, Sierevelt IN, van Hove RP, van den Bekerom MPJ, van Noort A. Prevalence of calcific deposits within the rotator cuff tendons in adults with and without subacromial pain syndrome: clinical and radiologic analysis of 1219 patients. *J Shoulder Elbow Surg*. 2015;24(10):1588-1593. doi:10.1016/j.jse.2015.02.024
3. Bosworth BM. Calcium deposits in the shoulder and subacromial bursitis. *JAMA*. 1941;116(22):2477. doi:10.1001/jama.1941.02820220019004
4. Ketola S, Lehtinen J, Arnala I, et al. Does arthroscopic acromioplasty provide any additional value in the treatment of shoulder impingement syndrome?: a two-year randomised controlled trial. *J Bone Joint Surg Br*. 2009;91(10):1326-1334. doi:10.1302/0301-620X.91B10.22094
5. Worland RL, Lee D, Orozco CG, SozaRex F, Keenan J. Correlation of age, acromial morphology, and rotator cuff tear pathology diagnosed by ultrasound in asymptomatic patients. *J South Orthop Assoc*. 2003;12(1):23-26.
6. Snow M, Cheong D, Funk L. Subacromial impingement: is there correlation between symptoms, arthroscopic findings and outcomes? *Shoulder Elbow*. 2009;1(2):89-92. doi:10.1111/j.1758-5740.2009.00022.x
7. Hackett L, Millar NL, Lam P, Murrell GAC. Are the Symptoms of calcific tendinitis due to neoinnervation and/or neovascularization? *J Bone Joint Surg Am*. 2016;98(3):186-192. doi:10.2106/JBJS.O.00417
8. de Witte PB, van Adrichem RA, Selten JW, Nagels J, Reijnierse M, Nelissen RGHH. Radiological and clinical predictors of long-term outcome in rotator cuff calcific tendinitis. *Eur Radiol*. 2016;26(10):3401-3411. doi:10.1007/s00330-016-4224-7
9. Kim SC, Lee SM, Park GT, Jang MC, Yoo JC. Ultrasound-guided needle decompression and steroid injection for calcific tendinitis of the shoulder: risk factors for repeat procedures and outcome analysis. *Clin Shoulder Elb*. 2021;24(2):55-65. doi:10.5397/cise.2021.00101
10. Bazzocchi A, Pelotti P, Serraino S, et al. Ultrasound imaging-guided percutaneous treatment of rotator cuff calcific tendinitis: success in short-term outcome. *Br J Radiol*. 2016;89(1057):20150407. doi:10.1259/bjr.20150407
11. Arirachakaran A, Boonard M, Yamaphai S, Prommahachai A, Kesprayura S, Kongtharvonskul J. Extracorporeal shock wave therapy, ultrasound-guided percutaneous lavage, corticosteroid injection and combined treatment for the treatment of rotator cuff calcific tendinopathy: a network meta-analysis of RCTs. *Eur J Orthop Surg Traumatol*. 2017;27(3):381-390. doi:10.1007/s00590-016-1839-y
12. Duymaz T, Sindel D. Comparison of radial extracorporeal shock wave therapy and traditional physiotherapy in rotator cuff calcific tendinitis treatment. *Arch Rheumatol*. 2019;34(3):281-287. doi:10.5606/ArchRheumatol.2019.7081
13. Abate M, Schiavone C, Salini V. Usefulness of rehabilitation in patients with rotator cuff calcific tendinopathy after ultrasound-guided percutaneous treatment. *Med Princ Pract*. 2015;24(1):23-29. doi:10.1159/000366422
14. Farin PU, Jaroma H, Soimakallio S. Rotator cuff calcifications: treatment with US-guided technique. *Radiology*. 1995;195(3):841-843. doi:10.1148/radiology.195.3.7754018
15. Roy J-S, MacDermid JC, Woodhouse LJ. Measuring shoulder function: a systematic review of four questionnaires. *Arthritis Rheum*. 2009;61(5):623-632. doi:10.1002/art.24396
16. Mintken PE, Glynn P, Cleland JA. Psychometric properties of the shortened disabilities of the Arm, Shoulder, and Hand Questionnaire (QuickDASH) and Numeric Pain Rating Scale in patients with shoulder pain. *J Shoulder Elbow Surg*. 2009;18(6):920-926. doi:10.1016/j.jse.2008.12.015
17. Rabin A, Irrgang JJ, Fitzgerald GK, Eubanks A. The intertester reliability of the Scapular Assistance Test. *J Orthop Sports Phys Ther*. 2006;36(9):653-660. doi:10.2519/jospt.2006.2234
18. Kelley MJ, Shaffer MA, Kuhn JE, et al. Shoulder pain and mobility deficits: adhesive capsulitis. *J Orthop Sports Phys Ther*. 2013;43(5):A1-31. doi:10.2519/jospt.2013.0302
19. Chester R, Jerosch-Herold C, Lewis J, Shepstone L. Psychological factors are associated with the outcome of physiotherapy for people with shoulder pain: a multicentre longitudinal cohort study. *Br J Sports Med*. 2018;52(4):269-275. doi:10.1136/bjsports-2016-096084
20. McClure PW, Michener LA. Staged Approach for Rehabilitation Classification: Shoulder Disorders (STAR-Shoulder). *Phys Ther*. 2015;95(5):791-800. doi:10.2522/ptj.20140156
21. Reinold MM, Escamilla RF, Wilk KE. Current concepts in the scientific and clinical rationale behind exercises for glenohumeral and scapulothoracic musculature. *J Orthop Sports Phys Ther*. 2009;39(2):105-117. doi:10.2519/jospt.2009.2835
22. Kang F-J, Ou H-L, Lin K-Y, Lin J-J. Serratus anterior and upper trapezius electromyographic analysis of the push-up plus exercise: a systematic review and meta-analysis. *J Athl Train*. 2019;54(11):1156-1164. doi:10.4085/1062-6050-237-18
23. Pozzi F, Plummer HA, Sanchez N, Lee Y, Michener LA. Electromyography activation of shoulder and trunk muscles is greater during closed chain compared to open chain exercises. *J Electromyogr Kinesiol*. 2019:102306. doi:10.1016/j.jelekin.2019.05.007
24. Engelen-van Melick N, van Cingel REH, Tijssen MPW, Nijhuis-van der Sanden MWG. Assessment of functional performance after anterior cruciate ligament reconstruction: a systematic review of measurement procedures. *Knee Surg Sports Traumatol Arthrosc*. 2013;21(4):869-879. doi:10.1007/s00167-012-2030-6
25. Scibek JS, Carcia CR. Presentation and conservative management of acute calcific tendinopathy: a case study and literature review. *J Sport Rehabil*. 2012;21(4):334-342. doi:10.1123/jsr.21.4.334
26. Wainner RS, Hasz M. Management of acute calcific tendinitis of the shoulder. *J Orthop Sports Phys Ther*. 1998;27(3):231-237. doi:10.2519/jospt.1998.27.3.231
27. Abdulla SY, Southerst D, Côté P, et al. Is exercise effective for the management of

subacromial impingement syndrome and other soft tissue injuries of the shoulder? A systematic review by the Ontario Protocol for Traffic Injury Management (OPTIMa) Collaboration. *Man Ther*. 2015;20(5):646-656. doi:10.1016/j.math.2015.03.013
28. Pieters L, Lewis J, Kuppens K, et al. An update of systematic reviews examining the effectiveness of conservative physical therapy interventions for subacromial shoulder pain. *J Orthop Sports Phys Ther*. 2020;50(3):131-141. doi:10.2519/jospt.2020.8498
29. Lombardi I, Magri AG, Fleury AM, Da Silva AC, Natour J. Progressive resistance training in patients with shoulder impingement syndrome: a randomized controlled trial. *Arthritis Rheum*. 2008;59(5):615-622. doi:10.1002/art.23576
30. Littlewood C, Malliaras P, Chance-Larsen K. Therapeutic exercise for rotator cuff tendinopathy: a systematic review of contextual factors and prescription parameters. *Int J Rehabil Res*. 2015;38(2):95-106. doi:10.1097/MRR.0000000000000113
31. Malliaras P, Johnston R, Street G, et al. The efficacy of higher versus lower dose exercise in rotator cuff tendinopathy: A systematic review of randomized controlled trials. *Arch Phys Med Rehabil*. 2020;101(10):1822-1834. doi:10.1016/j.apmr.2020.06.013
32. Naunton J, Street G, Littlewood C, Haines T, Malliaras P. Effectiveness of progressive and resisted and non-progressive or non-resisted exercise in rotator cuff related shoulder pain: a systematic review and meta-analysis of randomized controlled trials. *Clin Rehabil*. 2020;34(9):1198-1216. doi:10.1177/0269215520934147
33. Rice D, Nijs J, Kosek E, et al. Exercise-induced hypoalgesia in pain-free and chronic pain populations: state of the art and future directions. *J Pain*. 2019;20(11):1249-1266. doi:10.1016/j.jpain.2019.03.005
34. Littlewood C, Malliaras P, Mawson S, May S, Walters S. Patients with rotator cuff tendinopathy can successfully self-manage, but with certain caveats: a qualitative study. *Physiotherapy*. 2014;100(1):80-85. doi:10.1016/j.physio.2013.08.003
35. Rossettini G, Carlino E, Testa M. Clinical relevance of contextual factors as triggers of placebo and nocebo effects in musculoskeletal pain. *BMC Musculoskelet Disord*. 2018;19(1):27. doi:10.1186/s12891-018-1943-8
36. Testa M, Rossettini G. Enhance placebo, avoid nocebo: How contextual factors affect physiotherapy outcomes. *Man Ther*. 2016;24:65-74. doi:10.1016/j.math.2016.04.006

Intervention for Mid-Back Pain in a Patient with Thoracic Scoliosis: A Case Report

Julia Brownholtz, PT, DPT[1]
Brittany Chan, PT, DPT[2]
Jacqueline Bouchey, PT, DPT[3]
Brianna Cervizzi, PT, DPT[4]
Denise M. Cameron, PT, PhD[5]

[1]Burke Outpatient Rehabilitation & Physical Therapy, Bronx, NY
[2]SPEAR Physical Therapy-Center for the Performing Arts, Times Square, NY
[3]Lawrence and Memorial Outpatient Rehabilitation, Waterford, CT
[4]Orthopaedic Sports Specialists, Glastonbury, CT
[5]Associate Professor Emerita, Quinnipiac University DPT Program, Hamden, CT

ABSTRACT

Background and Purpose: Several studies have reported a relationship between back pain and scoliosis; however, very few studies have investigated scoliosis-specific exercises for the treatment of pain in patients with scoliosis. The primary purpose of this case study is to document the examination, intervention, and outcomes for a patient with mid-back pain hypothesized to be, in part, the result of stresses placed on spinal structures secondary to scoliosis. A secondary purpose was to investigage sport-related activities that may have contributed to the etiology of this patient's scoliosis. **Methods:** The patient was a 23-year-old female with persistent right mid-back pain and examination findings consistent with a right thoracic, left lumbar scoliosis. The patient was seen twice and was followed for a 12-week period during which time she was instructed in scoliosis-specific and motor control exercises as well as posture education. **Findings:** Improved outcome scores on both the Numerical Pain Rating Scale (NPRS) and Patient-Specific Function Scale (PSFS) were reported. **Clinical Relevance/Conclusion:** Scoliosis-specific and motor control exercises may be useful when treating patients with scoliosis related back pain.

Key Words: angle of trunk rotation, exercise, spine

BACKGROUND AND PURPOSE

Scoliosis is characterized by a coronal plane Cobb angle of ≥10° with vertebral rotation in the transverse plane.[1-3] When this deformity develops in individuals for no apparent reason during adolescent years, it is referred to as adolescent idiopathic scoliosis (AIS). While the etiology of AIS is unknown, several theories regarding contributing factors, including sports related activities,[4] have been proposed. Scoliosis deformity places abnormal and asymmetric torsional, compressive, and shear stresses on the spinal tissues that can lead to tissue breakdown and pain.[5] Several studies have reported a relationship between back pain and scoliosis.[2,6-8] According to the 2016 Scientific Society on Scoliosis Orthopaedic and Rehabilitation Treatment (SOSORT) guidelines on the treatment of idiopathic scoliosis, physiotherapeutic scoliosis-specific exercises are recommended, and supported with Level I evidence, as the first step to treat idiopathic scoliosis.[9] Many scoliosis-specific exercise approaches have been prescribed.[10] Common elements of these approaches include correction of spinal malalignment through static and dynamic postures and motor control exercises of trunk and extremity muscles with the aim of reducing the scoliotic curve(s) or preventing curve progression.

While many studies have been conducted on the effectiveness of scoliosis-specific exercises for reducing Cobb angles and improving quality of life in asymptomatic individuals with scoliosis,[11-20] there is a paucity of research on the examination and treatment of idiopathic scoliosis in patients with back pain hypothesized to be related to the mechanical stresses that are placed on the spine secondary to scoliosis. Therefore, the primary purpose of this case study was to document examination, intervention, and outcomes for a patient with mid-back pain hypothesized to be, in part, the result of stresses placed on spinal structures secondary to scoliosis. A secondary purpose was to investigate sport related activities that may have contributed to the etiology of this patient's scoliosis.

CASE DESCRIPTION

Patient History

The patient, a 23-year-old female graduate student, presented with persistent right-sided mid-back pain that she reported had been present for approximately 12 years. Pain and function were assessed using the Numerical Pain Rating Scale (NPRS) and Patient-Specific Function Scale (PSFS), respectively. The NPRS is an 11-point scale ranging from 0 to 10 with 0 indicating no pain and 10 indicating worst possible pain. While reliability, validity, and minimal clinically important difference (MCID) values have not been established for mid-back pain, this scale has been determined to be reliable and valid[21] for use with low back pain (LBP) with a reported MCID value of 2.0.[22] The patient rated her current pain as 3/10 and her worst pain over the previous week and past month as 6/10 at initial evaluation.

The PSFS asks patients to identify 3 activities that they have difficulty performing because of their pain and rate their ability to perform each of these activities on a scale of 0 (unable to perform the activity) to 10 (able to perform the activity at preinjury level). As the PSFS is the self-report outcome measure that most reflects the effect that activities identified as most relevant by the patient have on that patient, it was identified as the primary outcome measure. While reliability and validity have not been established for the PSFS in patients with mid-back pain, the PSFS has been determined to be both reliable[23] and valid[24] for use with LBP. Also, while MCID values for mid-back pain have not been established for the PSFS, the MCID value of 2.3 (medium change) has been reported for patients with LBP.[25] The patient identified participating in yoga, sitting for more than 60 minutes, and lifting as the 3 activities affected most by her mid-back pain and assigned ratings of 6/10, 6/10, and 7/10 respectively to each of those activities.

At the time of her initial visit, the patient reported that a diagnosis of AIS had been made at age 10 by an orthopedic surgeon based on radiograph images. While the patient was unable to locate the report or the radiograph images in which the diagnosis of right thoracic scoliosis was made, she reported remembering that the Cobb

angle was between 20 and 25°. The patient reported playing volleyball from age 14-18 and softball from age 5-16 in her activity history during her adolescent years and more recently reported participating in yoga.

Other relevant history included a diagnosis of fibromyalgia that was made by the patient's primary care physician 8 months prior. Fibromyalgia symptoms included widespread pain and fatigue identified as separate from her chief complaint of right sided mid-back pain. To manage her fibromyalgia symptoms, the patient had been taking duloxetine 40 mg once a day and gabapentin 400 mg 2 times a day for the past 8 months.

Clinical impression #1

The initial clinical impression was a diagnosis of right-sided mid-back pain possibly secondary to stresses caused by thoracic scoliosis. Functional limitations with participating in yoga, sitting for more than 60 minutes, and lifting were reported. A diagnosis of chronic fatigue syndrome had the potential to negatively influence prognosis while high motivation to decrease pain and improve function was a positive personal factor.

Examination

The examination was performed independently by 3 examiners, 2 doctor of physical therapy students, and 1 physical therapist. The findings presented are based on a consensus, or in the case of measurements, an average of the 3 examiners' measurements. Examination began with posture assessment in both sitting and standing. In the frontal plane, this assessment revealed the patient's shoulder girdle and pelvis were mildly higher on the right both in standing and sitting, findings consistent with right thoracic and left lumbar scoliotic curves, respectively. Furthermore, moderate right thoracic and mild left lumbar trunk rotations, also consistent with right thoracic and left lumbar curves, were observed in both standing and sitting. In the sagittal plane normal thoracic kyphosis and lumbar lordosis curves were observed.

To further assess for scoliosis the Adam Forward Bending Test (FBT), in combination with the Scolioscreen-smartphone device, was performed.[26,27] Historically the Adam FBT in combination with the Scoliometer (Orthopedic Systems, Inc., Hayward, CA) has been used clinically to assess the angle of trunk rotation (ATR) and the Scoliosis Research Society International Task Force states that there is moderate evidence to recommend referral with Scoliometer values between 5° and 7°, or greater.[27,28] Recently the Scolioscreen-smartphone device, a smartphone placed within a thermoplastic rubber cradle (Spinologics, Montreal, Canada), has been used to assess the ATR.[9] Measures of inclination are taken with the device using a downloaded inclination application. Several studies have found this device to be reliable and valid when compared with the Scoliometer.[29,30] With the patient seated on a treatment table and the table adjusted so that the feet were fully supported, the patient was instructed to flex forward. In this forward flexed position, the right thoracic and left lumbar trunk rotations observed in the upright position became more apparent. Trunk rotation measurements were taken using the Scolioscreen-smartphone device. The device was first calibrated and then actuated by moving the device along the patient's spine from L5 to C7. Each of the 3 examiners performed 3 trials. An average of the examiners' 3 averaged trials was calculated for each curve. Angle of trunk rotation measurements were 8.82° at T6 and 1.21° at L3 for the right thoracic and left lumbar curves, respectively.

Thoracic side-bending and rotation were assessed for symmetry and pain provocation in the seated position with feet flat on the ground and the lumbar spine manually stabilized. Thoracic side-bending was performed with the shoulders abducted, elbows flexed, and palms resting on the posterior aspect of the cranium and thoracic rotation with the arms crossed in front and hands on opposite shoulders. The patient was instructed to side-bend as far as possible in each direction, and this was repeated for rotation. Thoracic spine motions did not provoke her pain; however, decreased thoracic right side-bend[31] and increased thoracic right rotation[32] were noted, consistent with a right thoracic curve. A summary of examination findings consistent with the patient's right thoracic, left lumbar scoliosis are presented in **Table 1**. Lower abdominal muscle strength was graded 2/5 using the Sahrmann assessment method.[33,34]

Clinical impression #2

Examination findings included an ATR measurement of 8.82° at T6 confirming our initial impression of a right thoracic curve with right sided mid-back pain located at the apex of the curve. A compensatory left lumbar curve was also found; however, the lumbar ATR measurement of 1.21° was less than the minimal detectable change of 2.40° calculated using data from Vanwest et al.[30] Using the formula developed by Sapkas et al[35] to predict the Cobb angle of the thoracic curve based upon ATR measurements (C = 20.461 + 0.13S2 where C = predicted Cobb angle and S2 = square of ATR), the patient's predicted Cobb angle was 30.57°. Scoliosis is generally diagnosed when a Cobb angle of 10° or higher is present.[2] Based on the patient's perceived inability to fully perform lifting, yoga, and sitting activities on the PSFS, her right mid-thoracic pain, findings consistent with a right thoracic scoliosis, and weak lower abdominal muscles, it was determined that the patient would benefit from scoliosis-specific and motor control exercises as well as education on proper posture. To determine outcomes of the intervention, PSFS, NPRS, and patient perceived extent of recovery[36] were administered during follow-up visits at weeks 4, 8, and 12. It was hypothesized that after 12 weeks of scoliosis-specific and motor control exercises, the patient's NPRS scores would decrease, PSFS scores would increase, and patient perceived extent of recovery, expressed as a percentage, would improve.

Intervention

To address identified activity limitations and pain, the patient was seen twice during which time she was instructed in optimal sitting and standing postures[37] and in a home exercise program consisting of 6 exercises. Three of the 6 exercises were designed to correct the primary right thoracic curve, 2 exercises targeted both the primary right thoracic and secondary left lumbar curves, and one exercise was designed to improve motor control of the trunk and pelvis (**Table 2**). The 3 exercises that targeted the primary right thoracic curve were spinal correction performed seated in front of a mirror (**Figure 1**),[18,38] spinal correction performed standing with elastic band and weight (**Figure 2**),[39] and side-bend stretch in sidelying (**Figure 3**).[40] The muscle cylinder (**Figure 4**)[40] and modified half-moon (**Figure 5**)[15,41] exercises targeted both the primary right thoracic and secondary left lumbar curves, and the quadruped alternate arm and leg lifts[42] targeted motor control of the trunk and pelvis.

During the first visit the patient was educated on optimal sitting and standing postures and instructed in 3 of the 6 exercises: (1) spinal correction, seated, (2) spinal correction, standing with elastic band and weight, and (3) quadruped alternate arm and leg lifts. A second visit was scheduled 7 days after the first visit. At the beginning of the second session, the patient demonstrated the exercises from the previous visit and technique adjustments were made. The patient was then prescribed the remaining 3

Table 1. Examination Findings Consistent with Thoracic and Lumbar Curves for the Patient in this Case Report

Tests	Findings	Consistent with…
Posture – standing & sitting	Shoulder girdle & pelvis slightly higher on right	Right thoracic Left lumbar
	Moderate right thoracic rotation Mild left lumbar rotation	Right thoracic Left lumbar
Adam Forward Bending test	Moderate right thoracic rotation; Mild left lumbar rotation	Right thoracic Left lumbar
ATR measurements	8.82^0 (T6)	Right thoracic
	1.21^0 (L3)	Left lumbar
Thoracic active side-bend	Mildly decreased right side bending	Right thoracic
Thoracic active rotation	Mildly increased right rotation	Right thoracic
Abbreviation: ATR; angle of trunk rotation		

exercises: (1) modified half-moon, (2) muscle cylinder, and (3) side-bend stretch in sidelying. The patient was instructed to perform at least 4 of the exercises a minimum of 4 times per week and to complete an exercise log for tracking exercise compliance.

Outcome

The results of outcome measures at baseline and 4, 8, and 12-weeks follow-up assessments for the NPRS and PSFS are presented in **Table 3** and **Table 4**, respectively. The patient's "worst past week pain" on the NPRS was 3/10 at baseline, remained unchanged at the 4-week follow-up, increased to 4/10 at the 8-week follow-up and decreased to 2/10 at the 12-week follow-up. Thus, from baseline to week 12, the patient's "worst past week pain" decreased by 1 point on the 11-point scale. With respect to the PSFS, from baseline to week 4, the patient reported improvement in her ability to perform yoga and lift while sitting longer than 60 minutes did not change. From week 4 to week 8, the patient reported continued improvement in her ability to participate in yoga activities and in her ability to sit for more than 60 minutes. Her ability to lift however, decreased from 8/10 to 7/10. From baseline to 12-week follow-up, there was an improved ability to lift, perform yoga, and sit for longer than 60 minutes. At 12-week follow-up, the average PSFS for the 3 activities improved by 2.34 (from 6.33 to 8.67). Patient's perceived extent of recovery was obtained at weeks 4, 8, and 12. Perceived percentage of recovery from baseline was reported using 0% indicating no improvement and 100% indicating full recovery. The patient reported 50% overall improvement in mid-back pain at the week 4 follow-up and a 90% improvement at week 12.

DISCUSSION

This case report describes the examination and treatment of a 23-year-old right-hand dominant female with right mid-back pain and examination findings consistent with a right thoracic, left lumbar scoliosis. The patient was instructed in posture correction and a home exercise program consisting of 6 exercises over 2 treatment sessions spaced 1 week apart and was followed for a 12-week period. Pain intensity, "worst pain over past week", on the NPRS improved by 1 point, 3/10 to 2/10 from baseline to 12 weeks. While improvement in pain intensity did not reach the MCID of 2.0, percentage reduction in pain, rather than absolute change, has been suggested to be a more useful parameter for determining meaningful improvement.[43,44] Percent improvement on the NPRS, 33%, exceeded the 20% reduction considered to represent "moderately important" improvement in pain suggesting that the patient's improvement in pain was clinically important.[25] The average PSFS score for the 3 activities the patient identified as having difficulty performing because of her pain improved by 2.34, from 6.33 at baseline to 8.67 at 12 weeks. While the MCID for PSFS in patients with mid-back pain has not been established, the MCID for PSFS for patients with LBP has been reported to be 2.3, which suggests that the patient's improvement was clinically important.[25] Finally, a 50% and 90% overall improvement in mid-back pain was reported on patient perceived extent of recovery at the 4- and 12-week follow-ups, respectively. The patient attributed her recovery to her compliance with the exercise program.

Most intervention studies involving scoliosis-specific exercises have focused on the effects of scoliosis-specific exercises on decreasing the Cobb angle or ATR and improving quality of life in asymptomatic individuals with AIS.[11-20] One randomized control trial investigated the effectiveness of motor control exercises in patients with LBP and AIS.[45] Thirty-four participants were randomly assigned to a control or treatment group. The treatment group received 4 exercise progressions to target the transversus abdominal muscle, erector spinae/multifidus muscles, and global core. It was determined that motor control exercises for LBP in patients with AIS were effective in decreasing pain on the NPRS ($p<0.01$) and improving function on the PSFS ($p<0.01$) in patients with AIS compared to the control group. The results of the current case study conducted on a patient with mid-back pain and scoliosis are consistent with the findings of the Zapata et al[45] randomized control trial on patients with LBP.

The secondary purpose of this case report was to identify possible contributing factors to the development of this patient's scoliosis. Modi et al[4] proposed a sports-related scoliosis subgroup based upon their research involving volleyball players. Angle of trunk rotation measurements of 116 volleyball players were compared to a control group of 1,155 non-players and a significant difference ($p<0.01$) between the percentage of players versus non-players with a positive ATR was found. Specifically, 17% of players, versus 2.5% of nonplayers, had an ATR greater than 5°. They concluded that "sports involving predominately upper limb motions create an imbalance in the weight-transferring mechanism on the spine which results in the initiation of scoliosis."[4] The patient in this case study had a 4-year history of competitive volleyball and an 11-year history of softball during her adolescent years. Both sports required repetitive end-range rotation toward the player's dominant (right) side that may have contributed to the development of her right thoracic curve. Further studies are needed to investigate the contribution of sport-related activities to the development of scoliosis.

As this is a single case report design a causational relationship between the exercises and the increase in function and reduction in pain cannot be determined. Further research is indicated to investigate scoliosis-specific exercises in patients with scoliosis related pain and dysfunction using a case series or

Table 2. Scoliosis-Specific and Motor Control Exercises

	Exercises	Description	Prescription
Thoracic Curve	Spinal correction, seated in front of a mirror[18]	Patient sat on a chair placed in front of a mirror with weight equally distributed on the ischial tuberosities. Curve reversal was achieved by isometrically contracting the left rotators and right side-benders while elongating the spine.	10 reps, 2x/day with 30 sec holds
	Spinal correction, standing with elastic band & weight[39]	The patient held a 5-pound weight with her left hand and with her right hand grasped an elastic band that was attached to a door behind her at shoulder level. Correction was achieved by simultaneously reaching up toward the ceiling with the left hand to introduce right side-bend and reaching forward with the right arm to introduce left rotation.	3 sets x 10 reps, daily with a 2 second hold
	Side-bend stretch in side-lying[40]	The patient positioned herself in right side-lying and placed a half foam roll under the apex of her thoracic curve. In this position she reached overhead with her left arm to create right side-bending of the thoracic spine over the half foam roll.	Daily with a 5-10-minute hold
Thoracic & Lumbar Curves	Modified half-moon [15,40,41]	The patient secured a yoga strap around her left ankle, placed a stool on her right side, assumed the tall kneeling position, and placed her right forearm on the stool. She then lifted (abducted) the left leg by pulling on the yoga strap with her left arm. Correction of the right thoracic curve is achieved through activation of the muscles on the right side of the thoracic spine resisting body weight force through the right forearm. Correction of the left lumbar curve is achieved by isometrically contracting the muscles on the left side of the lumbar spine to resist counterforce from the abducted left leg. Isometric contraction of muscles on the right thoracic and left lumbar curve created a neutral alignment of the spine.	Daily, with 20-30 seconds for 1-week
	Muscle-cylinder[40]	The patient positioned herself on her left side next between a chair (above her head) and a stool (at her feet) and placed a half foam roll under her lumbar spine just proximal to her pelvis. She then placed the medial aspect of her right (uppermost) foot on the stool and her right hand on the chair with her shoulder abducted to 90 degrees and elbow flexed. She pushed her right hand down into the stool to stabilize the right scapula, thus allowing room for thoracic spine correction and simultaneously elongated her trunk in the cranial and caudal directions.	1 x 10, 2x/day with a 30 second hold in corrected posture
Trunk & Pelvis Motor Control	Quadruped alternate arm and leg lifts[42,45]	While in the quadruped position the patient performed alternating left and right shoulder flexion maintaining a neutral pelvis and spine. The exercise was progressed to alternating left and right hip and knee extension followed by alternating shoulder flexion with contralateral hip and knee extension.	1 set of 10 progressing to 2 sets of 10; 5 second holds at end positions

Figure 1. Spinal Correction for Right Thoracic Curve, Seated

Figure 2. Spinal Correction for Right Thoracic Curve, Standing with Elastic Band and Weight

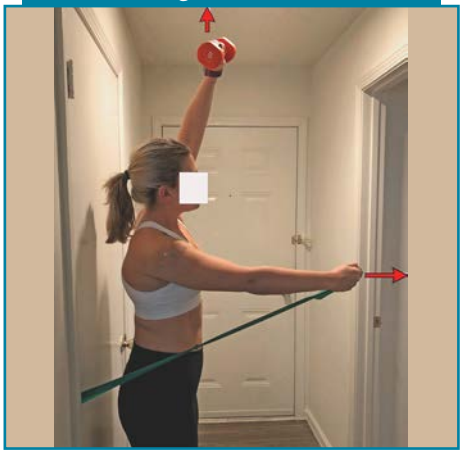
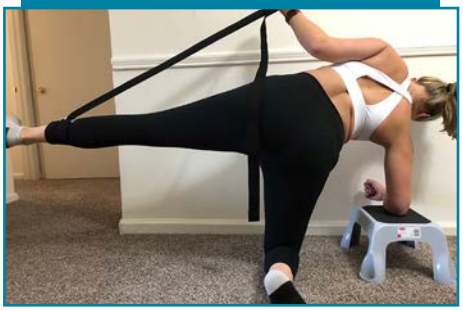


Figure 3. Side-Bend Stretch for Right Thoracic Curve, Sidelying

Figure 4. Muscle Cylinder Exercise for Right Thoracic and Left Lumbar Curves

Figure 5. Modified Half-Moon Exercise for Right Thoracic and Left Lumbar Curves



randomized control trial design. The fact that this patient was diagnosed with fibromyalgia and treated by pharmacological approach for 8 months prior to the start of the intervention is another limitation of the study. However, throughout the 12 weeks of intervention, the medications and dosages prescribed by her primary care physician were not altered; therefore, it is likely that the treatment for the fibromyalgia at the time of intervention were not responsible for the outcomes of this study. The unavailability of Cobb angle measurements for this patient was another limitation of the study. However, the predicted Cobb angle of 30.57° based upon the ATR measurement of 8.82° makes it likely that this patient's Cobb angle was greater than the 20° curve magnitude at which treatment is generally recommended.[2]

Table 3. Numerical Pain Rating Scale (NPRS) Outcomes Assessed at Baseline and After 4, 8, and 12 Weeks

	At Baseline	After 4 Weeks	After 8 Weeks	After 12 Weeks
Current pain	3/10	1/10	2/10	2/10
Worst past week pain	3/10	3/10	4/10	2/10
Worst past month pain	3/10	3/10	7/10	2/10

Table 4. Patient-Specific Function Scale (PSFS) Outcomes Assessed at Baseline and After 4, 8, and 12 Weeks

	At Baseline	After 4 Weeks	After 8 Weeks	After 12 Weeks
Yoga	6/10	8/10	10/10	10/10
Sitting > 60 minutes	6/10	6/10	7/10	8/10
Lifting	7/10	8/10	7/10	8/10

CLINICAL APPLICATIONS

The results of this case report indicate that scoliosis-specific and motor control exercises along with posture education may decrease mid-back pain and improve function in patients with mid-back pain and corresponding scoliosis. However, a single case report cannot provide a causational relationship between a comprehensive program to manage scoliosis and improvement in subjective pain and function reports thus further research is indicated. The 2 rotational sport activities that this patient participated in from early childhood to early adulthood, volleyball and softball, may have contributed to the development of this patient's scoliosis. Further research investigating the possibility that sport related activities contribute to the development of scoliosis is warranted.

ACKNOWLEDGEMENT

We thank Dr. David Cameron, PT, PhD, (Sacred Heart University) for reviewing the manuscript and providing feedback.

REFERENCES

1. Rigo M. Patient evaluation in idiopathic scoliosis: Radiographic assessment, trunk deformity and back asymmetry. *Physiother Theory Pract*. 2011;27(1):7-25. doi:10.3109/09593985.2010.503990
2. Weinstein SL. The natural history of adolescent idiopathic scoliosis. *J Pediatr Orthop*. 2019;39(Issue 6, Supplement 1 Suppl 1):S44-S46. doi:10.1097/BPO.0000000000001350
3. Weinstein SL, Dolan LA. The evidence base for the prognosis and treatment of adolescent idiopathic scoliosis: The 2015 orthopaedic research and education foundation clinical research award. *J Bone Joint Surg Am*. 2015;97(22):1899-1903. doi:10.2106/JBJS.O.00330
4. Modi H, Srinivasalu S, Smehta S, Yang JH, Song HR, Suh SW. Muscle imbalance in volleyball players initiates scoliosis in immature spines: A screening analysis. *Asian Spine J*. 2008;2(1):38-43. doi:10.4184/asj.2008.2.1.38
5. Mueller MJ, Maluf KS. Tissue adaptation to physical stress: A proposed "physical stress theory" to guide physical therapist practice, education, and research. *Phys Ther*. 2002;82(4):383-403.
6. Carreon LY, Glassman SD, Yanik EL, Kelly MP, Lurie JD, Bridwell KH. Differences in functional treadmill tests in patients with adult symptomatic lumbar scoliosis treated operatively and nonoperatively. *Spine (Phila Pa 1976)*. 2020;45(22):E1476-E1482. doi:10.1097/BRS.0000000000003640
7. Kovacs FM, Gestoso M, Gil Del Real, M T, Lopez J, Mufraggi N, Ignacio Mendez J. Risk factors for non-specific

low back pain in schoolchildren and their parents: A population based study. *Pain*. 2003;103(3):259-268. doi:10.1016/S0304-3959(02)00454-2
8. Theroux J, Le May S, Hebert JJ, Labelle H. Back pain prevalence is associated with curve-type and severity in adolescents with idiopathic scoliosis: A cross-sectional study. *Spine (Phila Pa 1976)*. 2017;42(15):E914-E919. doi:10.1097/BRS.0000000000001986
9. Negrini S, Donzelli S, Aulisa AG, et al. 2016 SOSORT guidelines: Orthopaedic and rehabilitation treatment of idiopathic scoliosis during growth. *Scoliosis Spinal Disord*. 2018;13:3. doi: 10.1186/s13013-017-0145-8
10. Berdishevsky H, Lebel VA, Bettany-Saltikov J, et al. Physiotherapy scoliosis-specific exercises - a comprehensive review of seven major schools. *Scoliosis Spinal Disord*. 2016;11:20. doi:10.1186/s13013-016-0076-9
11. Burger M, Coetzee W, du Plessis LZ, et al. The effectiveness of Schroth exercises in adolescents with idiopathic scoliosis: A systematic review and meta-analysis. *S Afr J Physiother*. 2019;75(1):904. doi:10.4102/sajp.v75i1.904
12. Day JM, Fletcher J, Coghlan M, Ravine T. Review of scoliosis-specific exercise methods used to correct adolescent idiopathic scoliosis. *Arch Physiother*. 2019;9:8. doi:10.1186/s40945-019-0060-9
13. Fan Y, Ren Q, To MKT, Cheung JPY. Effectiveness of scoliosis-specific exercises for alleviating adolescent idiopathic scoliosis: A systematic review. *BMC Musculoskelet Disord.* 2020;21(1):495. doi:10.1186/s12891-020-03517-6
14. Fan Y, To MKT, Yeung EHK, et al. Does curve pattern impact on the effects of physiotherapeutic scoliosis specific exercises on cobb angles of participants with adolescent idiopathic scoliosis: A prospective clinical trial with two years follow-up. *PLoS One*. 2021;16(1):e0245829. doi:10.1371/journal.pone.0245829
15. Fishman LM, Groessl EJ, Bernstein P. Two isometric yoga poses reduce the curves in degenerative and adolescent idiopathic scoliosis. *Top Geriatr Rehabil*. 2017;33(4):231-237. doi:10.1097/TGR.0000000000000159
16. Negrini A, Negrini MG, Donzelli S, Romano M, Zaina F, Negrini S. Scoliosis-specific exercises can reduce the progression of severe curves in adult idiopathic scoliosis: A long-term cohort study. *Scoliosis*. 2015;10:20. doi:10.1186/s13013-015-0044-9
17. Negrini S, Donzelli S, Negrini A, Parzini S, Romano M, Zaina F. Specific exercises reduce the need for bracing in adolescents with idiopathic scoliosis: A practical clinical trial. *Ann Phys Rehabil Med*. 2019;62(2):69-76. doi:10.1016/j.rehab.2018.07.010
18. Romano M, Negrini A, Parzini S, et al. SEAS (scientific exercises approach to scoliosis): A modern and effective evidence based approach to physiotherapic specific scoliosis exercises. *Scoliosis*. 2015;10:3. doi: 10.1186/s13013-014-0027-2
19. Schreiber S, Parent E. Schroth physiotherapeutic scoliosis-specific exercises added to the standard of care lead to better cobb angle outcomes in adolescents with idiopathic scoliosis – an assessor and statistician blinded randomized controlled trial. *PLoS One*. 2016;11(12):e0168746. doi:10.1371/journal.pone.0168746
20. Thompson JY, Williamson EM, Williams MA, Heine PJ, Lamb SE, ACTIvATeS Study Group. Effectiveness of scoliosis-specific exercises for adolescent idiopathic scoliosis compared with other non-surgical interventions: A systematic review and meta-analysis. *Physiotherapy*. 2019;105(2):214-234. doi:S0031-9406(18)30315-8
21. Yao M, Xu BP, Li ZJ, et al. A comparison between the low back pain scales for patients with lumbar disc herniation: Validity, reliability, and responsiveness. *Health Qual Life Outcomes*. 2020;18(1):175. doi:10.1186/s12955-020-01403-2
22. Childs JD, Piva SR, Fritz JM. Responsiveness of the numeric pain rating scale in patients with low back pain. *Spine (Phila Pa 1976)*. 2005;30(11):1331-1334. doi:00007632-200506010-00018
23. Stratford PW, Binkley J. The Quebec back pain disability scale: Measurement properties. *Spine (Phila Pa 1976)*. 1995;20(19):2169-2170.
24. Hall AM, Maher CG, Latimer J, Ferreira ML, Costa LO. The patient-specific functional scale is more responsive than the Roland Morris disability questionnaire when activity limitation is low. *Eur Spine J*. 2011;20(1):79-86. doi:10.1007/s00586-010-1521-8
25. Abbott JH, Schmitt J. Minimum important differences for the patient-specific functional scale, 4 region-specific outcome measures, and the numeric pain rating scale. *J Orthop Sports Phys Ther*. 2014;44(8):560-564. doi:10.2519/jospt.2014.5248
26. Balg F, Juteau M, Theoret C, Svotelis A, Grenier G. Validity and reliability of the iPhone to measure rib hump in scoliosis. *J Pediatr Orthop*. 2014;34(8):774-779. doi:10.1097/BPO.0000000000000195
27. Cote P, Kreitz BG, Cassidy JD, Dzus AK, Martel J. A study of the diagnostic accuracy and reliability of the scoliometer and Adam's forward bend test. *Spine (Phila Pa 1976)*. 1998;23(7):796-802; discussion 803. doi:10.1097/00007632-199804010-00011
28. Labelle H, Richards SB, De Kleuver M, et al. Screening for adolescent idiopathic scoliosis: An information statement by the scoliosis research society international task force. *Scoliosis*. 2013;8:17. doi:10.1186/1748-7161-8-17
29. Driscoll M, Fortier-Tougas C, Labelle H, Parent S, Mac-Thiong JM. Evaluation of an apparatus to be combined with a smartphone for the early detection of spinal deformities. *Scoliosis*. 2014;9:10. doi: 10.1186/1748-7161-9-10
30. van West HM, Herfkens J, Rutges, JP Reijman M. The smartphone as a tool to screen for scoliosis, applicable by everyone. *Eur Spine J*. 2021 May 18. doi:10.1007/s00586-021-06860-x
31. Galvis S, Burton D, Barnds B, et al. The effect of scoliotic deformity on spine kinematics in adolescents. *Scoliosis Spinal Disord*. 2016;11:42. doi:10.1186/s13013-016-0103-x
32. Sahrmann S. *Movement System Impairment Syndromes of the Extremities, Cervical and Thoracic Spines*. Elsevier Mosby; 2011.
33. McDonnell MK, Sahrmann SA, Van Dillen L. A specific exercise program and modification of postural alignment for treatment of cervicogenic headache: A case report. *J Orthop Sports Phys Ther*. 2005;35(1):3-15. doi:10.2519/jospt.2005.35.1.3

34. Sahrmann S. *Diagnosis and Treatment of Movement Impairment Syndromes*. Mosby; 2002.
35. Sapkas G, Papagelopoulos PJ, Kateros K, et al. Prediction of Cobb angle in idiopathic adolescent scoliosis. *Clin Orthop Relat Res*. 2003;(411):32-39. doi:10.1097/01.blo.0000068360.47147.30
36. Cook CE, Learman KE, O'Halloran BJ, et al. Which prognostic factors for low back pain are generic predictors of outcome across a range of recovery domains? *Phys Ther*. 2013;93(1):32-40. doi:10.2522/ptj.20120216
37. Korakakis V, O'Sullivan K, O'Sullivan PB, et al. Physiotherapist perceptions of optimal sitting and standing posture. *Musculoskelet Sci Pract*. 2019;39:24-31. doi:10.1016/j.msksp.2018.11.004
38. Monticone M, Ambrosini E, Cazzaniga D, Rocca B, Ferrante S. Active self-correction and task-oriented exercises reduce spinal deformity and improve quality of life in subjects with mild adolescent idiopathic scoliosis. results of a randomised controlled trial. *Eur Spine J*. 2014;23(6):1204-1214. doi:10.1007/s00586-014-3241-y
39. Bialek M. Conservative treatment of idiopathic scoliosis according to FITS concept: Presentation of the method and preliminary, short term radiological and clinical results based on SOSORT and SRS criteria. *Scoliosis*. 2011;6:25. doi:10.1186/1748-7161-6-25
40. Schreiber S, Parent EC, Hedden DM, Moreau M, Hill D, Lou E. Effect of Schroth exercises on curve characteristics and clinical outcomes in adolescent idiopathic scoliosis: Protocol for a multicentre randomised controlled trial. *J Physiother*. 2014;60(4):234; discussion 234. doi:10.1016/j.jphys.2014.08.005
41. Fishman LM, Groessl EJ, Sherman KJ. Serial case reporting yoga for idiopathic and degenerative scoliosis. *Glob Adv Health Med*. 2014;3(5):16-21. doi:10.7453/gahmj.2013.064
42. Ko KJ, Kang SJ. Effects of 12-week core stabilization exercise on the cobb angle and lumbar muscle strength of adolescents with idiopathic scoliosis. *J Exerc Rehabil*. 2017;13(2):244-249. doi:10.12965/jer.1734952.476
43. Dworkin RH, Turk DC, Wyrwich KW, et al. Interpreting the clinical importance of treatment outcomes in chronic pain clinical trials: IMMPACT recommendations. *J Pain*. 2008;9(2):105-121. doi:10.1016/j.jpain.2007.09.005
44. Maughan EF, Lewis JS. Outcome measures in chronic low back pain. *Eur Spine J*. 2010;19(9):1484-1494. doi:10.1007/s00586-010-1353-6
45. Zapata KA, Wang-Price SS, Sucato DJ, Thompson M, Trudelle-Jackson E, Lovelace-Chandler V. Spinal stabilization exercise effectiveness for low back pain in adolescent idiopathic scoliosis: A randomized trial. *Pediatr Phys Ther*. 2015;27(4):396-402. doi:10.1097/PEP.0000000000000174

Combined Approach to Treating a Patient with Post-Concussion Syndrome and Whiplash Associated Disorder

Abbey Liebert, DPT[1]
Angela Stagliano, DPT[2]
Aimee Klein, DPT, DSc[3]

[1]Optimal Performance and Physical Therapies, Tampa FL
[2]At the time of the development of this Case Report, Dr. Stagliano was at the University of South Florida
[3]University of South Florida, School of Physical Therapy and Rehabilitation Sciences, Tampa, FL

ABSTRACT

Background and Purpose: Patients who present with post-concussion syndrome (PCS) and whiplash associated disorder (WAD) suffer similar and lasting impairments to the cervical spine. The purpose of this case report is to describe a combined approach to evaluating and treating a patient who presents with these conditions. **Methods:** A literature review was performed focusing on the most recent concussion management guidelines. These guidelines were used to develop an evaluation and treatment plan for a 19-year-old patient with PCS. **Clinical Findings:** Following treatment the patient demonstrated improvement in cervical mobility, joint position error, and decreased pain. These improvements allowed a successful return to school and recreational activities. **Conclusion:** The outcomes suggest recognizing the similarities between PCS and WAD with regards to examination and intervention, as it relates to cervical spine dysfunction is important for successful rehabilitation. **Clinical Relevance:** Physical therapists are important members in identifying PCS and providing appropriate treatment and management as the recognition and awareness of patients suffering from PCS increases.

Key Words: external feedback, joint position error, motor learning

INTRODUCTION

A concussion is a minor traumatic brain injury (TBI) caused by a bump, blow, or jolt to the head or by a hit to the body that causes the head and brain to move rapidly back and forth.[1] Patients who sustain a concussion do not consistently seek medical care, therefore statistics are mostly based on athletic training or emergency room databases that leads to underreporting. The Centers for Disease Control and Prevention (CDC) estimates that 1.6 to 3.8 million sports-related concussions occur annually.[1] In the general population, approximately 1.1 million emergency department (ED) visits are attributable to mild TBI that are reported each year.[1] Additionally, authors have reported that approximately 5 out of every 10 concussions goes undetected, which helps to explain the discrepancy in reported numbers.[2]

The growing awareness of appropriate concussion management warrants a further look into the process of recovery, including expected timeframe and appropriate rehabilitation methods. Up to 90% of sports-related concussions recover within 7 to 10 days following injury.[3] However, recovery from non-sports related concussions is more difficult to report given the of lack follow-up methods and variability in the patient population. As many as 5% to 58% of patients with non-sports related concussions have persistent symptoms lasting a few weeks or months.[4] Though some have been identified, it is still unclear which specific factors predispose patients suffering from a concussion for a prolonged recovery. Early concussion management is shown to be an important factor that influences recovery following a concussion.[5] The ability to predict recovery after concussion remains a focus of research.[5]

Individuals with persistent symptoms who go on to seek further medical care are diagnosed with Post-Concussion Syndrome (PCS).[5] Patients with PCS can present with symptoms including dizziness, headaches, neck pain, altered postural stability and balance, coordination difficulties, hearing impairments and tinnitus, positional vertigo, and ocular impairments. Patient presentations can vary greatly, which makes an accurate diagnosis difficult and often missed by health care providers. Physical therapists are specifically trained to evaluate and treat patients with these symptoms and have become key members to the interdisciplinary approach in managing patients with concussions.[6]

Recent evidence has shown that classifying patients with concussions based on symptoms and impairments can help providers tailor examinations and interventions, guide prognosis, and develop an appropriate individualized plan of care. Matched treatment strategies may improve patient's overall recovery trajectory in this specific population.[7] These classifications, outlined by the most recent post-concussion clinical practice guidelines (CPG) include vestibulo-oculomotor impairments, autonomic/exertional tolerance impairments and cervical musculoskeletal impairments.[8]

Patients suffering from post-concussion symptoms in the cervical classification present with impairments including altered cervical active and passive range of motion, decreased strength and endurance of cervical and scapula-thoracic musculature and impaired joint position error (JPE) of the cervical spine. Treatment for these patients aim to address cervical and scapulothoracic muscle strength, cervical active and passive range of motion as well as improving cervicocephalic kinesthesia, defined as the ability to reposition the head to a previous position.[9-11] Few studies have been dedicated to specific interventions for cervical musculoskeletal impairments in patients who have sustained a concussion.[10,11]

The symptom presentation and mechanism of injury (MOI) of patients with PCS can mirror those presenting with whiplash-associated disorder (WAD). Whiplash-associated disorder is a result from a rapid forward and backward motion of the neck, caused by motor vehicle accidents, sports injuries, or falls. The symptoms associated with WAD include neck pain and mobility impairments; however, other symptoms such as hypersensitivity, motor weakness, and cognitive impairments can be present.[11] The mechanism of injury of WAD and PCS is similar causing these conditions to occur simultaneously given that acceleration/deceleration of the head will also result in some degree of inertial loading of the neck.[12] Thorough screening for both WAD and PCS by primary care physicians for patients following a traumatic injury can lead to proper identification and referral to the appropriate members of the healthcare team.[12] The concurrent injury to the joints and soft tissues of the cervical spine following a concussion demonstrates the importance of considering WAD as concomitant

injury.[13] Patients who present with PCS and WAD suffer similar and lasting impairments to the cervical spine. The purpose of this case report is to describe a combined approach to evaluating and treating a patient who presents with these conditions.

CASE DESCRIPTION

The patient was a 19-year-old male college student who fell while attempting to do a back flip about 4 months prior to his initial physical therapy evaluation. The patient went to the emergency room the day following the incident with complaints of bilateral neck pain, dizziness, and blurred vision. During the ED evaluation, the patient denied any loss of consciousness at the time of the event and reports being able to get up and walk home later that afternoon. Based on the NEXUS and the Canadian C-Spine rules, the patient could not be ruled out for a cervical fracture, therefore a CT scan without contrast was taken[14,15] and were reported to be normal. Following discharge from the ED, the patient was given Flexeril, a cervical collar, and instructions to follow-up with outpatient services if symptoms persisted. Two months following discharge, the patient followed up with neurological services with complaints of continued right sided neck pain, transient dizziness, headaches, fogginess, and sensitivity to light, and difficulty focusing his vision. Following this appointment, the patient was referred to physical therapy. The patient was also referred for a brain MRI without contrast and were reported to be negative for any structural abnormalities.

The patient was a freshman in college enrolled in a double major curriculum, and was involved in extracurricular activities including an acapella group. Prior to the injury the patient was independent in all activities of daily living (ADLs) and exercised intermittently. Following the injury however, the patient reported being limited in his ability to exercise, sit for long periods of time in class, or stand for long periods of time in his acapella practices. At initial evaluation, the patient reported symptoms including neck and upper back pain, intermittent headaches starting at the base of his skull, and difficulty concentrating in class. The patient reported that his current symptoms were exacerbated by looking up and prolonged sitting. Alleviating factors included stretching and sleep. On the Numerical Pain Rating Scale (NPRS), he reported pain to be a 7/10 at its worse and 5/10 at its best located on the right side of his neck and throughout his upper back. The patient's self-reported outcome measures are outlined in **Table 1**. The patient's goals were to "recover from neck and back trauma and sit through class without pain."

The patient's past medical history was significant for fibromyalgia, anxiety, and depression; but no significant past surgical history was noted. The patient's review of systems to identify any red flag pathology was negative.

Physical Examination

The patient's posture in sitting was significant for forward head position and bilateral rounded shoulders. Cervical active range of motion was significant for decreased cervical extension and decreased cervical right rotation with reproduction of midline and right sided neck pain at end ranges (**Table 2**). A neurological screen was performed that was negative cervical myotomal or dermatomal changes. Reflexes of the upper quarter were shown to be 2+ bilaterally. The patient demonstrated weakness bilaterally in scapulo-thoracic muscle groups (**Table 3**). The patient was hypomobile throughout his upper and lower cervical spine and upper thoracic spine in posterior to anterior joint mobility testing. Due to the MOI, cervical ligament testing including Sharp Purser, alar ligament, and transverse ligament tests were performed, all negative for laxity or reproduction/reduction of symptoms. The patient presented with soft tissue restrictions and tenderness to palpation throughout his posterior sub occipital musculature, his thoracic paraspinals, right upper trapezius, and right levator scapulae. Oculomotor screening was performed including smooth pursuit and vestibular occular reflex (VOR) testing. These were both negative. Spurlings, distraction and upper limb tension test (ULTT) were all performed to rule out cervical radiculopathy, which were negative. Deep neck flexor endurance testing was performed, and the patient was able to maintain the appropriate position for 5 seconds before losing cranio-cervical flexion and reporting pain. During cervical joint position error testing, the patient demonstrated impaired relocation ability during extension and left rotation.

Clinical Assessment/Evaluation

The differential diagnoses at this time included: PCS, WAD, cervical or thoracic muscle sprain or strain, cervicogenic headaches, and cervical radiculopathy. The patient presented with impairments including decreased upper quarter strength and endurance, impaired cervical JPE, impaired cervical active range of motion, and impaired cervical and thoracic joint mobility. Based on these impairments, the patient was given a physical therapy diagnosis of PCS, cervical classification, and WAD. The patient had a good prognosis for recovery given his young age, high motivation, and physical capability to achieve his goals. Negative prognostic

Table 1. Initial and Discharge Outcome Measures of the Patient for this Case Report

Outcome Measure	Score at Evaluation	Score After 4-6 Weeks
Post-concussion Symptom Scale	18	8
STarT Back	Total score 4, subscore 2	Total score 2, subscore 0
Neck Disability Index	26%	16%
Oswestry Disability Index	34%	Not taken at d/c
Numeric Pain Rating Scale	5/10	3/10
Global Rating of Change	N/A	+5

Table 2. Initial Range of Motion Measures of the Patient for this Case Report

Range of Motion	Active Range of Motion	Passive Range of Motion
Cervical flexion	78°	Within functional limits
Cervical extension	55°*	Within functional limits
Left lateral flexion	50°	Within functional limits
Right lateral flexion	45°	Within functional limits
Left rotation	85°	Within functional limits
Right rotation	65°*	75%
*denotes pain		

Table 3. Initial Manual Muscle Test Measures of the Patient for this Case Report

Manual Muscle Test	Left Upper Extremity	Right Upper Extremity
Scapular depression	4-/5	4-/5
Scapular adduction	4-/5	4-/5
Scapular downward rotation	4-/5	4-/5

factors associated with his recovery include a history of anxiety and depression, history of fibromyalgia, and high STarT Back score.[16,17]

Intervention

A multifaceted approach was used to address patient's WAD and PCS symptoms. The initial treatment following the evaluation included education. He was educated to remain active, improve sleep hygiene, and was given different strategies for stress reduction and management.

Initially manual therapy was used to address soft tissue restrictions. Suboccipital stretching and release was performed in the beginning of the session, as well as thoracic paraspinal trigger point release. Joint mobility restrictions and pain were addressed with sustained natural apophyseal glides (SNAGS) to the cervical spine, and gentle foam rolling to the thoracic spine given the increased pain intensity in this area. Deep neck flexor training was initiated to increase cervical muscle strength and decrease overuse of accessory muscles.

A main focus of this patient's rehabilitation was working on cervical joint position sense in combination with scapulothoracic muscle training. A laser was attached to the patient's head and a target was used during upper extremity and scapulothoracic strengthening exercises. The purpose of the laser was to provide the patient with external feedback and cueing throughout plan of care. For specific exercises including the progression and repetitions, see **Table 4**.

Outcomes and Follow-up

The patient was seen 5 times over a 4-week period. Formal final objective measures were not taken due to the patient leaving the state because of COVID 19, however, subjective report from patient included increased ability to perform functional and recreational activities. Patient reported outcome measures are outlined in **Table 1**.

Discussion

This case report demonstrates how a combined approach to treatment and management with the focus on cervical spine dysfunction can result in a successful recovery for a patient with WAD and PCS. The Academy of Orthopedics concussion management CPG outlines the use of the following evidence-based interventions: patient education, manual therapy, scapulothoracic and cervical musculature strengthening and cervical JPE, and proprioception exercises for treatment of patients with PCS.[8] These interventions as well as recent evidence were combined to develop an appropriate treatment plan for this patient.[8,11,12,14]

A thorough subjective interview and objective physical examination are necessary to rule out any red flag diagnoses and determine appropriateness for physical therapy. The Academy of Orthopaedics concussion management CPG for the treatment of patients' with PCS has the strongest level A evidence for screening all patients for signs of medical emergency or severe pathology. In addition, the CPG also includes level A evidence to screen those patients for mental health issues, cognitive impairments and other related conditions that may require an additional referral.[8] It is important to consider those comorbidities given the primary diagnosis of concussion. Patients often have associated neck trauma and tests should be chosen by the clinician to identify the cause of their symptoms.[14] The patient in this case report did not have any significant red flag findings but had a history of anxiety and depression; however, he reported these health conditions were well managed with medication, therefore, additional outside referral was not warranted. The patient reported his fibromyalgia seemed to be associated with stress levels, which were increased during the semester.

Initial treatment for patients following a concussion includes patient education for appropriate symptom management.[15] In the Statement of Agreement regarding Approaches to Treating Concussion, 3 studies show the importance of patient education following discharge from the ED.[7] Patients and families who received explicit discharge information exhibited more positive recovery outcomes than control participants. Positive recovery outcomes were defined as decreased number of days with PCS.[7] When considering treatment interventions, clinicians should educate patients on the importance of sleep, cognitive rest, and physical exercise while social dysfunction and stress should be mitigated.[15] The patient in this case report received education to remain active and use coping strategies including meditation and mindfulness to reduce stress. The patient was also educated on the expected course of recovery and provided a home exercise program at the initial evaluation that was updated and modified through his plan of care.

Manual therapy is recommended in both the neck pain and post-concussion CPG to enhance function and improve symptoms in patients with WAD and PCS.[8,11] Given that neck pain, headaches, and dizziness are some of the most common symptoms associated with PCS, positive findings for upper cervical spine dysfunction are relevant. In a study that included 20 participants with persistent symptoms following a concussion, 90% of them were considered to have a neck problem contributing to their symptoms. Of these participants, 10 received manual therapy as an intervention based on their physical examination. Overall, individuals who received manual therapy intervention had decreased reports of headaches, dizziness, and NPRS of neck pain following a mean of 4 hours of neck treatment over an average of 4 to 5 weeks.[18] Based on best-supported evidence and clinical findings, this patient was treated with manual therapy interventions including suboccipital stretching, lower cervical and upper thoracic joint mobilization.

The PCS CPG states physical therapists should implement interventions addressing cervical spine dysfunction including strength deficits, cited as level B evidence.[8] There continues to be limitations in evidence regarding specific exercise for patients who have experienced a concussive event, however, an overall consensus supports postural muscle strengthening. A retrospective study that assessed 73 individuals who received physical therapy following a concussion found the most common muscles to demonstrate weakness included rhomboids, middle, and lower trapezius. This study also found 40% of patients to have impaired neck flexor endurance.[19] The patient in this case report presented with strength impairments in the above listed muscles. There is moderate evidence to support the use of strengthening postural control muscles to reduce pain and

Table 4. Interventions for the Patient in the Case Report

Intervention	Patient Education	Manual Therapy	Therapeutic Exercise	Neuromuscular Re-education
Sessions 1-2	• Remain active • Increase hours of sleep • Use phone app to allow for mindfulness and mediations throughout the day • Sleeping posture	• Manual cervical traction • Suboccipital release/ stretch • SCM soft tissue mobilization • Middle and upper thoracic mobilization	• Upright bike for 10 minutes • Seated rows (3x20)** • Seated B shoulder extension (3x20)**	• Cervical DNF training, chin tuck 10 sec x15 times***
Sessions 3-4	• Remain active • Desk set up education • Activity modification	• Lower cervical mobilization with movement • Thoracic paraspinals soft tissue mobilization and stretching • SCM and upper trap soft tissue mobilization • Quadruped cervical extension with manual glide at lower cervical spine	• Treadmill walking for 10 minutes • Standing rows (4x20)* • Standing B shoulder extension (4x20)* • B GH external rotation with resistance (10 sec hold x10)* • Prone rows and prone shoulder extension on physio ball (3x15)* • Modified push-ups (3x12)*	• Cervical DNF training, chin tuck 10 sec x15 times*** • Chin tuck with B shoulder abduction against resistance (3x10) • JPE relocation, eyes open and eyes closed (3x10 or until ability to relocate improved) • JPE maze tracing (x10 reps)
Session 5 and HEP	• Return to previous levels of activity/ gym routine • Frequency/ duration and intensity of HEP	• Self-mobilization through foam roller to middle thoracic spine • Self-SNAGS to middle/lower cervical spine	• Treadmill walking for 10 minutes • Standing rows (4x20)** • Standing B shoulder extension (4x20)** • Prone rows and prone shoulder extension on physio ball (3x15) • Modified push-ups (3x12)**	• Chin tuck with B shoulder abduction against resistance (3x10) • JPE relocation, eyes closed, standing on uneven surface (3x10 or until ability to relocate improved) • JPE maze tracing, standing on uneven surface (x10 reps)

Abbreviations: SB, side bend; JPE, joint position error; GH, glenohumeral; SCM, sternocleidomastoid; SNAGS, sustained natural apophyseal glides; HEP, home exercise program; B, bilateral; DNF, deep neck flexors

* Laser on head and target was used to provide external feedback to maintain neutral cervical spine
** Laser on head was discontinued due to patient improvement in head/neck position without the cueing
*** Blood pressure cuff was used as external feedback to limit the degree of cervical flexion the patient could perform

decrease time to return to work for patients with acute and subacute WAD.[20] The patient was given progressive resistance exercises with a goal of improving strength in the short term and to reduce pain and disability in the long term.

The PCS CPG recommends examining joint position sense, level C evidence, for potential sources of musculoskeletal dysfunction.[8] Cervical JPE testing measures the ability of the neck to reposition itself using afferent input from the neck joint and muscle receptors.[19] Patients with WAD have shown to have errors in JPE, especially in those with moderate to severe pain.[15] Impaired JPE can lead to lasting dizziness, impaired postural control, and poor head eye coordination during functional tasks. The high percentage of patients with WAD and PCS who present with impaired cervical JPE warrant consideration of testing and intervention during their plan of care.[20]

This patient presented with impaired cervical JPE into extension and left rotation that resulted in poor coordination during functional tasks. The patient made improvements in JPE during and between each session that led to improved coordination during dual tasks. A laser, worn on the patient's forehead, was an integral part of the treatment plan as it gave the patient external cueing and feedback during motor control exercises. An external focus of attention enhances motor performance and learning. One of the first studies to examine the advantages of using an external focus for motor learning found that instructions directing attention away from one's body parts and instead to the intended movement have an enhancing effect on performance and learning.[21]

To promote motor learning, a laser was used as external feedback during cervical proprioception and scapulothoracic strengthening exercises. This was progressed into more functional activities including upper extremity weight-bearing and dynamic exercises. The laser allowed for real time feedback and assisted the patient in enhancing cervical and upper extremity dissociation. External focus has been shown to increase effective and efficient movement patterns, leading to skilled performances.[22] An external focused target effectively speeds up the learning process so that a higher skill level can be achieved

sooner.[23] After 3 treatment sessions, the patient no longer required the laser feedback and demonstrated ability to perform skilled exercise activities without cueing.

Throughout the plan of care, the patient's treatments transitioned from passive interventions for symptom management to active interventions addressing primary impairments including postural muscle strengthening and endurance training. As the patient improved strength and endurance, his pain decreased and his overall tolerance to functional and recreational ADLs improved. The patient reported less neck pain with prolonged sitting and standing positions required during class and acapella group.

LIMITATIONS

There are several limitations to this case report. Due to COVID-19, we were unable to formally assess objective outcomes at discharge. Another limitation is that this case report cannot be applied to all patients presenting with post-concussion symptoms. Future research should be done regarding the specific exercises for patients presenting to physical therapy following a non-sports related concussion and to identify the benefit of using external feedback to enhance motor learning in this patient population.

CONCLUSION

Evidence from the concussion CPG as well as the neck pain CPG helped to create a comprehensive and evidence-based plan of care for this patient. This case report highlights the importance performing a detailed subjective and objective examination, to help rule out any red flags and develop a differential diagnosis. The use of available evidence to provide a multifaceted approach to treatment for the patient who presented with PCS and WAD led to a favorable outcome for this patient at discharge.

REFERENCES

1. Langlois JA, Rutland-Brown W, Wald MM. The epidemiology and impact of traumatic brain injury: a brief overview. *J Head Trauma Rehabil*. 2006;21(5):375-378. doi:10.1097/00001199-200609000-00001
2. UPMC Sports Medicine. Concussion Facts and Statistics and Facts. Accessed July 23, 2020. upmc.com/services/sports-medicine/services/concussion/facts-statistics
3. McCrory P, Meeuwisse WH, Aubry M, et al. Consensus statement on concussion in sport: the 4th International Conference on Concussion in Sport, Zurich, November 2012. *J Athl Train*. 2013;48(4):554-575. doi:10.4085/1062-6050-48.4.05
4. O'Connor KL, Baker MM, Dalton SL, Dompier TP, Broglio SP, Kerr ZY. Epidemiology of sport-related concussions in high school athletes: National Athletic Treatment, Injury, and Outcomes Network (NATION), 2011-2012 through 2013-2014. *J Athl Train*. 2017;52(3):175-185. doi:10.4085/1062-6050-52.1.15
5. Iverson GL, Gardner AJ, Terry DP, et al. Predictors of clinical recovery from concussion: a systematic review. *Br J Sports Med*. 2017;51(12):941-948. doi:10.1136/bjsports-2017-097729
6. Alsalaheen BA, Mucha A, Morris LO, et al. Vestibular rehabilitation for dizziness and balance disorders after concussion. *J Neurol Phys Ther*. 2010;34(2):87-93. doi:10.1097/NPT.0b013e3181dde5685
7. Collins MW, Kontos AP, Okonkwo DO, et al. Statements of agreement from the Targeted Evaluation and Active Management (TEAM) Approaches to Treating Concussion meeting held in Pittsburgh, October 15-16, 2015. *Neurosurgery*. 2016;79(6):912-929. doi:10.1227/NEU.0000000000001447
8. Quatman-Yates CC, Hunter-Giordano A, Shimamura KK, et al. Physical therapy evaluation and treatment after concussion/mild traumatic brain injury. *J Orthop Sports Phys Ther*. 2020;50(4):CPG1-CPG73. doi:10.2519/jospt.2020.0301
9. McCrory P, Meeuwisse W, Dvorak J, et al. Consensus statement on concussion in sport—the 5th International Conference on Concussion in Sport held in Berlin, October 2016. *Br J Sports Med*. 2017;51(11):838-847. doi:10.1136/bjsports-2017-097699
10. Bhattacharyya N, Gubbels SP, Schwartz SR, et al. Clinical Practice Guideline: Benign Paroxysmal Positional Vertigo (Update). *Otolaryngol Head Neck Surg*. 2017;156(3 Suppl):S1-S47. doi:10.1177/0194599816689667
11. Blanpied PR, Gross AR, Elliott JM, et al. Neck Pain: Revision 2017. *J Orthop Sports Phys Ther*. 2017;47(7):A1-A83. doi:10.2519/jospt.2017.0302
12. Drescher K, Hardy S, Maclean J, Schindler M, Scott K, Harris SR. Efficacy of postural and neck-stabilization exercises for persons with acute whiplash-associated disorders: A Systematic Review. *Physiother Canada*. 2008;60(3):215-223. doi:10.3138/physio.60.3.215
13. Morin M, Langevin P, Fait P. Cervical spine involvement in mild traumatic brain injury: a review. *J Sports Med (Hindawi Publ Corp)*. 2016;2016:1590161. doi:10.1155/2016/1590161
14. Blanpied PR, Gross AR, Elliott JM, et al. Neck pain: revision 2017. *J Orthop Sports Phys Ther*. 2017;47(7):A1-A83. doi:10.2519/jospt.2017.0302
15. Panacek EA, Mower WR, Holmes JF, Hoffman JR. Test performance of the individual NEXUS low-risk clinical screening criteria for cervical spine injury. *Ann Emerg Med*. 2001;38(1):22-25. doi:10.1067/mem.2001.116499
16. Chaput G, Lajoie SP, Naismith LM, Lavigne G. Pain catastrophizing correlates with early mild traumatic brain injury outcome. *Pain Res Manage*. 2016;2016:2825856. doi:10.1155/2016/2825856
17. Hill JC, Afolabi EK, Lewis M, et al. Does a modified start back tool predict outcome with a broader group of musculoskeletal patients than back pain? A secondary analysis of cohort data. *BMJ Open*. 2016;6(10):e012445. doi:10.1136/bmjopen-2016-012445
18. Treleaven J. Dizziness, unsteadiness, visual disturbances, and sensorimotor control in traumatic neck pain. *J Orthop Sports Phys Ther*. 2017;47(7):492-502. doi:10.2519/jospt.2017.7052
19. Kennedy E, Quinn D, Chapple C, Tumilty S. Can the neck contribute to persistent symptoms post concussion? a prospective descriptive case series. *J Orthop Sports Phys Ther*. 2019;49(11):845-854. doi:10.2519/jospt.2019.8547
20. Kenzie ES, Parks EL, Bigler ED, Lim MM, Chesnutt JC, Wakeland W. Concussion as a multi-scale complex system: an interdisciplinary synthesis of current knowledge. *Front Neurol*. 2017;8:513. doi:10.3389/fneur.2017.00513

21. Marshall CM, Howard V, Leddy JL, Baldwin BA. The role of the cervical spine in post-concussion syndrome. *Phys Sportsmed*. 2015;43(3):274-284. doi:10.1080/00913847.2015.1064301
22. Wulf G, Höß M, Prinz W. Instructions for motor learning: Differential effects of internal versus external focus of attention. *J Motor Behav*. 1998;30(2):169–179. doi:10.1080/00222899809601334
23. Wulf G, Lewthwaite R. (2016). Optimizing performance through intrinsic motivation and attention for learning: The OPTIMAL theory of motor learning. *Psychon Bull Rev*. 2016;23(5):1382-1414. doi:10.3758/s13423-015-0999-9
24. Palmgren PJ, Andreasson D, Eriksson M, Hägglund A. Cervicocephalic kinesthetic sensibility and postural balance in patients with nontraumatic chronic neck pain – a pilot study. *Chiropr Osteo. 2009*;17:6. doi:10.1186/1746-1340-17-6
25. Wulf G. *Attention and Motor Skill Learning*. Human Kinetics; 2007.
26. O'leary S, Jull G, Wyk LV, Pedler A, Elliott J. Morphological changes in the cervical muscles of women with chronic whiplash can be modified with exercise-A pilot study. *Muscle Nerve*. 2015;52(5):772-779. doi:10.1002/mus.24612

Case Report: Management of a Patient with Low Back Pain Using the Treatment-based Classification System

Kaylor Kelley, PT, DPT
Michael McMorris, PT, DPT
J. Quinlon Curtis, PT, DPT
Michael T. Gross, PT, PhD

The University of North Carolina at Chapel Hill, Chapel Hill, NC

ABSTRACT

Background and Purpose: Treatment-based classification (TBC) systems have been developed and frequently revised to help standardize the treatment of patients with low back pain (LBP). The purpose of this case report is to discuss the application of the revised TBC system in the management of a patient with LBP. **Methods:** The patient was a 24-year-old female with a 2-month history of localized LBP with no mechanism of injury. She met the movement control approach subgroup of the TBC system for patients with LBP based on examination findings. **Clinical Findings:** A progressive rehabilitation approach was used that focused on quality movement patterns. The patient was able to return to her desired level of function with no pain or dysfunction. **Clinical Relevance:** Higher-quality studies are needed to improve the applicability of the movement control approach of the TBC system. **Conclusion:** This case report highlights the implementation of the revised TBC system for treating patients with LBP. Positive outcomes in pain, disability, and function can be achieved with a movement control approach when a patient demonstrates poor movement patterns.

Key Words: lumbar, movement control, rehabilitation

BACKGROUND

Low back pain (LBP) affects many individuals each year and accounts for substantial healthcare costs. Up to 80% of the population experiences at least one episode of back pain throughout the lifespan. Most episodes improve without intervention, but as many as 10% of individuals with LBP will become disabled with chronic pain.[1] Nursing assistants have a high incidence of LBP due to occupational demands. Henriques et al reported that 31.4% of nursing assistants experienced at least one bout of LBP over a 12-month period.[2] The increased incidence of LBP was associated with an increased demand and lack of assistance with patient transfers, hygiene, bed mobility, transport, and feedings for patients.[2]

One potential contributor to LBP may be impairments related to instability of the spine. Stability of the spine is maintained by 3 systems: the passive, active, and neural systems. The passive system consists of the vertebrae, facet joints, ligaments, and intervertebral discs. The active system includes the local and global muscles and tendons. The neural system includes the central nervous system and peripheral nerves. Ideally all 3 systems work eloquently together to provide optimal stability and mobility of the spine.[3] Abnormal movement patterns and pain can occur if dysfunction exists in one or more of the systems. Movement deficits relating to neural dynamics, soft tissue flexibility and extensibility, neuromuscular coordination, strength, and/or joint mobility can all be addressed with physical therapy management.[4]

Core stabilization exercises have been a treatment of choice for managing LBP. Treatment-based classification (TBC) systems and clinical prediction rules (CPR) have been developed to guide clinical reasoning and standardize physical therapy treatment. The TBC system for LBP was first introduced in 1995 by Delitto et al[5] and focused on 4 classification groups: manipulation, stabilization, specific exercise, and traction. The TBC system was revised by Fritz et al[6] in 2007 with updated criteria for placing patients in to these groups.[6] Aberrant movements during lumbar motion, 40 years of age or younger, straight leg raise (SLR) of greater than 91°, and a positive prone instability test placed a patient in the stabilization classification.[6,7] Aberrant movements may include a painful arc, Gower's sign, instability catch, hinging, or reversal of lumbopelvic rhythm,[1,4,8] the 4 criteria from the CPR.[9] Although the CPR has not been validated, the study by Rabin et al[9] asserts that the presence of 3 of the 4 criteria predicts probable success with a stabilization program.[9] Research to support stabilization exercises for LBP is lacking.[10–12]

Although the prevalence of LBP continues to increase, outcomes for physical therapy intervention remain fair. The TBC system for LBP was most recently revised in 2016 by Arlwaily et al.[13] Upon the first point of contact the clinician should determine the best approach among the following: medical management, rehabilitation management, or self-care management. In the absence of medical "red flags," most patients with LBP are appropriate for rehabilitation management that includes 3 approaches: symptom modulation, movement control, and functional optimization.[3] A patient is placed in one of the groups based on stage, stability, and severity of the pain, disability status, comorbidities, and psychosocial factors.[3,13] The approaches however, can overlap. A patient may present in the symptom modulation group and progress to the movement control and/or functional optimization groups as status changes. Symptom modulation includes patients with more acute, severe LBP that may require interventions such as specific exercise, manipulation/mobilization, traction, or active rest.[3,13,14] The movement control approach, which is the focus of this report, is appropriate for individuals with low to moderate levels of dysfunction. Symptoms are stable and easily reproduced with specific activities of daily living (ADLs). This group often demonstrates normal lumbar motion but may show aberrant movement patterns. Treatment is focused on restoring optimal motion and improving motor control. The functional optimization approach encompasses individuals with minimal to no pain, low disability, and well-controlled symptoms. Muscle strength, endurance, and/or power deficits can also be accommodated with the functional optimization approach. Functional optimization implements the Transfer Principle, which focuses on interventions simulating specific job and/or sport responsibilities.[3,13] The purpose of this case report is to discuss the application of the revised TBC system in the management of a patient with LBP.

CASE DESCRIPTION

Patient History

The patient was a 24-year-old female who worked part-time as a certified nursing assistant (CNA) at a large hospital system while attending school with clinical affiliations in respiratory therapy. Her chief complaint included constant midline LBP that had

minimally improved over the preceding 2 months. She believed her pain began following an increased number of dependent patient transfers but could not recall a specific incident. She had experienced similar pain multiple times in the past, however, the pain usually improved after a week of rest and use of ibuprofen. Six weeks prior to her physical therapy evaluation, she went to the emergency department due to worsening LBP. She was given muscle relaxants and oxycodone, all of which provided her minimal relief. At the time of the initial physical therapy evaluation, her pain had marginally improved, and she was only taking ibuprofen as needed. Her symptoms were aggravated with bending forward, sitting for longer than 20 minutes, sitting unsupported, lifting objects from the floor, pushing/pulling equipment, and assisting with transfers at work. She also reported painless "popping" in her low back with bending forward. Lying down on her back, sitting with back support, and taking time off from work eased her pain. The Numeric Pain Rating Scale (NPRS) is an 11-point scale with 0/10 being no pain and 10/10 being the most severe pain.[14] She indicated her pain at rest was a 2/10 "dull ache" and would increase to a "sharp" 8/10 with dependent patient transfers. Her pain returned to her reported resting level immediately upon cessation of the offending activity. She started to wear a lumbar support brace at work, which provided symptom relief and improved tolerance for her 12-hour shifts. She did not report any recent changes in bowel or bladder function and denied any pain, tingling, or numbness into her buttocks or legs. No significant past medical history, surgical history, or red flags were identified. The patient also denied the possibility of pregnancy at the time of the evaluation. A computed tomography scan of her abdomen 6 months prior to the physical therapy evaluation for an unrelated issue demonstrated a Grade I L5-S1 retrolisthesis, however, radiographic imaging performed approximately 1 month after initiating physical therapy revealed mild narrowing between L5-S1 vertebral bodies with no retrolisthesis. The patient's goal was to return to work as a CNA, participate in respiratory therapy clinical affiliations, and sit during her academic courses without pain.

Self-Report Outcome Measure

The Focus on Therapeutic Outcomes (FOTO) is a validated functional outcome tool. The FOTO scores range from 0-100 with greater scores indicating better function. The instrument considers age, gender, pain, medical history, insurance, daily function, exercise, and patient beliefs to predict expected outcomes in physical therapy. The FOTO places the patient in 1 of 5 stages. Stage 1 represents the most limited function and Stage 5 indicates no functional limitations. The patient's score at the initial evaluation was 53/100 placing the patient in Stage 3. This initial FOTO predicted that the patient would achieve a final score of 71/100 after 11 physical therapy visits, thereby meeting the criteria for Stage 4 at discharge.[15]

Physical Examination

The patient shifted her sitting positions throughout the subjective interview and used both upper extremities for support while sitting. She reported more pain when she sat still and did not "brace" herself with her arms or by using the chair's back support. Visual observation in standing revealed decreased lumbar lordosis. The patient's concordant pain was reproduced with standing forward flexion. She reported the most pain as she was returning to erect standing. She demonstrated a positive Gower's sign to return to standing position. Minimal limitations existed with active lumbar motion testing. The patient had poor pelvic control with a positive Trendelenburg at each hip during mid-stance of gait. She demonstrated poor frontal plane knee control with dynamic knee valgus and anterior translation of knees during a squat test. Hip range of motion (ROM) was asymptomatic and within normal limits bilaterally. The patient had a SLR greater than 91° bilaterally. Manual muscle testing revealed weakness in her hip abductors, extensors, and external rotators. She was unable to perform a prone plank for more than 10 seconds without allowing arching of her back. Single limb stance assessment demonstrated contralateral hip drop bilaterally. The patient had increased muscle tone in the middle and lower thoracic paraspinal musculature, as well as pain along L5 and S1 spinous processes with palpation examination. Passive intervertebral movements demonstrated relative hypermobility and reproduced her pain at the L4 and L5 levels. Neural testing was not indicated based on pain location and her subjective report of no tingling or numbness. Sacral thrusts, sacroiliac joint (SIJ) compression test, and FABER's test were positive for the patient's LBP. Gaenslen's, thigh thrust, and distraction SIJ tests were negative. No leg length discrepancy or pelvic alignment asymmetries were noted.

Clinical Impression

This young patient was a petite female who worked in a physically demanding job, a demographic group who reports high incidences of back pain. The patient reported pain with unsupported and prolonged sitting, previous episodes of similar LBP, and symptom relief when she wore a back brace. Objective testing included a positive Gower's sign, painful arc, SLR of greater than 91°, and lumbar hypermobility. The patient demonstrated proximal hip weakness with poor lumbopelvic control with gait, squatting, and single limb stance. Based on the collective findings, the working diagnosis was LBP with movement coordination deficits. Although her pain reached a level of 8/10, this level of pain was only reproduced when she performed dependent patient transfers. The pain diminished to 2/10 immediately on cessation of the activity. Based on the low irritability and stability of her symptoms at the initial evaluation, she was placed into the movement control approach subgroup of the revised TBC system. The patient did not meet the criteria for specific exercise, manipulation, or traction. She had localized LBP and displayed no signs of nerve root compression, radicular symptoms, or lumbar hypomobility.

The primary competing diagnosis was SIJ dysfunction. The relationship between LBP and the SIJ are questionable but cannot be dismissed.[16] Pain with sitting and asymmetrical loading activities such as lunging, stooping, or pivoting performed by a CNA during patient care can all be risk factors for SIJ involvement.[16] Special tests in isolation for the SIJ have poor clinical utility, however, grouping these tests together may provide improved clinical meaningfulness. Laslett's cluster of pain provocative tests is a commonly used diagnostic tool to detect SIJ dysfunction.[16–18] The patient had 2 positive tests from Laslett's cluster. Sacroiliac joint involvement is more likely when 3 or more tests are positive.[17] The FABER test assesses lumbar, SIJ, and hip dysfunction, but does not clearly indicate which structure is implicated.[18] The patient demonstrated hip ROM within normal limits with no leg length discrepancy or pelvic alignment asymmetries. She was not overweight and had no pain in the buttock, hip, or groin, which might indicate SIJ dysfunction.[16] Based on the findings, SIJ dysfunction was ruled out as the primary diagnosis.

Interventions

Interventions incorporated lumbopelvic neuromuscular control exercises, hip strengthening, and proper lifting techniques based on subjective and objective findings

from the initial examination. The patient was seen twice a week for 2 weeks and then tapered to one time per week for the remaining visits. The first 6 sessions focused on coordinating transverse abdominus (TrA) activation without compensating with posterior pelvic tilting and gluteus maximus activation. The patient performed 4 sets of approximately 20 repetitions since the goal was motor control. The patient performed TrA activation in an unloaded, hooklying position initially and progressed to weight-bearing positions in seated, quadruped, standing, and walking. Once proper performance of TrA activation was achieved without cueing, dynamic control was challenged by integrating lower and/or upper extremity movements with exercises like the deadbug (**Figure 1**), birddog (**Figure 2**), alternating hip march while sitting on a Swiss ball, resisted trunk rotations, and plank series (**Figures 3** and **4**).

Proximal hip strengthening was also introduced based on impairments. Exercises focused on the hip extensors, abductors, and external rotators. Exercises included sidelying clams, sidelying hip abduction, bridging, resisted lateral and anterior-lateral stepping, step-ups, deadlifts, and squatting. The patient was instructed to maintain a "braced" core with TrA activation during the exercises. Core activation improves hip muscle recruitment in the sidelying clam and sidelying hip abduction exercise according to an EMG study by Chan et al.[19]

The patient progressed as expected through the established plan of care. As pain decreased and self-reported confidence increased, functional activities were reintroduced in a graded manner with emphasis on body mechanics. Squat lifting techniques were taught to the patient with a focus on hip hinging and keeping a neutral spine. By the final 3 visits, the patient was primarily participating in therapeutic activities to recreate work-specific tasks with functional squatting, stooping, lunging, carrying, lifting, pushing, and pulling. The patient performed dependent transfers with the physical therapist simulating a patient. Aerobic exercise on the treadmill was initiated early and continued through the treatment plan based on evidence that aerobic exercise can improve LBP.[14] Her lumbar support brace was not worn for any interventions in the clinic. A detailed home exercise program was provided to the patient and updated throughout the sessions to supplement interventions in the clinic.

Outcomes

The patient was treated over the course of 9 weeks for a total of 13 visits. Upon discharge, the patient reported feeling that she had achieved 100% of normal function. Improvements in the NPRS, functional strength, FOTO, work-related duties as a CNA, and self-reported confidence were made. The NPRS improved from 8/10 to 0/10 with aggravating factors, meeting the minimal clinically important difference of 2 points.[14] She showed improved single limb stance and ambulation with no Trendelenburg sign and improved squat mechanics with no dynamic knee valgus. She could perform a prone plank for more than 60 seconds without arching her back. The patient was able to squat, lift, and carry over 50 pounds and push/pull over 100 pounds without pain. The patient met all her goals and was able to work a 12-hour shift that involved patient handling, pushing/pulling carts, lifting, and carrying equipment without pain and without her back brace. She could sit through her academic classes and participate in clinical affiliations without discomfort. Her FOTO score improved from 53/100 to 94/100, which was significantly greater than the predicted discharge score of 71/100 and placed her in the Stage 5 category of no functional limitations.

Figure 1. Deadbug

Figure 2. Birddog

Figure 3. Plank Series: Prone Plank

Figure 4. Plank Series: Side Plank

DISCUSSION

This case report demonstrates successful management of a patient who presented with LBP using the revised TBC system. Once structural instability and red flags are ruled out, the preferred treatment for impaired movement coordination is a movement control approach. The goal is to retrain the local and global muscles such as the transverse abdominus, lumbar multifidi, internal oblique, and gluteal muscles while also ensuring proper mobility of nerves, joints, and soft tissue structures. The TBC system is helpful in developing a more standardized algorithm for classifying and treating patients with LBP. Patients may not always clearly meet the criteria that would place them in a particular subgroup. The previous TBC system by Stanton et al[7] included more restricted subgroups such that only about 50% of their patients met the criteria for a specific subgroup, 25% did not satisfy the criteria for a subgroup, and 25% met the criteria for more than one subgroup. This suggests that approximately 50% of their patients did not fit the TBC system, questioning the effectiveness of the system in improving efficiency and standardizing care. The updated TBC system provides a more flexible method for placing patients in subgroups. The patient in this case report technically fit the stabilization subgroup by Stanton et al.[7] Additional impairments, however, such as hip weakness and poor lumbopelvic motor control with gait, squatting, and single leg stance needed to be addressed to optimize her functional movement outcomes. This was especially true for the movement patterns required for her work as a CNA. The patient's total presentation was consistent with the selection of the movement control approach. The Transfer Principle further supports the importance of integrating therapeutic activities into physical therapy practice.[3] Treatments should simulate the specific functional tasks that would transfer to the performance of ADLs.

A randomized control trial by Macedo et al compared the effect of motor control exercises versus graded activity for individu-

als with non-specific LBP. No significant differences were found between the 2 treatment groups but both groups demonstrated improvements in pain and function.[20] The results support that one singular treatment approach may not be superior over another. Treatment plans should be multi-modal. A meta-analysis performed by Bystrom et al[21] further supports the implementation of motor control exercises (MCE) in the rehabilitation of patients with recurrent LBP. Improvements in disability were superior with MCE versus manual interventions or no intervention. The results of the meta-analysis support physical therapy as a primary intervention. The disability improvements are also notable considering how greatly LBP and disability can affect physical and mental well-being. Motor control exercises should be considered when treating patients who have recurrent LBP.[21]

CLINICAL APPLICATION

In general, lack of consensus exists regarding the best treatment approach for managing lumbar spine dysfunction.[14] The movement control approach as part of the TBC system provides an inclusive framework for the examination and treatment of LBP, allowing the clinician to tailor the interventions to the specific needs of the patient. The approach, however, is not currently based on high-quality evidence.[3] No experimental studies are available that specifically examine the utility of the movement control approach. More research is necessary to disseminate and integrate this approach into clinical practice more confidently. Physical therapists should integrate the 3 pillars of evidence-based-practice of current best evidence, clinical expertise, and patient values to select the most appropriate interventions when evidence is not available.[22] Clinicians should be aware of the TBC system as a potentially effective biopsychosocial examination and treatment approach for patients who have LBP.

REFERENCES

1. O'Sullivan PB. Lumbar segmental "instability": clinical presentation and specific stabilizing exercise management. *Man Ther*. 2000;5(1):2-12. doi:10.1054/math.1999.0213
2. Henriques M, Sacadura-Leite EM, Serranheira F. Low back pain among hospital nursing assistants. *Rev Bras Med Trab*. 2019;17(3):370-377. doi:10.5327/Z1679443520190365
3. Alrwaily M, Timko M, Schneider M, et al. Treatment-based classification system for patients with low back pain: the movement control approach. *Phys Ther*. 2017;97(12):1147-1157. doi:10.1093/ptj/pzx087
4. Beazell JR, Mullins M, Grindstaff TL. Lumbar instability: an evolving and challenging concept. *J Man Manip Ther*. 2010;18(1):9-14. doi:10.1179/106698110X12595770849443
5. Delitto A, Erhard RE, Bowling RW. A treatment-based classification approach to low back syndrome: identifying and staging patients for conservative treatment. *Phys Ther*. 1995;75(6):470-85; discussion 485. doi:10.1093/ptj/75.6.470
6. Fritz JM, Cleland JA, Childs JD. Subgrouping patients with low back pain: evolution of a classification approach to physical therapy. *J Orthop Sports Phys Ther*. 2007;37(6):290-302. doi:10.2519/jospt.2007.2498
7. Stanton TR, Fritz JM, Hancock MJ, et al. Evaluation of a treatment-based classification algorithm for low back pain: a cross-sectional study. *Phys Ther*. 2011;91(4):496-509. doi:10.2522/ptj.20100272
8. Ferrari S, Manni T, Bonetti F, Villafañe JH, Vanti C. A literature review of clinical tests for lumbar instability in low back pain: validity and applicability in clinical practice. *Chiropr Man Therap*. 2015;23:14. doi:10.1186/s12998-015-0058-7
9. Rabin A, Shashua A, Pizem K, Dickstein R, Dar G. A clinical prediction rule to identify patients with low back pain who are likely to experience short-term success following lumbar stabilization exercises: a randomized controlled validation study. *J Orthop Sports Phys Ther*. 2014;44(1):6-B13. doi:10.2519/jospt.2014.4888
10. Gomes-Neto M, Lopes JM, Conceição CS, et al. Stabilization exercise compared to general exercises or manual therapy for the management of low back pain: A systematic review and meta-analysis. *Phys Ther Sport*. 2017;23:136-142. doi:10.1016/j.ptsp.2016.08.004
11. Coulombe BJ, Games KE, Neil ER, Eberman LE. Core stability exercise versus general exercise for chronic low back pain. *J Athl Train*. 2017;52(1):71-72. doi:10.4085/1062-6050-51.11.16
12. Javadian Y, Behtash H, Akbari M, Taghipour-Darzi M, Zekavat H. The effects of stabilizing exercises on pain and disability of patients with lumbar segmental instability. *J Back Musculoskelet Rehabil*. 2012;25(3):149-155. doi:10.3233/BMR-2012-0321
13. Alrwaily M, Timko M, Schneider M, et al. Treatment-Based Classification System for Low Back Pain: Revision and Update. *Phys Ther*. 2016;96(7):1057-1066. doi:10.2522/ptj.20150345
14. Delitto A, George SZ, Van Dillen LR, et al. Low back pain. Clinical practice guidelines linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association. *J Orthop Sports Phys Ther*. 2012;42(4):A1-57. doi:10.2519/jospt.2012.42.4.A1
15. Gozalo PL, Resnik LJ, Silver B. Benchmarking outpatient rehabilitation clinics using functional status outcomes. *Health Serv Res*. 2016;51(2):768-789. doi:10.1111/1475-6773.12344
16. Gartenberg A, Nessim A, Cho W. Sacroiliac joint dysfunction: pathophysiology, diagnosis, and treatment. *Eur Spine J*. July 2021. doi:10.1007/s00586-021-06927-9
17. Laslett M, Aprill CN, McDonald B, Young SB. Diagnosis of sacroiliac joint pain: validity of individual provocation tests and composites of tests. *Man Ther*. 2005;10(3):207-218. doi:10.1016/j.math.2005.01.003
18. Laslett M. Evidence-based diagnosis and treatment of the painful sacroiliac joint. *J Man Manip Ther*. 2008;16(3):142-152. doi:10.1179/jmt.2008.16.3.142
19. Chan MK, Chow KW, Lai AY, Mak NK, Sze JC, Tsang SM. The effects of therapeutic hip exercise with abdominal core activation on recruitment of the hip muscles. *BMC Musculoskelet Disord*. 2017;18(1):313. doi:10.1186/s12891-017-1674-2
20. Macedo LG, Latimer J, Maher CG, et al. Effect of motor control exercises versus graded activity in patients with chronic nonspecific low back pain: a randomized controlled trial. *Phys Ther*. 2012;92(3):363-377. doi:10.2522/ptj.20110290
21. Byström MG, Rasmussen-Barr E, Grooten WJA. Motor control exercises reduces pain and disability in chronic and recurrent low back pain: a meta-analysis. *Spine*. 2013;38(6):E350-8. doi:10.1097/BRS.0b013e31828435fb
22. Noteboom JT, Allison SC, Cleland JA, Whitman JM. A primer on selected aspects of evidence-based practice to questions of treatment. Part 2: interpreting results, application to clinical practice, and self-evaluation. *J Orthop Sports Phys Ther*. 2008;38(8):485-501. doi:10.2519/jospt.2008.2725

A 6-week Balance and Gait Training Program Using the AlterG for a Patient with Cervical Myelopathy After Spinal Decompression Surgery: A Case Report

Palak R. Patel, PT, DPT
Matthew Somma, PT, DPT, MTC, CSCS

University of New England, Portland, ME

ABSTRACT

Background and Purpose: Degenerative cervical myelopathy (DCM) describes various degenerative changes in the cervical spine that may result in neurological deficits, gait deviations, and muscle weakness. The purpose of this case report was to describe a balance and gait training program on the AlterG in an older adult patient with DCM who underwent spinal decompression surgery. **Case Description:** The patient was an 83-year-old male who underwent C4 corpectomy with C3-5 anterior fusion and posterior cervical laminectomy. The patient completed a balance and gait training program using the AtlerG Treadmill. **Outcomes:** After 6 weeks of training, the Six-Minute Walk Test improved from 185.62 meters to 264.26 meters, a 78.64-meter improvement. This was twice as good as the minimal clinically important difference (MCID) of 30.5 meters. The 30 Second Chair Stand Test improved from 6 to 8 stands (an improvement of 2 stands) thus reaching the MCID that is 2 stands. The Berg Balance Test improved from 28/56 to 35/56 reaching the MCID of 7 points. **Discussion:** The patient's functional mobility and functional outcome scores improved following the balance and gait training program with the use of the AlterG. While a cause-effect relationship cannot be determined with a single case report, future research is needed to assess the use of the AlterG Treadmill in this patient population.

Key Words: antigravity treadmill, cervical stenosis, geriatric, myelopathy

BACKGROUND AND PURPOSE

Degenerative cervical myelopathy (DCM), formerly known as cervical spondolytic myelopathy, describes various degenerative changes in the cervical spine. Ninety percent of degenerative cervical myelopathy is derived from cervical spondylosis, but the etiology is unknown.[1] The incidence of DCM is estimated at a minimum of 41 cases per million and the prevalence is 605 cases per million in North America.[2] It is reported that about 80% of patients over 70 years of age have some form of degenerative changes to the cervical spine.[3] Degenerative cervical myelopathy is commonly associated with structural changes including degeneration of the intervertebral discs, vertebral bodies, facet joints, hypertrophy of the ligamentum flavum, and ossification of the posterior longitudinal ligament. These degenerative findings often narrow the spinal canal causing spinal cord compression that can result in upper and lower motor neuron findings. Patients with DCM may present with cervical spine pain, radiculopathy, paresthesia, myotomal changes, abnormal gait, impaired balance, and changes in muscle tone.[4]

The progressive nature of DCM often results in surgery to decompress the spinal cord with surgical management at a rate of 3-11 cases per 100,000 each year.[5,6] The most common indications for surgery are in patients older than 65 years of age who present with progressive myelopathy and severe pain.[5,7] Although there is no evidence in the literature on the best surgical approach, patients are treated with an anterior cervical approach or posterior cervical approach.[8] The anterior approach consists of discectomy or corpectomy with the removal of osteophytes, followed by internal fixation with cervical plates[5,7] and offers the most direct access to the cause of myelopathy and offers restoration of lordosis effectively.[8] The posterior approach consists of laminoplasty or laminectomy[5,7] that decompresses the spinal cord without removal of spondylotic protrusion impinging on the neural tissue and provides more spinal stability.[9] However, with data from AOSpine North America and International prospective multicenter studies, there were no significant differences in functional mobility and quality of life for patients who had a laminoplasty versus laminectomy with fusion.[10]

Patients with milder forms of DCM initially start with conservative care. If there is a continuous deterioration, then timely surgical intervention is indicated.[11] Conservative care for DCM may include physical therapy, cervical orthoses, spinal injections, steroids, and nonsteroidal anti-inflammatory drugs.[9] A study by Browder et al[12] suggests that intermittent cervical traction and manipulation of the thoracic spine can help reduce pain and functional mobility in patients with mild cervical compressive myelopathy as a result of disc herniation. The Clinical Practice Guideline for the management of DCM strongly recommends surgical interventions for patients with moderate and severe myelopathy as it effectively halts neurological progression and helps improve functional status, disability, and quality of life.[11] A study by Mannion et al[13] reported that 12 weeks of post-operative physical therapy did not influence change in pain or functional mobility up to 24 months after decompression surgery. Their post-operative management included surgical protection with cervical collar, wound healing, and early mobility. The subsequent phases of rehabilitation include strength training, global spinal stabilization and endurance exercises, as well as soft tissue mobilization.

A systematic review completed by Badran et al[3] attempted to determine if there was a role for post-operative physical therapy management but there was insufficient evidence to make any recommendations regarding physical therapy in the post-operative management of cervical decompression surgery.

Interventions using an anti-gravity treadmill provide opportunities for patients to progressively ambulate and improve upon these impairments. Body weight support systems and the anti-gravity treadmills assist in unloading the patient's body weight and aides with ambulation. Studies have reported that anti-gravity treadmills are safe and effective in improving walking distances and dynamic postural balance as well as reducing fall risk for other patient populations such as patients diagnosed with cerebral palsy, muscular dystrophy, and stroke.[14-17] The AlterG Treadmill (AlterG Anti-Gravity Treadmill M320/F320,

Fremont, CA) is one such antigravity treadmill that uses a pressurized air chamber to reduce gravitational load and body weight. The AlterG is patented with differential air pressure (DAP) technology and originally developed for NASA.[18] With the DAP technology, the patient can walk in the chamber that surrounds the treadmill and has a cockpit that allows extra trunk support for those who need it.[18] Although there is no evidence to support the use of the AlterG in patients with DCM, authors have shown improvement in gait or balance using a body-weight support system with treadmill walking in other patient populations.[19-22]

The purpose of this case report was to describe the use of a balance and gait training program on the AlterG Treadmill in an older adult patient with degenerative cervical myelopathy who underwent spinal decompression surgery.

CASE DESCRIPTION

Patient History and Systems Review

The patient was an 83-year-old male who was a retired farmer and lived with his wife. The patient had good family support from his children who lived separately but were there to assist with most outdoor activities including driving for medical appointments. He was referred to outpatient physical therapy status post C4 corpectomy with C3-5 anterior fusion and posterior cervical laminectomy and instrumented fusion. The patient had a right total hip arthroplasty that was complicated by multiple hospital visits due to numerous illnesses that occurred 2 years ago.

The physical therapist noticed a decline in the patient's functional mobility, coordination, and gait pattern. The patient reported he had a fall, and the physical therapist referred the patient to a neurologist. The patient reported 3 falls since first initiating physical therapy. The patient was diagnosed with cervical stenosis with myelopathy affecting his upper extremity (UE) and lower extremity (LE) equally and subsequently had surgery. Approximately 4 months after his cervical spine fusion, the patient was medically stable and referred back to physical therapy. Currently, the patient complained of numbness and tingling in his UE and LE and was referred to physical therapy diagnosed with chronic neuropathy. His primary complaints were difficulty with walking, performing daily activities, and loss of function of his UE and LE. He still reported numbness and tingling in bilateral (B/L) UE and was unable to ambulate with his cane. He used a rolling walker (RW) to ambulate with moderate assistance (ModA) to minimal assistance (MinA) only in his home and used a wheelchair as his primary way of mobility in the house and the community. The patient did not complain of pain with cervical range of motion (ROM). A systems review was performed and is presented in **Table 1**.

The patient's past medical history included arthritis, deep vein thrombosis, multiple fractures, chronic obstructive pulmonary disease (COPD), dyspnea, and hypertension. He also presented with an implantable cardioverter defibrillator. The patient's past surgical history consisted of bilateral total hip arthroplasty and spinal decompression surgery.

The patient's primary goals for physical therapy were to improve ambulation and improve overall functional mobility in his home and the community. The patient provided written and verbal informed consent for participation in this case report, and any photography or videography used within this article.

CLINICAL IMPRESSION 1

Following the subjective history and systems reviews, it was hypothesized that the subject's inability to ambulate independently and transfer was due to the decreased strength in his LE and impaired balance. Fracture, spondylolysis/spondylolisthesis, or re-occurrence of stenosis with myelopathy at different segments of the spine were all considered for differential diagnoses.

The plan for examination was to assess the patient's functional mobility, LE strength, LE ROM, gait, and balance. Further tests/measures included were Berg Balance Scale (BBS), Six Minute Walk Test (6MWT), and 30 Second Chair Stand Test (30 CST).

EXAMINATION

Tests and Measures

The initial evaluation was performed by another physical therapist 13 weeks before the re-examination presented in this case report. The patient did not complain of pain throughout the re-examination. The re-examination started with bilateral passive ROM of the patient's LE, manual muscle testing, light touch sensation, and deep tendon reflexes of the LE. The patient's LE strength of the hip, knee, and ankle was symmetrical bilaterally of 3+/5. His LE passive ROM of the hip, knee, and ankle was within normal limits. Deep tendon reflexes were 2+ and light touch sensation from C2-T2 and L1-S2 were unimpaired. Cervical ROM was within normal limits.

The patient required MinA for functional mobility including wheelchair to chair/mat and sit-to-stand. A gait assessment revealed a toe out gait pattern and genu valgum. The patient relied heavily on the RW to help support himself upright. During the 6MWT, he walked with a RW and required contact guard assist (CtgA) and then toward the end of the test, he required MinA. The patient ambulated a total distance of 185.62 meters, required one seated break, and his right knee buckled 3 times during the test.

A BBS was completed to assess the risk of falls. A score under 45/56 indicates an increased probability of a fall, and a score under 40/56 indicates 100% probability of a fall risk.[23] He scored a 28/56, which indicates a high risk of falling.

The patient performed a 30 CST that evaluates functional LE strength in older adults.[24] The patient was not able to perform this test without B/L UE assist; therefore, this test was modified, and the patient did use both UEs. In older adults, males between the ages of 80 and 84 years old who are moderately active should score between 10-15 number of stands.[24] The patient had 6 stands within the 30 seconds, well below the range. **Table 2** presents the initial examination data compared to re-evaluation of the program from week 1 and week 6.

Table 1. Systems Review of the Patient in the Current Case Report

Cardiovascular/Pulmonary	Shortness of breath with moderate level activities such as ambulation
Musculoskeletal	Impaired strength, bilateral lower extremity strength 3+/5
Neuromuscular	Normal
Integumentary	Normal
Communication	Impaired hearing, used hearing aids
Affect, Cognition, Language, Learning Style	Normal

Table 2. Patient's Examination, Test, and Measure Results Comparing Week 1 to Week 6

Tests & Measures	Initial Examination (Physical therapy before training)			Re-Examination of Training Results (Week 1)	Re-Examination of Training Results (Week 6)
LE Passive ROM	Not tested			WNL	WNL
LE Gross Strength Testing	**Movement**	**Right**	**Left**	bilaterally equal 3+/5	bilaterally equal 4-/5
	Hip Flexion	3/5	3/5		
	Hip Extension	3/5	3/5		
	Hip Abduction	3/5	3/5		
	Hip Adduction	3/5	3/5		
	Ankle Plantar Flexion	3/5	3-/5		
	Ankle Dorsiflexion	3-/5	3-/5		
Deep Tendon Reflexes	2+ for Patella and Achilles			2+ for patella and Achilles	2+ for patella and Achilles
Light touch sensation C2-T2 and L1-S2	Not tested			Sensation was normal, and patient was able to verbalize location of light touch	Sensation was normal, and patient was able to verbalize location of light touch
Functional mobility:	MinA Supine to Sit and Sit to Supine			MinA Supine to Sit and Sit to Supine	ClS Supine to Sit and Sit to Supine
	Wheelchair mobility- learning to propel with LE			Wheelchair mobility independent, propelled with feet	Wheelchair mobility independent, propelled with feet
	MinA- ModA Transfers			MinA Transfers	ClS Transfers
Gait assessment	ModA with ambulation using a RW			Toe out gait pattern	Improved gait with symmetrical gait pattern
	Toe out gait pattern and genu valgum			Genu valgum	Reduced genu valgum and toe-out gait pattern
				Heavily used UE assistance on the RW to keep upright position	Patient relied less on the RW and was able to maintain an upright posture independently with his trunk support
6MWT	ModA/MinA with RW Total distance: 61.57 meters			MinA/CtgA with RW 1 seated rest break Total distance: 185.62 meters	CtgA with RW 2 standing rest breaks Total distance: 264.26 meters
Berg Balance Scale	21/56 (High fall risk)			28/56 (High fall risk)	35/56 (High fall risk)
30 Second Chair Stand Test	4 total stands			6 total stands	8 total stands

Abbreviations: LE, lower extremities; ROM, range of motion; WFL, within functional limits; MinA, minimal assistance; 6MWT, Six Minute Walk Test; ClS, close supervision; CtgA, contact guard assist; RW, rolling walker

CLINICAL IMPRESSION 2

The findings from the re-examination were consistent with the patient's diagnosis of impaired functional mobility and gait secondary to spinal decompression from the cervical stenosis with myelopathy. The patient's impairments included reduced strength, endurance, and balance that affected functional mobility and gait. Although the patient had a complex medical history, he made strength gains immediately after surgery and had return of function of his bilateral UE and LE after the surgery. Although some patients have permanent impairment because of myelopathy, it has been suggested that spinal decompression surgery prevents the progression of impairments.[5] Due to the decrease in the patient's functional mobility and the results of the re-examination findings, the patient demonstrated the need for skilled physical therapy services to improve functional transfers and ambulation.

The intervention plan was to treat the patient for 2 physical therapy sessions per week for 6 weeks. Each treatment session was planned for 60 minutes. There were no plans for referral at that time, and the patient's primary care doctor and the orthopedic doctor were consulted when needed for any complications or setbacks. The patient was very motivated, which indicated that he would be compliant with his home exercise program (HEP).

INTERVENTIONS

The patient was treated for 13 weeks of physical therapy before this 6-week balance and gait training program. During the 13 weeks, the patient was scheduled for 30-minute appointments twice per week. The plan of care primarily consisted of LE strengthening such as seated leg press, resisted side stepping at the parallel bars, hip clocks, calf raises, step ups with UE assist with parallel bars, sit-to-stands with UE assist, and seated hamstring curls. Overground gait training was performed every session with the RW, and he learned how to propel the manual wheelchair with his LEs. Balance exercises were performed in the parallel bars including tandem high marching with UE assist, static stance on foam pad, tandem forward walking, and static stance with ball taps.

The patient concurrently received occupational therapy services and care was coordinated with the physical therapist. The patient was educated about the results of the re-examination, the expectations for physical therapy, goals, and the anticipated plan of care moving forward with physical therapy for this 6-week balance and gait training programming using the AlterG. A HEP was provided and demonstrated as seen in **Table 3**.

The weekly interventions consisted of gait training and balance exercises in the AlterG treadmill and overground. The activities performed in the AlterG included single leg stance, tandem walking, and using dual tasks, such as motor-motor dual tasks walking with a cup of water in one hand and dynamic reaching activities while the patient was ambulating. Another form of dual task performed was cognitive-motor dual task while the patient counting backwards from a certain number, stating months and days backwards out loud.[25] The patient received visual feedback from video analysis during the AlterG training and verbal and tactile feedback from the physical therapist. After the patient performed various exercises in the AlterG treadmill, overground gait training was performed to assess for activity transference. In addition to the AlterG, balance exercises in the parallel bars and general LE strengthening exercises were performed. The daily interventions are listed in **Table 4** and further descriptions of exercises are provided in the Appendix.

OUTCOMES

Six weeks of balance and gait training with the AlterG improved his functional transfers, ambulation, and overall strength compared to his initial treatment session. The minimal clinically important difference (MCID) for the 6MWT is 30.5 meters; therefore, anything over 30.5 meters is considered meaningful.[26] The patient's 6MWT improved by 78.64 meters from 185.62 meters to 264.26 meters; he required CtgA with RW and 2 standing breaks. The MCID for the Berg Balance Test is 7 points.[27] During this 6-week program, the patient's score on the Berg Balance Test improved by 7 points from 28/56 to 35/56. The MCID of the 30 CST is 2 stands.[28] The 30 CST was modified, and the patient required UE assistance. The patient improved from 6 full stands to 8 full stands, an improvement of 2 stands.

The patient's gait was re-assessed and there was a reduction in the toe-out gait pattern, he relied less on his RW to maintain an upright posture, and there was no sign of genu valgum with ambulation. The patient continued to progress requiring CtgA/close supervision for the majority of transfers and ambulation. Results of the patient's outcome measures after the 6-week program are in **Table 2**.

DISCUSSION

This case report describes a 6-week program using the AlterG Treadmill for a patient with degenerative cervical myelopathy status post spinal decompression surgery. Many patients with severe cervical stenosis and who have undergone a spinal decompression surgery do not regain lost function.[5] Considering the patient's age, co-morbidities, and multiple stays in the hospital, the patient was able to regain functional mobility and made substantial improvement during his 6 weeks of therapy. Currently, there is little evidence to support the use of the AlterG for a patient with DCM. Authors that used the anti-gravity treadmill on patients diagnosed with muscular dystrophy showed an improvement in their dynamic balance.[29]

This patient demonstrated improvements in gait, the 6MWT, the BBS, and the 30 CST after using the AlterG treadmill for 6 weeks. More specifically, improvements on the BBS and the 30 CST during the 6-week training program were equivalent to the prior 13 weeks of physical therapy. The patient met the MCID for the BBS, 6MWT and the 30 CST. The patient continued physical therapy after the 6-week program for gait and balance training using the AlterG.

The patient's primary goals included safe ambulation at home and having the ability to walk to his barn. After completion of the 6-week program, the patient was able to ambulate 264.26 meters with CtgA and required supervision level when ambulating under 60.96 meters with his RW. The patient reported a subjective improvement with his gait and felt safer walking around his home. Additionally, he noticed an improvement walking in the community when he was with his family. The patient improved in transfers for which he only required close supervision level after the 6-week program.

Balance training was needed for improvements in gait and to reduce the risk of falls. This was important for this patient because he had 3 falls in the past year and his BBS indicated the probability of a fall risk. Hesse et al[30] reported that patients with hemiparesis improved gait and improvements in balance with partial body weight support treadmill training. Another review looked at 6 systematic reviews and 1 randomized control trial, and suggested that a HEP provided by physical therapists and Tai Chi or inclusion of challenging balance exercises helps to reduce the risk of falls.[31] The patient in this case study was provided with a HEP and performed challenging balance exercises, both on the AlterG and overground during every physical therapy session.

The outcomes of this case report suggest that balance and gait training with the use of the AlterG can be beneficial in the treatment of patients with DCM status post decompression surgery. A limitation of a case report is that a cause-and-effect relationship cannot be determined nor can the results of this case report be applied to a population. However, it does provide evidence that this approach did improve this patient's gait, balance, and loss of strength. The rapid improvements that were observed in this patient suggest that balance and gait training with the use of the AlterG may reduce the risk of falls. Future research should focus on the use of the AlterG effects on gait and balance in a larger sample size of older adults with DCM.

REFERENCES

1. Yamaguchi S, Mitsuhara T, Abiko M, Takeda M, Kurisu K. Epidemiology and overview of the clinical spectrum of degenerative cervical myelopathy. *Neurosurg Clin N Am*. 2018;29(1):1-12. doi:10.1016/j.nec.2017.09.001
2. Nouri A, Tetreault L, Singh A, Karadimas SK, Fehlings MG. degenerative cervical myelopathy: epidemiology, genetics, and pathogenesis. 2015;40(12):E675-

(Continued on page 106)

Table 3. Home Exercise Program Used for the Patient

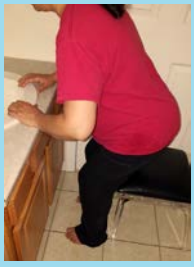
Intervention	Sets, Repetitions, Timing	Picture
Seated Clamshells with TheraBand: Have a seat in a chair with no armrests and wrap a TheraBand around your knees. Move both knees to the sides to separate your legs and make sure your feet are on the floor when performing this exercise.	Repeat 10 Times Complete 3 Sets	
Seated Marching: Have a seat in a chair and lift your foot and knee, then set it down. Alternate and perform with the other leg.	Repeat 10 Times Complete 3 Sets	
Bridging: Lie down on your back, tighten your abs, and squeeze your buttocks. Then lift your buttocks off the mat just as if you are creating a "bridge" with your body. Hold for 1 second and then lower your buttocks slowly. Make sure to put a folded pillow in between your knees.	Repeat 5 Times Complete 3 Sets Hold 1 second	
Straight Leg Raise: Point the toes toward your face. Lie down on your back and raise your leg with your knee straight. Make sure you keep your opposite knee bent, and when raising your leg, it should not go past the opposite knee.	Repeat 10 Times Complete 3 Sets	
Supine Ankle Plantar Flexion with TheraBand: Perform this exercise lying down on your back. Tie a TheraBand above the middle of your foot but below the toes. Next, hold onto the band making sure there is resistance in the band and point your foot down just as if you were pressing down on a gas pedal of a car. Return to starting position and repeat.	Repeat 10 Times Complete 3 Sets	
Supine Ankle Dorsiflexion with TheraBand: Perform this exercise lying down on your back. Tie a TheraBand above the middle of your foot but below the toes. Have a family member hold the end of the band and make sure there is some tension on it. Once there is some tension, move your ankle so that your foot is pointing towards the ceiling. Return to starting position and repeat.	Repeat 10 Times Complete 3 Sets	
Sit to Stand at Countertop: Stand toward your kitchen countertop sink and have your feet shoulder-width apart. Hold onto the countertop for support and slowly lower your hips into the chair. Make sure you bend your knees and do not allow your knees to travel forward over toes. Your body weight should be through your heels. Return to a standing position.	Repeat 10 Times Complete 3 Sets	

Table 4. Daily Interventions

	Session 1	Session 2	Session 3	Session 4	Session 5
Intervention 1	AlterG Treadmill: AMB Cockpit level 10 Time: 10 minutes BW: 65% → 70% Speed: 1.0-1.2mph	AlterG Treadmill AMB: Cockpit level 10 Time: 7 minutes BW: 65% → 70% Speed: 1.0-1.2mph	AlterG Treadmill AMB: Cockpit level 10 Time 10 minutes BW: 65% → 70% Speed: 1.2mph	30 min apt: Exercises were demonstrated, and patient performed exercises with good technique. Handout was provided, please see Table 3 for more details. Assessed patient's STG; patient met all STG.	30 min apt: Overground gait training: CtgA with RW Time: 10 minutes Patient required 2 seated rest breaks.
Intervention 2	SLS in AlterG: Right: 15sec, 40sec Left: 30 sec, 40 sec	Tandem Walking in AlterG: Speed: 0.3mph Time: 1 minute	SLS in AlterG: Right: 45 sec, 1 min Left: 35 sec, 1 minute		Tandem walking in parallel bars without UE support: 3x6 reps
Intervention 3	Overground gait training: CtgA/MinA with RW for 111.55 meters	Walking with half cup of water in Right hand while in AlterG: Time: 2 minutes Speed: 1.0mph	Tandem walking in AlterG: Speed: 0.3 mph Time: 1 minute		Ball toss with beach ball at parallel bars: 60 reps
Intervention 4	Ball Taps with beach ball at parallel bars: 53 reps CtgA/ MinA	SLS in AlterG: Right: 1-minute x 2 Left: 20sec, 1 minute	Overground walking: CtgA with RW for 108.20 meters		SLS in parallel bar attempted without UE support: Right: 3 sec, 5 sec, 10 sec Left: 4 sec, 7 sec, 11 sec
Intervention 5	SLS in parallel bars: had a difficulty lifting foot, was able to perform 3 seconds bilaterally	Heel raises in AlterG: 2x10 reps	Seated leg press: 40 pounds 3x10 reps		STS at mat: 3x10 reps without UE assist
Intervention 6		Overground walking: 94.79 meters ClS with RW	Step ups over 6-inch step: Bilateral 3x10		
Intervention 7		STS at parallel bars: 1x5 reps with no UE assist 2x7 reps with UE assist			
	Session 6	**Session 7**	**Session 8**	**Session 9**	**Session 10**
Intervention 1	AlterG Treadmill: AMB Cockpit level 10 Time: 10 minutes BW: 70% Speed: 1.0 mph	AlterG Treadmill AMB: Cockpit level 9 Time: 7 minutes BW: 70% Speed: 1.0-1.2mph	AlterG Treadmill AMB: Cockpit level 9 Time: 5 minutes BW: 72% Speed: 1.0-1.2mph	AlterG Treadmill AMB: Cockpit level 9 Time: 5 minutes BW: 75%-77% Speed: 1.5 mph	Re- Evaluation-performed: Berg Balance Test, 30 Second Chair Stand score, 6MWT, Strength, and assessed functional mobility.
Intervention 2	Dual tasking: walking in AlterG while holding a cup of water. Speed: 0.8 mph R: 2.5 minutes L: 2.5 minutes	Dual tasking: walking in AlterG while holding a cup of water. Speed: 1.0 mph R: 2.5 minutes L: 2.5 minutes	Dual tasking: fast pace walking in AlterG while counting backwards from 70, stating months and days backwards Time: 5 minutes	Dual tasking: counting backwards from 100, stating months and days backwards while ambulating in AlterG Time; 4 minutes Speed: 1.0 mph	Patient attempted to walk without RW and held onto a hand on each side for balance. Patient ambulated 204.52 meters in 10 minutes with 3 standing rests.
Intervention 3	Tandem walking in AlterG: Speed: 0.6mph Time: 3 minutes	Dual tasking: counting backwards from 50, stating months and days backwards while ambulating in AlterG Time; 3 minutes Speed: 1.0 mph	Dynamic reaching across midline for rings and ambulating in AlterG 2x 12rings Time: 5 minutes Speed: 1.2mph	Dynamic reaching across midline for rings and ambulating in AlterG 2x 12 rings Time: 5 minutes Speed: 1.2mph	

(Continued on page 105)

Table 4. Daily Interventions *(Continued from page 104)*

	Session 6	Session 7	Session 8	Session 9	Session 10
Intervention 4	SLS in AlterG: Right: 30 sec x 2 Left: 30 sec x 2	SLS in AlterG: Right: 30 sec x 2 Left: 30 sec x 2	Tandem walking in AlterG 1.0mph Time: 3 minutes	Dual tasking: walking in AlterG while holding 2 cups of water in each hand. Speed: 1.0 mph Time: 3 minutes	
Intervention 5	Fast Paced walking in AlterG Speed: 1.3-1.5mph Time: 5 minutes	Fast Paced walking in AlterG Speed: 1.5mph Time: 5 minutes	Overground gait training: CtgA with RW for 139.29 meters Time: 4 minutes	Tandem walking in AlterG Speed: 1.1mph Time: 3 minutes	
Intervention 6	Overground gait training: CtgA with RW for 6 minutes, Patient ambulated 190.19 meters and required 2 standing rests breaks.	Overground gait training: CtgA with RW for 222.80 meters Time: 7 minutes 2 standing rests	SLS at parallel bar: R: 10 sec x 1 L: 11 sec x 1	Overground gait training: CtgA with RW for 4 minutes. Time: 6 minutes 2 standing rests	
Intervention 7	RTB Perturbations at parallel bar, patients' feet together and therapist tug TB while patient keeps balance Time: 2 minutes	Perturbations at parallel bar when walking without UE support. 3X3	Ball toss with beach ball at parallel bars: 60 reps	RTB Perturbations at parallel bar, patients' feet together and PT tug TB while patient keeps balance Time: 3 minutes	

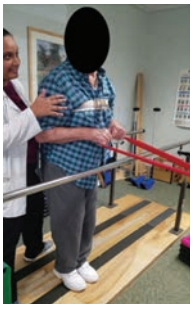
Abbreviations: Apt, appointment; AMB, ambulation; SLS, single leg stance; STS, sit to stand; CtgA, contact guard assist; MinA, minimal assistance; ClS, close supervision; RW, rolling walker; UE, upper extremities; RTB, red TheraBand; YTB, yellow TheraBand; BW body weight; TB, TheraBand

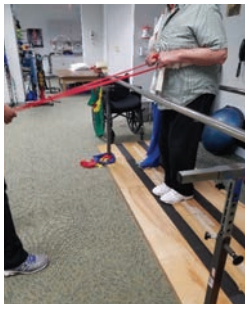
Appendix. Ambulation in the AlterG Illustrated

Intervention Description:

AlterG:
The anti-gravity treadmill with video analysis available in the left image. The right image demonstrates the patient ambulating in the AlterG. The patient is walking in the chamber that surrounds the treadmill and has a cockpit that allows extra trunk support.

Static Perturbation Exercise:
Patient stands with feet touching together. The patient holds onto a TheraBand and is required to maintain his balance while the TheraBand is being pulled on from the other end in multiple directions.



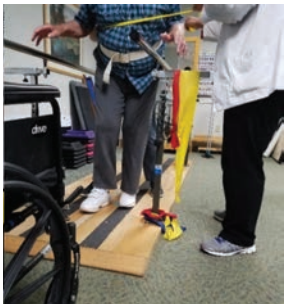


(Continued on page 106)

Appendix. Ambulation in the AlterG Illustrated *(Continued from page 105)*

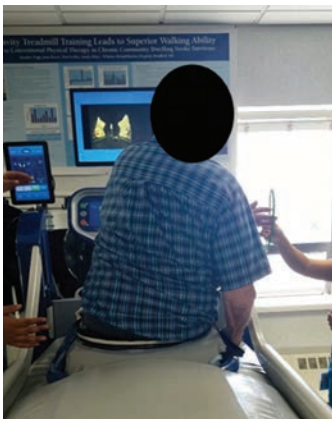
Intervention Description:

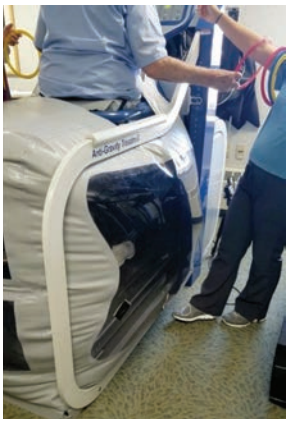
Dynamic Perturbation Exercise:
Patient is walking on the parallel bars while a physical therapist is guarding the patient. Another physical therapist has a yellow TheraBand around the patient's trunk and is applying multidirectional perturbations.



Motor-motor Dual Task[25] with 2 Cups of Water:
While the patient is ambulating in the AlterG, he was also able to hold 2 cups of water--one in each hand.

Motor-motor Dual Task[25] with Rings:
The patient is demonstrating reaching across midline for the ring and placing it on the other side while he is still ambulating in the AlterG.





(Continued from page 102)

93. *Spine*. doi:10.1097/BRS.0000000000000913

3. Badran A, Davies BM, Bailey H, Kalsi-Ryan S, Kotter MR. Is there a role for postoperative physiotherapy in degenerative cervical myelopathy? A systematic review. *Clin Rehabil*. 2018;32(9):1169-1174. doi:10.1177/0269215518766229
4. Fehlings MG, Tetreault LA, Riew KD, Middleton JW, Wang JC. A Clinical Practice Guideline for the Management of Degenerative Cervical Myelopathy: Introduction, Rationale, and Scope. *Global Spine J*. 2017;7(3 Suppl):21S-27S. doi:10.1177/2192568217703088
5. Melancia JL, Francisco AF, Antunes JL. Spinal stenosis. In: *Handbook of Clinical Neurology*. Vol 119. Netherlands: *Elsevier Health Sciences*; 2014:541-549. doi:10.1016/B978-0-7020-4086-3.00035-7
6. Berg Balance Scale. Shirley Ryan AbilityLab - Formerly RIC Web site. Accessed January 18, 2021. https://www.sralab.org/rehabilitation-measures/berg-balance-scale
7. Hillard VH, Apfelbaum RI. Surgical management of cervical myelopathy: indications and techniques for multilevel cervical discectomy. *Spine J*. 2006;6(6):S242-S251. doi:10.1016/j.spinee.2006.05.005
8. Yonenobu K, Oda T. Posterior approach to the degenerative cervical spine. *Eur Spine J*. 2003;12(Suppl 2):S195–S201. doi:10.1007/s00586-003-0599-7
9. Tetreault L, Goldstein CL, Arnold P, et al. Degenerative cervical myelopathy: a spectrum of related disorders

affecting the aging spine. *Neurosurg*. 2015;77 Suppl 4:S51-67. doi:10.1227/NEU.0000000000000951
10. Fehlings MG, Santaguida C, Tetreault L, et al. Laminectomy and fusion versus laminoplasty for the treatment of degenerative cervical myelopathy: results from the AOSpine North America and International prospective multicenter studies. *Spine J*. 2017;17(1):102-108. doi:10.1016/j.spinee.2016.08.019
11. Fehlings MG, Tetreault LA, Riew KD, Middleton JW, Wang JC. A Clinical Practice Guideline for the Management of Degenerative Cervical Myelopathy: Introduction, Rationale, and Scope. *Global Spine J*. 2017;7(3 Suppl):21S-27S. doi:10.1177/2192568217703088
12. Browder DA, Erhard RE, Piva SR. intermittent cervical traction and thoracic manipulation for management of mild cervical compressive myelopathy attributed to cervical herniated disc: a case series. *J Orthop Sports Phys Ther*. 2004;34(11):701-712. doi:10.2519/jospt.2004.34.11.701
13. Mannion AF, Denzler R, Dvorak J, Müntener M, Grob D. A randomised controlled trial of post-operative rehabilitation after surgical decompression of the lumbar spine. *Eur Spine J*. 2007;16(8):1101-17. doi:10.1007/s00586-007-0399-6
14. Berthelsen MP, Husu E, Christensen SB, Prahm KP, Vissing J, Jensen BR. Anti-gravity training improves walking capacity and postural balance in patients with muscular dystrophy. *Neuromusc Disord*. 2014;24(6):492-8. doi:10.1016/j.nmd.2014.03.001
15. Kurz MJ, Corr B, Stuberg W, Volkman KG, Smith N. Evaluation of lower body positive pressure supported treadmill training for children with cerebral palsy. *Pediatr Phys Ther*. 2011;23(3):232-9. doi:10.1097/PEP.0b013e318227b737
16. Lathan C, Myler A, Bagwell J, Powers CM, Fisher BE. Pressure-controlled treadmill training in chronic stroke: a case study with AlterG. *J Neuro Phys Ther*. 2015;39(2):127-33. doi:10.1097/NPT.0000000000000083
17. El-Shamy SM. Effects of antigravity treadmill training on gait, balance, and fall risk in children with diplegic cerebral palsy. *Am J Phys Med Rehabil*. 2017;96(11):809-815. doi:10.1097/PHM.0000000000000752
18. About AlterG. AlterG Web Site. Accessed January 18, 2021. https://www.alterg.com/who-we-are
19. Gojanovic B, Cutti P, Shultz R, Matheson G. Maximal physiologic parameters during partial body-weight support treadmill testing. *Med Sci Sports Exerc*. 2012;44(10):1935-41. doi:10.1249/MSS.0b013e31825a5d1f
20. Hoffman M, Donaghe H. Physiological responses to body weight--supported treadmill exercise in healthy adults. *Arch Phys Med Rehabil*. 2011;92(6):960-966. doi:10.1016/j.apmr.2010.12.035
21. Moore M, Vandenakker-Albanese C, Hoffman M. Use of partial body-weight support for aggressive return to running after lumbar disk herniation: a case report. *Arch Phys Med Rehabil*. 2010;91(5):803-5. doi:10.1016/j.apmr.2010.01.014
22. Kurz M, Stuberg W, DeJong S. Body weight supported treadmill training improves the regularity of the stepping kinematics in children with cerebral palsy. *Dev Neurorehabil*. 2011;14(2):87-93. doi:10.3109/17518423.2011.552459
23. Berg K, Wood-Dauphinee S, Williams JI, Maki, B: Measuring balance in the elderly: Validation of an instrument. *Can J Pub Health*. 1992;83 Suppl 2:S7-11.
24. Make STEADI Part of Your Medical Practice | STEADI - Older Adult Fall Prevention | CDC Injury Center. Centers for Disease Control and Prevention. Accessed January 18, 2021. https://www.cdc.gov/steadi/
25. McIsaac T, Lamberg E, Muratori L. Building a framework for a dual task taxonomy. *Biomed Res Int*. 2015;2015:591475. doi:10.1155/2015/591475
26. Bohannon RW, Crouch R. Minimal clinically important difference for change in 6-minute walk test distance of adults with pathology: a systematic review. *J Eval Clin Pract*. 2017;23(2):377-381. doi:10.1111/jep.12629
27. Godi M, Franchignoni F, Caligari M, Giordano A, Turcato AM, Nardone A. Comparison of reliability, validity, and responsiveness of the Mini- BESTest and Berg Balance Scale in patients with balance disorders. *Phys Ther*. 2013;93(2):158-167. doi:10.2522/ptj.20120171
28. Wright AA, Cook CE, Baxter GD, Dockerty JD, Abbott JH. A comparison of 3 methodological approaches to defining major clinically important improvement of 4 performance measures in patients with hip osteoarthritis. *J Orthop Sports Phys Ther*. 2011;41(5):319-327. doi:10.2519/jospt.2011.3515
29. Berthelsen MP, Husu E, Christensen SB, Prahm KP, Vissing J, Jensen BR. Anti-gravity training improves walking capacity and postural balance in patients with muscular dystrophy. Current neurology and neuroscience reports. *Neuromuscul Disord*. 2014;24(6):492-498. doi:10.1016/j.nmd.2014.03.001
30. Hesse S, Konrad M, Uhlenbrock D. Treadmill walking with partial body weight support versus floor walking in hemiparetic subjects. *Arch Phys Med Rehabil*. 1999;80(4):421-427. doi:10.1016/S0003-9993(99)90279-4
31. Sherrington C, Lord SR, Finch CF. Physical activity interventions to prevent falls among older people: Update of the evidence. *J Sci Med Sport*. 2004;7(1):43-51. doi:10.1016/S1440-2440(04)80277-9

Congratulations to our CSM Awardees

The Awards Ceremony was held during the Combined Sections Meeting this past February in San Antonio, TX.

PARIS DISTINGUISHED SERVICE AWARD

Aimee B. Klein, PT, DPT, DSc, OCS, is a Professor and Assistant School Director at the University of South Florida, USF Health, College of Medicine, School of Physical Therapy and Rehabilitation Sciences in Tampa, FL. Previously, she was a Clinical Assistant Professor and Coordinator of the Clinical Residency in Orthopaedic Physical Therapy at the MGH Institute of Health Professions (Institute) in Boston, MA. Prior to joining the Institute, Dr. Klein held an academic appointment at Boston University's Sargent College of Allied Health Professions.

She received her BS in PT and MS in Sports Physical Therapy from Boston University. She completed her tDPT from the (Institute) and her Doctor of Science in Orthopaedic Physical Therapy from Rocky Mountain University. She has been involved in residency training since 2007 and currently is the Program Director for the USF Health School of Physical Therapy and Rehabilitation Sciences' Orthopaedic Residency Program. Since 1996, she has been Board Certified in Orthopaedic Physical Therapy.

Dr. Klein has worked in acute care and outpatient orthopedics throughout her clinical career. Her areas of expertise are in the examination and management of individuals with lower extremity dysfunction. In addition, she has worked with dancers and runners to assist in return to sport from musculoskeletal injury.

Dr. Klein has been an active APTA member at the state, academy, and national levels. She was a Director on the APTA Academy of Orthopaedic Physical Therapy's (AOPT) Board of Directors (2015-2021) and was a member of a number of committees and task forces. She served as a member of the APTA's Board of Directors (2006-2012) and represented the AOPT on the Movement System's Work Group's Task Analysis Task Force. She is a member of the ABPTRFE's Accreditation Services On-site Committee. She received the Mary McDonald Distinguished Service Award from the APTA of Massachusetts (2003), the APTA's Lucy Blair Service Award (2004), and the Robert C. Bartlett Trustee Recognition Service Award from the Foundation for Physical Therapy for her time as a member of the Board of Trustees (2014-2017).

ROSE EXCELLENCE IN RESEARCH AWARD

Linda Van Dillen, PT, PhD, FAPTA, is a Professor in Physical Therapy and Orthopaedic Surgery at Washington University School of Medicine in St. Louis. Dr. Van Dillen is also the Director of the Research Division in the Program in Physical Therapy at Washington University School of Medicine. Dr. Van Dillen's research focuses on sensorimotor contributions to musculoskeletal pain, with an emphasis on the study of spinal pain conditions. She serves as a scientific reviewer for private foundations and federal agencies, both national and international. She has been funded by the National Institutes of Health, the Foundation for Physical Therapy Research, the Missouri Physical Therapy Association, the Academy of Orthopaedic Physical Therapy, the Hip Society, and the Foundation for Physical Medicine Research. She has served as a consultant to the Barnes Jewish Hospital Outpatient Rehabilitation Clinical Outcomes Committee and to the Program for the Advancement of the UAW-Ford On-Site Rehabilitation Centers in collaboration with Physical Medicine and Rehabilitation at the Johns Hopkins University School of Medicine. She has been an active member of the Academy of Orthopaedic Physical Therapy and the Academy of Physical Therapy Research serving on a variety of committees for both sections. She has presented as a keynote speaker, plenary speaker, and symposium presenter at numerous national and international scientific conferences as an expert in the study of musculoskeletal pain conditions. She recently was recognized by Expertscape as an expert in the study of low back pain. She is a member of the Board of Trustees for the Foundation for Physical Therapy Research. She is a Catherine Worthingham Fellow of the American Physical Therapy Association. She also is a recipient of the Research Award from the Academy of Pelvic Health Physical Therapy, the John P. Maley Research Award from the Academy of Physical Therapy Research, and the Helen Hislop Award for Outstanding Contributions to the Professional Literature from the American Physical Therapy Association.

JAMES A. GOULD EXCELLENCE IN TEACHING ORTHOPAEDIC PHYSICAL THERAPY AWARD

Carey E. Rothschild, PT, DPT, OCS, SCS, CSCS, is an Assistant Professor in the Doctor of Physical Therapy Program at the University of Central Florida in Orlando, FL. Dr. Rothschild earned a Bachelor of Health Science in Physical Therapy from the University of Florida and a Doctor of Physical Therapy from Boston University. She is a board-certified clinical specialist in both Orthopaedic and Sports Physical Therapy.

She earned a Certificate of Achievement in Pelvic Physical Therapy in 2020. Her 20+ years of clinical practice has been in the areas of orthopedics and sports medicine. Her research interests include running injuries, conditions of the female athlete, and pain science education. She is the former Chair of the Sports Specialty Council through the American Board of Physical Therapy Specialties (APBTS) and currently serves as the Sports representative on the ABPTS Board. She is the Membership Lead for the Academy of Sports Physical Therapy's Running SIG and the Nominating Committee member of the Academy of Orthopaedic Physical Therapy's Pain SIG. She lives in Orlando, Florida with her husband and 3 children. In her spare time, she enjoys running, swimming, and traveling.

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

Gerard Brennan, PT, PhD, FAPTA, is experienced in the management of patients from the aspect of care delivery and measurement of treatment effectiveness, effectively integrating standardization of care in physical therapy and consistent tracking of patient-centered outcomes.

For the past 25 years, Brennan has been in practice at Intermountain Healthcare, working closely with primary care physicians, orthopedic surgeons, and spine specialist physicians in the management of surgical and nonsurgical patients. He holds a PhD in Exercise Science & Sport from the University of Utah-Salt Lake City; MS in Physical Therapy from Duke University; and BA in Biology from Providence College.

As a Senior Research Scientist and Director of Research for Rehabilitation Services at Intermountain Healthcare, Brennan developed and supervised ongoing efforts in physical therapy to standardize care and measure patient-centered outcome measures on approximately 20,000 patients per year using an intranet application encompassing 30 sites in Utah. He has also implemented a national network of physical therapy practices using a cloud-hosted, web-based analytic outcomes tracking system, Intermountain ROMS. In addition, he has led a "pay for quality" program with Select Health, Utah's largest payer. He has published over 40 manuscripts and led randomized trials, plus quality-improvement, observational and practice-based studies. He has been funded by AHRQ and PCORI for multi-centered trials related to knee pain and low back pain, respectively.

A 45-year member of APTA, Brennan has served as Vice President of the Orthopaedic Section, and as Program Chair and Vice President of the Research Section. He serves the Academy as a member of the Clinical Practice Guideline Implementation Advisory Panel. He served the APTA as a member of the National Advisory Task Force for Development of a National Outcomes Registry. Currently he serves on the Scientific Advisory Committees for the Physical Therapy Outcomes Registry and the Physical Therapy Foundation. He has been honored with the Rose Excellence in Research Award in 2007, 2017, and 2019, and as a Catherine Worthingham Fellow.

OUTSTANDING PT STUDENT AWARD

Carly Esposito, SPT, is a third-year student physical therapist at Mercer University. Throughout physical therapy school, Carly has found interest in service, leadership, and advocacy. She has been able to serve as

the APTA Georgia Student Focused Interest Network president, a student member of the ACAPT Leadership Academy Student Leadership Development Subcommittee, an APTA PT Moves Me Campaign Ambassador, and an ambassador for the College of Health Professions at Mercer University. Carly has been involved in many service initiatives, including food drives and fundraisers and hands-on service at a local food bank and at a boxing class for clients with Parkinson's Disease. Carly became interested in physical therapy at 12 years old and is thrilled to be fulfilling her lifelong dream of working in this profession - particularly in the orthopaedic setting.

OUTSTANDING PTA STUDENT AWARD

Trevor Schooley, SPTA, of Somerset Community College (SCC) has been named the recipient of the APTA Academy of Orthopaedic Physical Therapy's Outstanding PTA Student Award for 2022. Schooley serves as

president of SCC's Physical Therapy Student Organization and treasurer of his class. He was appointed to the Kentucky Council on Post-Secondary Education's statewide Student Advisory Group and was selected to serve as an SCC Student Ambassador through a highly competitive process. He is an active member of the APTA-Kentucky and was named to the 2021 APTA-Kentucky All-Academic Team.

Schooley has been active in a number of charitable and community service activities including food and supplies drives for SCC's Share and Care Center, a voluntary program that supports students who are struggling financially. He has also served as a coordinator and participant in activities to support the funding of research for the Foundation for Physical Therapy through the Marquette Challenge, with Somerset Community College named the "Outstanding PTA Program" nationally in 2021. He is currently participating in fundraisers for the 2022 Challenge.

Schooley was nominated for the award by Ron Meade, the Director of SCC's PTA Program. The nomination was supported by program faculty members Melanie Hines and Steve Hammons and by program students Rob Ray and Seth Russell.

Schooley is the son of Kirk and Melissa Schooley of London, Kentucky. He is expected to graduate from the Physical Therapist Assistant Program in May 2022, with plans to work in an outpatient orthopaedic clinic in eastern Kentucky while advancing his education to ultimately obtain a DPT.

PRESIDENT'S MESSAGE

Rick Wickstrom, PT, DPT, CPE, CME

Networking with members in the Occupational Health Special Interest Group is a great benefit of belonging that helps appreciate *what new opportunities exist, how to deliver cost-effective care,* and *why advocacy is needed* to promote health in our clients and practice. At CSM, I was prompted by my colleague, Drew Snyder, to identify the single greatest government accomplishment during my lifetime. For me, it was the Americans with Disabilities Act (ADA), whereas for him, it was Operation Warp Speed. Both are great examples of putting aside social and political differences to unite in a common purpose of health and productivity for society.

My thirst for **what new opportunities exist** explains my sense of happiness to return to participation in-person at the Combined Sections Meeting in San Antonio. I love to network with enthusiastic students, colleagues, and exhibiters to learn more about opportunities, challenges, tests, measures, interventions, and elements of program design that represent our common purpose as physical therapy professionals. The AOPT all-SIG meet and greet social event was a good opportunity to connect with all SIG leaders. Our OHSIG-branded OMNI Exertion Scale was a popular SWAG item at the AOPT booth. We plan to make batches of OMNI scales available to OHSIG members for student use in schools or therapist use in clinics. Lorena Payne and Dee Daley engaged us in our OHSIG sponsored educational program, *Return to Work–It Does Not Happen by Accident*.

How to deliver cost-effective care is reflected in our OHSIG focus on implementing direct-to-employer services that demonstrate value with workplace population health management. January 2022 marked the release of a new AOPT Independent Study Course 32.4, *Bridging the Gap Between the Workplace and Clinic*. This is the first component of our Occupational Health Advanced Practitioner (OHAP) certificate program. It details opportunities and best practices for physical therapy professionals within a new frontier of workplace *Total Worker Health*® programs, functional job analyses and employment examinations, and entry point care of injured workers with job participation barriers. We appreciate the outstanding monographs in this ISC by author teams led by Josh Prall, Moyo Tillery, and Jennifer Klose.

Stay tuned for the release of the second required ISC course for the certificate of OHAP this summer that is titled, *Advanced Therapy Programs in Occupational Health*. Katie McBee, Leslie Pickett, and Wayne McMasters are setting a new bar for best practice guidance by their author teams. This ISC will cover clinical practice guidelines for work rehabilitation to address prolonged episodes of care, elements of ergonomic programs in healthcare and industry, and functional capacity evaluation and impairment. We have an outstanding steering committee for our certificate initiative that includes Marc Campo (Research Committee Chair), David Hoyle, Jennifer Klose, Lisa Krefft, Sarah Martin, Leslie Pickett, Michelle Urban-Stewart, and Rick Wickstrom. We completed a AOPT member survey that is informing our design for the third phase of our certificate process with a focus on program design and marketing.

Why advocacy is needed is reflected in regulatory or policy barriers that continue to limit a physical therapists ability to promote individual participation in physical activities across all practice settings. We must boldly assert to all stakeholders that a physical therapist is a **direct access primary health practitioner** who serves individuals across the lifespan at the entry point of care. The OHSIG has challenged our members to add their state to the growing list of states where physical therapists are authorized to perform Department of Transportation Physical Examinations of commercial drivers. My experience with having to clarify my scope of practice to become a DOT Certified Medical Examiner in OH and KY motivated me to draft a House of Delegates motion to better clarify the physical therapist's role in participation physical examinations to determine the presence or absence of physical impairments and to certify fitness for activity participation, functional limitations, and need for accommodations in work, school, sports, and other activities of daily living. I found it concerning that physical therapists who perform objective performance-based physical exams faced barriers to conducting participation exams, compared to health practitioners who prescribe medications. We need to point to positive examples such as the inclusion physical therapists to perform exams such as a DOT physical exam that have a public safety purpose in our advocacy to get physical therapists include on the list of practitioners who are authorized to perform other participation exams such as sports pre-participation evaluation required by youth or high school athletic associations.

Finally, I would like to express my thanks and appreciation to other leaders. Past-president Lorena Payne just completed a 3-year term as Practice Chair and will continue to assist with implementation of the OHSIG Work Rehab CPG published in August 2021. Caroline Furtak completed her second term as Membership Chair and will continue in another role on the AOPT Membership Committee. Michelle Despres completed a 3-year term on our Nominating Committee and will continue to assist as a member of the Work Rehab CPG Committee with Lorena Payne, Dee Daley (first author), and Lori Deal. Cory Blickenstaff completed a 3-year term as Communications Committee Chair and has accepted a new role as our Practice Committee Chair to drive our OHSIG State Resource Liaison initiative. The state of the union is bright for OHSIG. I value the amazing works and encouragement of my leadership sidekick, Steve Allison (Vice President and Education Chair). We are thankful for all the support from Janet Konecne (AOPT Director) and entire AOPT staff for our many initiatives. We greatly benefited from the outstanding leadership of AOPT's outgoing President, Joe Donnelly, who was tenacious in updating AOPT governance and the strategic plan, while being very inclusive and encouraging of SIG leaders.

PRESIDENT'S MESSAGE

Laurel Daniels Abbruzzese, PT, EdD | labbruzzese@orthopt.org

COMBINED SECTIONS MEETING 2022 HIGHLIGHTS

Our pre-conference course co-sponsored with the Imaging SIG was a big success. Thanks again to Dirk Hartog, PT, DPT, OCS, CSCS, for adding a "Performing Arts" lens to the use of musculoskeletal ultrasound for the upper extremity. Thank you to Brooke Winder, PT, DPT, Marisa Hentis, PT, DPT, Kristen Schuyten, PT, DPT, MS, and Tiffany Marulli, PT for their engaging talk on building resilience in Performing Arts care in this post-COVID world.

NEW PASIG LEADERS

We want to welcome our newly elected leaders to the team. Our new VP-Education, Melissa Strzelinski, PT, PhD, has been a practicing physical therapist specializing in orthopedics, sports medicine, and dance medicine since 2009; she completed her PhD in Orthopedic and Sport Science in 2018. Our newest member of the Nominating Committee, Taylor Augustine, PT, DPT, graduated with her DPT in December 2020, and has over a decade of experience in the physical therapy field and performing arts. We also want to officially welcome back Annette Karim, PT, DPT, PhD, OCS, FAAOMPT as our AOPT BOD Liaison.

We want to extend our deep gratitude to our outgoing leaders, Rosie Canizares, Duane Scotti, Mark Romanick, and Brooke Winder. You have been exceptional team members and have contributed so much to the SIG. Thank you for your service to the PASIG!

PASIG CALL FOR MEDIA!

We are extending our call for media. The PASIG would like to feature our own members in videos being created for various strategic initiatives.

You can scan the QR code to submit entries at:

https://cumc.co1.qualtrics.com/jfe/form/SV_6nRQ8IQ5ZKCtDBc

Here are some great examples submitted by Rosie Cazinares.

PASIG PRACTICE PEARLS PODCAST

Our fourth installment of **PASIG Practice Pearls Podcast** series should be available on our website this spring! This episode will focus on Irish Step Dancers.

BECOME A PASIG MEMBER!

Direct email-blasts go to registered PASIG members. If you would like to receive the monthly **citation blast** and PASIG news, be sure to ***become a member***. [https://www.orthopt.org/login.php?forward_url=/content/special-interest-groups/performing-arts/become-a-pasig-member]

SCAN ME

PERFORMING ARTS–SIG FEATURED CONTENT

Thank you to Kendall Lynch, PT, DPT, OCS, PMA-CPT, for submitting your case study of a tap dancer with a hip pointer injury. Dr. Lynch is a Board Certified Orthopedic Clinical Specialist with a specialty focus on pelvic health. She is also the 2021-2022 fellow in the Columbia University Irving Medical Center - West Side Dance Physical Therapy Performing Arts Fellowship Program.

Hip Pointer in a Professional Tap Dancer: A Case Report

Kendall Lynch, PT, DPT, OCS

BACKGROUND

Tap dancing is a highly complex skill requiring inter-limb coordination, timing, and amplitude due to the percussive nature of the steps.[1] There are low ground reaction forces in tap dance repertoire that may contribute to the relatively low injury prevalence.[2] In order to produce the sound, tap dancing is more reliant on ankle dorsiflexion, knee flexion, and hip flexion in the sagittal plane; while in the frontal plane, there are more hip and knee adduction forces.[2] A study of lower extremity kinetics in tap dance revealed that the vertical ground reaction forces in tap are greater than walking tasks and comparable to aerobic dance. The peak hip flexion and hip extension moments for common tap movements like flaps, cramp rolls, and pullbacks are closely related to aerobic dance and stair climbing.[2]

According to Rocha et al,[1] in the tap movements they assessed, the ankles and knees showed greater range of motion compared to the hips. In professional tap dancers there is a requirement of timing and coordination between the 2 legs to create the appropriate movements for performance. Tap movements and articulations are fairly symmetrical when comparing left to right and through the 3 joints of the lower extremity, ranging above 90%, except for stamping the foot down which was 72%. To achieve high precision movements with a gesture leg, it is important to have good stability through the stance limb. Limiting the excursion of the gesture leg hip allows the ankle to create the high amplitude, fast dance rhythms common in tap.[1]

Mayers et al[2] have reported a tap injury occurrence rate ranging

from 0.26 to 0.42 per 1000 dance exposures; and of these exposures, the injury rate of tap dancers decreases as their experience increases.[3] The majority of tap-related injuries involve the foot and ankle, and are rarely traumatic in nature; however, there is still not consensus in the literature on how best to define injury, as many dancers would not include musculoskeletal "aches or pains" as an injury.[3] The full scope of dance injuries in tap dancers should include increased exposure to other exercises or activities that may have led to their injuries. This is relevant for this case as the injury was unrelated to the studio.

Hip pointers are common injuries typically found in contact sports, such as hockey or football. A hip pointer is a deep bruise caused by a high impact injury to the iliac crest or to the greater trochanter, usually by another athlete. Hip pointers can result in serious pain and decreased function that can alter a person's athletic performance.[4] This type of traumatic injury is not well studied in non-contact athletics, especially as a result of a fall directly onto one of the two bony prominences. While non-contact hip pointers are less common, they are quite debilitating in the acute stage and can prevent any professional athlete from performing.

Due to the region of the iliac crest and greater trochanter having less adipose tissue or muscle bulk, it is an area that can be more susceptible to injury.[5] For the purposes of this case, attention will be focused on the anatomy at the greater trochanter. As mentioned earlier, there are little to no soft tissues protecting the iliac crest and/or greater trochanter. There are multiple muscles that insert into the greater trochanter including gluteus medius, gluteus minimus, piriformis, obturator externus, and obturator internus (**Figure 1**).[6] In addition to the local insertion points on the greater trochanter, due to trauma to this bony prominence it could impact the femoral neck, femoral head, and/or the acetabulum. In the younger population, fractures to the femoral neck, femoral head, or acetabulum are commonly caused from car accidents or falls from a tall height.[7-9]

Figure 1. Deep Lateral Hip Muscular Anatomy

Reprinted royalty-free from shutterstock.com.

The incidence rate of hip pointers has not been reported, but within certain sports there is some limited data with the overarching definition of "hip contusion". Within the National Football League, hip contusions are the second most common injury following muscle strains.[4] In those football players, the average workdays lost was reported at 5.6 days, but anecdotally there may be even more training loss.[4] There is, however, no literature that discusses falls to the lateral hip that results in hip pointers in the general population.

CASE REPORT

History

The patient is a 27-year-old male professional tap dancer who arrived via direct access after incurring a right hip injury. He had abrasions on his right elbow as well as the right knee and presented with a hematoma at the right greater trochanter. The injury was sustained falling from a skateboard directly onto his right greater trochanter while he tucked his arm into his body. Immediately following the injury, he had acute pain and difficulty with weight bearing. He sought physical therapy treatment the next day where modalities were performed to reduce pain: transcutaneous electrical nerve stimulation, ultrasound, and ice. That physical therapist referred the patient to diagnostic imaging to rule out a fracture. On day 2, he went to urgent care for a radiograph that was negative for acute bony abnormalities.

Day 3 the patient arrived for initial evaluation by the author. He walked in using a single crutch on the left side. When he put weight through his right leg, he reported feeling very weak and would compensate by translating his rib cage over the right lower extremity. At that time, he was taking 600 mg ibuprofen 3 times daily as well as intermittent icing throughout the day for pain management as advised by the urgent care practitioner. He reports that his pain at worst was 8/10 and that it felt sharp in nature. It was worsened with weight bearing, lying on the right, and general movements, especially abduction of the right lower extremity. He noted that his pain could be 0/10 if he had been sitting and with medication. The pain was localized to the greater trochanter with referral pain posteriorly and superiorly. He completed the Lower Extremity Functional Scale[10] with a score of 13.75 percent, demonstrating substantial functional impairments.

His past medical history is remarkable with a right fifth metatarsal fracture in December 2020 as well as recent right hip bursitis in July 2021. The latter pain resolved with help from a chiropractor and was not irritated prior to the inciting injury for this case. He also has a history of focal seizures. His history is negative for any significant surgical interventions.

Prior to the injury the patient had been preparing for a tap performance. He was scheduled to perform 3 different pieces that would run twice in 3 weeks. He also needed to participate in the rehearsals that would be a few hours a day 5 days a week for the 2 weeks preceding the show. Due to the high demands of the choreography in one of the pieces (a lot of lunge shifts), he decided to withdraw from that piece only, but was eager to perform in the other 2 pieces, both about 20 minutes in length. The choreography had some improvisational components where the patient would be able to reduce the load through his lower body and control his movements. His goals were first to be able to walk without pain and then to be able to perform at the tap show in 3 weeks.

Evaluation

The patient's gait was observed while walking from the waiting room to the treatment room. During this assessment, it was noted that the patient demonstrated decreased weight bearing on the right lower extremity with decreased step length and poor balance. Upon closer examination of the skin, there was an obvious contusion and bruise to the right lateral hip (**Figure 2**).

The examination continued in supine secondary to the patient's marked discomfort in weight bearing. In supine, passive range of motion (ROM) was assessed bilaterally. The ROM was within normal and functional limits bilaterally, however, the patient expressed pain with passive hip internal rotation in both a 90/90 supine position and in prone with the knee flexed to 90°. The patient exhibited gross 5/5 strength of the left hip and knee musculature that was used as a comparison when assessing the right lower extremity via manual muscle testing. A significant limitation in hip muscle strength was noted. He was unable to actively abduct the right hip secondary to pain. There were no notable weaknesses

Figure 2. Patient's Contusion 5 Days Post Injury

noticed in the knee, foot, or ankle musculature. **Table 1** summarizes the specific limitations of the right lower extremity.

With palpation, there was right sided tenderness at the greater trochanter, the gluteus medius tendon, iliotibial band, and the common tendon of the hip rotators. He had some mild muscle guarding of the gluteus maximus, gluteus minimus, and gluteus medius. He had no referral to the knee with palpation. For special tests, the author chose the flexion, abduction, external rotation test (FABER); the flexion adduction, internal rotation test (FADDIR); and the scour test (impingement test) to rule out possible labral pathology secondary to the mechanism of injury. The FABER and FADDIR test have been shown to have high sensitivity, but low specificity.[11] Another study showed that FABER and scour test have high sensitivity and low specificity regarding differentiating between extra-articular or intra-articular pathologies.[11] The patient in this case study presented with a negative result for all 3 special tests and ruled out intra-articular pathology.

Upon further assessment, the patient was unable to single leg stance on the left lower extremity without use of the crutch. He was unable to perform any type of lunge. When asked to perform a double leg squat, the patient demonstrated decreased weight bearing over the right leg with a large shift to the left. A single leg squat was not attempted.

Table 1. Summary of Examination Findings at Evaluation and 5th Session for the Patient

	Initial Evaluation (2 days post injury)	5th Session (17 days after Injury)
Range of Motion		
Prone Hip External Rotation	13°, painful	27°, painfree
Prone Hip Internal Rotation	25°, painful	40°, painfree
Strength		
Gluteus Medius	Unable to move leg without assistance; gravity eliminated and gravity dependent	4-/5, painfree
Deep Hip External Rotation	3/5, painful	4/5, painfree
Functional Tests/Return to Dance Tests		
Double Limb Squat	Weight shifted 50% to the left	Within functional limitations with equal weight distribution between legs
Single Leg Squat	Unable	10 repetitions
Single Leg Stance	Using crutch; 5 sec	No assistive device; 30 sec
Airplane Test	Unable	5 out of 5 successful attempts
Outcome Measure		
Lower Extremity Functional Score	13.75%	93.75%

Diagnosis

Examination findings were consistent with diagnosis of acute right hip pointer at the greater trochanter. There was no intra-articular component as it was ruled out secondary to his testing negative to the cluster of intra-articular tests. His main presenting deficits were trauma to the contractile tissues as evidenced by decreased active ROM into abduction, decreased ability to weight bear, tenderness, and decreased strength and coordination. Due to the nature of hip pointers, there would be expected resolution of symptoms in 3 to 6 weeks and the prognosis for him was good. He would be expected to perform in 3 weeks with appropriate grading of activity to tolerance.

Intervention

The patient was seen for 5 physical therapy appointments over a two-and-a-half-week span prior to his scheduled tap performance. He was concurrently receiving acupuncture care that involved microfilament needling and cupping. Physical therapy interventions included pain modulation, balance and proprioception, and normalizing ROM and strength (**Table 2**). Due to the nature of injury and anticipated performance demands, interventions were focused on gradual loading of the lateral hip stabilizers, both the abductors and the hip rotators in both open and closed kinetic chain. Tap dancing requires direction changes and the ability to shift posteriorly and laterally, or the combination of the two, as well as with higher levels of speed.

Outcome Measures

Liederbach et al[12] developed a readiness screen specific for dancers that was used for this particular case due to the patient's functional limitations and inability to return to dance. Due to the nature of tap, the functional tests chosen were single leg balance, single leg squat, and the airplane test (**Figure 3**). The airplane test is an advanced single limb motor control test that integrates core stability with upper and lower limb coordination.

At the end of 5 sessions, the patient demonstrated marked improvement. His return to dance tests assessed as per Table 1 were a pass. His maximal pain with prolonged walking was 2/10. He had returned to normal sleeping without stiffness in the morning. He was able to demonstrate a normal gait pattern without antalgia or an assistive device. While his gluteus medius strength improved to 4 out of 5, one would suspect that this was due to a reduction in pain rather than a true strength change of one manual muscle test grade within one month.[3]

DISCUSSION

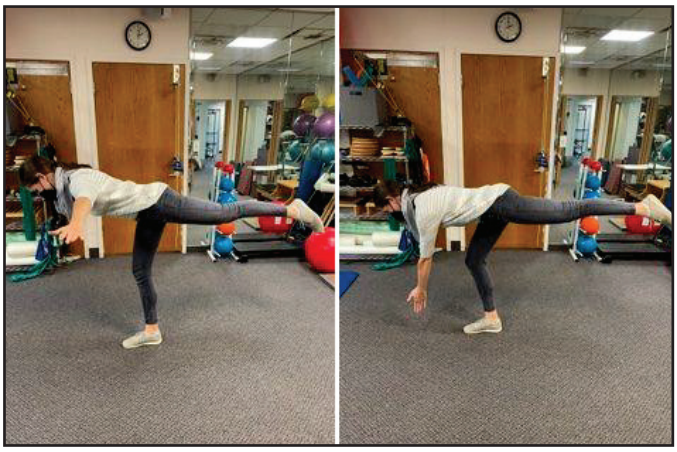
There is limited data regarding acute falls and trauma without any substantial damage and how to rehabilitate to a higher level of function; even within the population that incurs repetitive traumas. In this case, there was also a lack of research regarding

Table 2. Interventions over the Number of Visits for the Patient

	Visits 1-2	Visit 3	Visit 4	Visit 5
Pain Modulation	Cryotherapy: over the counter anti-inflammatories	No use of over-the-counter medication	N/A	
Decreased Active Range of Motion	Passive ROM: PNF to the pelvis; isometrics to begin mid-range activation		WFL	
Decreased Hip Strength	Isometrics: Active ROM gravity eliminated	MRE R hip abduction		WFL
Poor Weight Acceptance	Heel strike cuing: step up with opposite limb to promote single leg weight bearing	Pilates Reformer: single leg work in supine and left side-lying	Side stepping and diagonal stepping; verbal call outs for quick directional changes	
Decreased Balance/ Proprioception	Double leg stance with lateral shifts to bring weight onto the right lower extremity		Single leg squat with deep hip rotator cuing for femoral control	Return to dance tests
Return to Dance	Observing rehearsal, seated	SLS with tap specific movements (shuffling)	Seated foot rhythms and choreography at rehearsal, in tap shoes	Standing tap choreography for endurance time within center of gravity

Abbreviations: ROM, range of motion; PNF, proprioceptive neuromuscular facilitation; MRE, manual resistive exercise; WFL, within functional limits; SLS, single leg stance

Figure 3. "Airplane" Test



rehabilitation of injured tap dancers, especially injuries that occur outside of the dance realm, as was this case. In addition, tap dance is highly improvisational that can be both detrimental and helpful in treatment. It is challenging to prepare the dancer to be performance ready without predictability of the skills involved. On the positive side, improvisation assists with rehabilitation in that the dancer was able to modify their choreography to allow less stress through the injured body part during performance.

The return to dance tests served as a useful battery of functional measures for return to tap dancing. It was also important to understand and appreciate the patient's level of pain as a guide to facilitate recovery and optimization of his functional goals. Although a fear avoidance behavior questionnaire was not used for this case, there was a clear impact of fear on movement. The patient feared the possibility of sharp sensations without warning and limited movements due to the high nature of the pain. The patient required positive feedback with graded loading to lessen his concern as well as reduce the onset of pain and return him to his goals.

CONCLUSION

A hip pointer involves mechanical disruption of homeostasis and can lead to significant functional limitations in athletes and dancers. This case demonstrates the debilitating effect of acute falls, even without fracture or severe injury. This case also highlights the importance of managing patient's fears during recovery. In the presence of limited research regarding return to tap dancing, functional outcome measures can guide return to function even in cases with less predictable movement demands. In this case, there was a goal to return to performing in a short timeline that assisted in the patient's focus.

REFERENCES

1. Rocha P, McClelland J, Sparrow T, Morris ME. The biomechanics and motor control of tap dancing. *J Dance Med Sci.* 2017;21(3):123-129. doi:10.12678/1089-313X.21.3.123
2. Mayers L, Bronner S, Agraharasamakulam S, Ojofeitimi S. Lower extremity kinetics in tap dance. *J Dance Med Sci.* 2010;14(1):3-10.
3. Mayers L, Judelson D, Bronner S. The prevalence of injury among tap dancers. *J Dance Med Sci.* 2003;7(4):121-125.
4. Hall M, Anderson J. Hip pointers. *Clin Sports Med.* 2013;32(2):325-330. doi:10.1016/j.csm.2012.12.010

(Continued on page 118)

Hello AOPT Foot and Ankle SIG members! This newsletter marks the transition of our FASIG leadership as Dr. Frank DiLiberto steps in as President and Dr. Christopher Neville steps away after 2 completed terms. We would like to thank the membership for their sustained engagement and preview some of the plans we have for the future.

FASIG members – over the past 6 years it has been truly a pleasure to work with the membership and the AOPT as we developed FASIG interest and content. In 2011 I took my first leadership role with the FASIG, offering to help develop entry-level foot and ankle curricular guidelines. This first experience connecting to an outstanding group of people was truly rewarding. It was this experience that led me to run for President in 2016 that serendipitously has circled back to the development of an advanced fellowship curriculum for foot and ankle specialty practice in 2022, during my final year. Again, this was possible with great people who have tremendous insight into specialty practice and a genuine focus on advancing the profession. Overall, the FASIG is full of insightful and dedicated people who make the SIG successful, and exciting to work with to complete tasks. I look back on great initiatives the FASIG led including the CSM SIG social that brought together our membership and some key industry partners. The FASIG formally executed the first memorandum of understanding with an external partner when we finalized our partnership with the American Orthopaedic Foot and Ankle Society (AOFAS) in 2019. We continue to foster this relationship today with webinars and joint annual programing. At this time the FASIG is over 700 members strong, has a student led intern program that develops quarterly newsletters, developed a leadership award, developed the first AOPT infographics to translate evidence-based information to clinicians, and continues to advance foot and ankle specialty content to CSM each year. Additionally, the SIG has used author spotlights to highlight current and innovative research to share with the membership. It has truly been a pleasure to work with the SIG for the last 6 years and I look forward to seeing many of the SIG initiatives continue in the future. Frank and I have known each other for many years and the FASIG is certainly in great hands as we look to the future.

Christopher Neville, PT, PhD
FASIG President 2016-2022

FASIG members – I look forward to the next 3 years with optimism. Great strides have been made under Chris's leadership. We all owe him a debt of gratitude for how much has been accomplished; I certainly have big shoes to fill (lame pun fully intended). I am grateful for the support of you all as I begin my term and I feel fortunate for the opportunity to lead, work with you, and grow our momentum as a SIG. Long term, I intend to support the development of a foot and ankle fellowship and the continuation of the number of fantastic FASIG activities mentioned above. Here are some things to look out for in the more immediate future:

- Next Virtual Membership Meeting - tentatively slated for April 2022. Please join us to reconnect or introduce yourself and learn about FASIG initiatives and activities that you might be interested in and able to assist with. Come to share your thoughts as we preview newer ideas including a larger social media presence, an abstract of the month, the potential expansion of our author spotlight series into an accredited educational opportunity, as well as to discuss the status of current initiatives. Speaking of…
- Foot and Ankle AOPT Infographics - creation of additional foot and ankle AOPT infographics would further build the FASIGs role in the promotion of excellent foot and ankle physical therapy. We are in search of a new Practice Chair to spearhead this effort, and members to assist. Are you interested or particularly adept at treating a specific foot and ankle pathology? I bet the membership could benefit from your insight.
- Foot and Ankle article in *Orthopaedic Physical Therapy Practice (OPTP)* – stay tuned for a foot and ankle feature article this summer!
- AOFAS Annual Meeting 2022 – this collaborative educational experience will be here in September before we know it. The FASIG will again have a presence and offer programming at this event – consider attending or even helping the FASIG with our programming. It would be great to see you there.

Frank DiLiberto, PT, PhD
FASIG President, 2022-2025

The FASIG Leadership
https://www.orthopt.org/content/special-interest-groups/foot-ankle

PRESIDENT'S MESSAGE

Nancy Robnett Durban, PT, MS, DPT

Hello All…I hope this report finds you well and safe.

The leaders of the Pain SIG would like to thank all those who attended the zoom membership meeting held on February 15 and those who have volunteered to help. Please visit the AOPT Pain SIG website for meeting details. The next zoom membership meeting will be held on August 16th 5:00 p.m. PST/7:00 p.m. CST/8:00 p.m. EST. The Pain SIG has many exciting plans for 2022. This is our year to reboot and upgrade. Stay tuned. Watch for Pain SIG emails regarding education, research, and opportunities to become involved.

Current Efforts

Eric Kruger, PT, DPT, PhD, Vice President is leading two efforts:

The first effort is for the Pain SIG to help merge the *Pain Education Manual (PEM)* content and language with the *Guide to PT Practice* that is currently under revision.

The second effort involves The Commission on Accreditation in Physical Therapy Education (CAPTE), the accrediting organization for DPT Education. The Commission is revising the accreditation standards for DPT education. The Pain SIG has been leading efforts in our profession to increase the depth and breadth of pain content in DPT education with the publication of the *Pain Education Manual*. If you support the recommended changes to pain-related content in DPT curriculum, as outlined by the *Pain Education Manual* and the *International Association for the Study of Pain (IASP)* curriculum outline for physical therapy programs, please advocate for pain content in DPT curriculum. Note that pain content most likely fits under Standard 7 of the Standard of Accreditation. Please send your comments to Peggy Gleeson at pgleeson@twu.edu and Mary Romanello at maryromanello@apta.org. Please mark the email as **Standard and Required Elements Revisions.**

The Pain SIG would like to thank the all the AOPT office personnel, Beth Collier, PT, DPT, PhD, OCS, FAAOMPT, AOPT Director and Pain SIG Liaison and AOPT President, Bob Rowe, PT, DPT, DMT, MHS, FAAOMPT, for their continued support and guidance.

Introduction

It is now my pleasure to introduce you to Pain SIG member, Kory Zimney, PT, DPT, Associate Professor at the University of South Dakota teaching curricular content related to pain neuroscience and musculoskeletal content. Active line of research and publications in pain neuroscience education and therapeutic alliance. Educator of post-professional education courses through Evidence in Motion on Pain Neuroscience Education and Manual Therapy. Dr. Zimney's article is entitled, Pain Education Manual – A Guide for the Change Ahead. Thank you, Kory, for your article.

Pain Education Manual – A Guide for the Change Ahead

There continues to be growing awareness that the management of chronic pain in the United States is not meeting the needs of our society. The 2016 Global Burden of Disease study affirmed this by finding that pain-related diseases are the leading cause of disability and disease burden.[1] It has been reported that once Dr. Patrick Wall stated, "If we are so good, how come our patients are so bad?" The numbers are a continual wake-up call that we need to do better in caring for those with chronic pain as a health community. Approximately 100 million United States adults suffer from some level of chronic pain, with an economic burden estimated to be $560-630 billion.[2] This has led to our current opioid epidemic, where over 100 people are dying from an opioid overdose every day.[3]

In 2011, the Institute of Medicine (IOM) produced a significant assessment of pain research, care, and education in the United States detailed in the document: "Relieving Pain in America, A Blueprint for Transforming Prevention, Care, Education, and Research."[2] One area of focus in the report was to discuss one of the challenges in improving care for individuals with chronic pain lies within the educational process for health professionals. There are stark inconsistencies within various healthcare professionals on what constitutes quality pain education for healthcare students. The International Association for the Study of Pain (IASP) created curricular guidelines for pain content in 2012 to combat this. Fishman and colleagues followed this up by publishing the core competencies for pain management in 2013 to help create more consistent guidelines for academic institutions to align with current evidence-based care and best practices around pain evaluation and treatment.[4] These competencies were further developed to be specific for prelicensure education in pain management for physical therapy the following year.[5] Through this timeline, one can see the steady progression and concerted effort to make changes to improve how pain education is delivered in physical therapy programs to enhance the competency of the future physical therapist to treat individuals suffering from pain adequately.

Even with these efforts, many physical therapists and physical therapist assistants are not adequately prepared and trained in the multidimensional nature of chronic pain and the unique methods to assess and treat those with chronic pain. One survey found that 72% of therapists stated their entry-level education in pain management was very inadequate or less than adequate.[6] A more recent survey demonstrated that while we have improved, we still have room for improvement when it comes to providing education to our entry-level clinicians. The study by Bement and Sluka in 2015 reported that less than 50% of the physical therapy programs were aware of the IOM report or the IASP guidelines.[7]

The profession is working to increase awareness and use of the curricular guidelines to improve entry-level education. The *Pain Education Manual (PEM)*[8] was developed in direct response to the passing of the 2018 American Physical Therapy Association (APTA) House of Delegates (HOD) RC 43-18 position statement. The HOD position statement centered around the APTA endorsing and promoting the integration of the IASP curriculum outline into physical therapy education, practice, and research initiatives, where feasible. In 2019 the Academy of Orthopedic Physical Therapy (AOPT) organized the Pain Education Committee. It

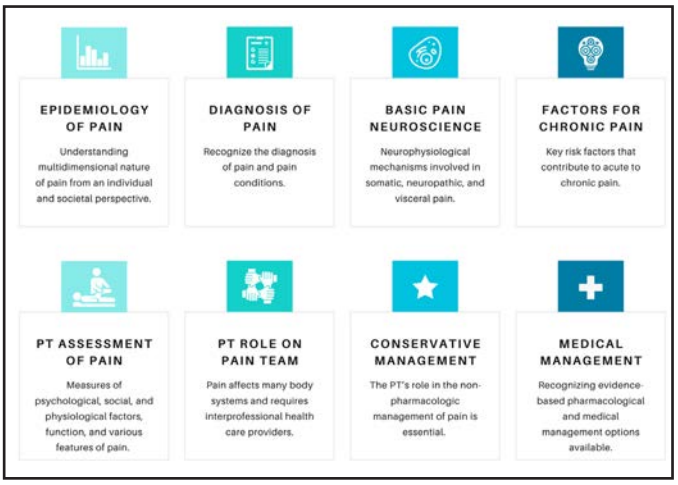
appointed the Pain Special Interest Group within the AOPT to take the lead role in developing the PEM to assist physical therapy programs to comply with the APTA HOD recommendation.

Unfortunately, one challenge is that academic faculty have notoriously been resistant to change.[9,10] There are numerous potential reasons for resistance to curricular changes by faculty. One possible cause is not being aware of the ever-changing and evolving pain literature regarding pain mechanisms and best practices to care.[11] This was noticed by various faculty members, including myself, that were involved in the PEM project. The vast array of information brought forward during the development of the manual highlighted gaps in areas that we had in teaching pain content within our programs. Everyone should be aware of the Dunning-Kruger Effect.[12] The Dunning-Kruger Effect is where an individual tends to overestimate their knowledge in an area, especially if they have below-average expertise in that area. No academic faculty member wants to fall prey to this cognitive bias, and the PEM helps reduce the risk of this happening. The PEM provides a standard for which programs can match their current content to ensure that it meets the primary content areas needed for a comprehensive program to educate entry-level physical therapists. The pain literature has expanded significantly in the last few decades, which means the training that experienced clinicians and faculty members received in their initial training is not current with the explosion of current evidence. Moreover, transformative learning experiences require specific approaches to teaching that are not currently represented in most physical therapy curriculum, especially as it relates to pain.[13] Therefore, one of the primary goals of the PEM was to support the ongoing development of pain instruction within physical therapy programs by providing a resource to assist with curriculum planning and development and academic and clinical teaching activities.

With the implementation of curricular changes within physical therapy schools around pain education, change can happen. This change is evident when students understand pain better and change their attitudes and beliefs surrounding caring for patients who suffer from chronic pain. Positive shifts in student learning and behavioral responses have been found when innovative teaching methods incorporate the IASP guidelines and the dimensions listed in the PEM.[14,15] After going through a modernized pain curriculum, students demonstrated increased empathy, attitudes, and beliefs toward individuals with chronic pain. This finding is important as evidence shows that these improved attitudes lead to improving therapeutic alliance and outcomes.[16,17]

At first glance, the PEM may appear daunting to the faculty member or clinician with 119 pages of information to digest. The length of the PEM is attributed to the depth of knowledge that it provides. The beginning of the manual reviews the history behind the importance of the manual's development. Next, it moves into the curricular content. The Pain Education Committee settled on 8 curricular dimensions that should be included within a physical therapy program's pain content (**Figure 1**). Other curricular components beyond the primary dimensions are also reviewed, such as the importance of advocacy, evidence-based practice, interprofessional collaboration, and person/family-centered care. A pain program's pedagogical and andragogical structure is detailed out using the praxis of learning elements laid out by Jensen and colleagues.[18,19] The majority of the pages in the PEM are dedicated to the Didactic Pain Dimension Tables. These tables provide curricular details on each of the 8 dimensions for the academic faculty

Figure 1. Pain Education Manual Curricular Pain Dimensions[8]



to insert into their specific program. Learning levels, sample course objectives, learning activities and assessments, and primary content areas are provided as examples to be used by faculty members. In addition, various readings and resources are listed along with links to the various IASP and Pain Management Domains and Core Competency Alignment. Lastly, sample syllabi are provided for pain-specific courses for the faculty member to gain insights on what a stand-alone course in pain might look like. The PEM shares both integrated and threaded options for pain content delivery along with options for a stand-alone course model. Currently, there is no one best delivery method for pain content. Thus, the PEM is not overly prescriptive but does provide the primary learning domains and content along with various successful activities to achieve learning objectives to prepare physical therapy students for clinical practice.

The PEM is for physical therapy faculty, but it also can be used by our clinical instructors and other clinicians. Various sample clinical instructor activities and experiences are also listed in a table format within the PEM to help the clinical instructor look at the learning experiences they provide their physical therapy student during their clinical rotation. In addition, it links to where in the Clinical Performance Instrument items align with each of the 8 pain dimensions. The PEM can also serve as a road map for the clinician who may not have had a depth and breadth of content in their entry-level training to advance their knowledge and become current with the pain science literature.

More steps need to occur to continue meeting the challenges to improve care for individuals with chronic pain, but change is happening. The authors involved in the PEM should be commended for taking critical first steps to meet the charge set forth by the APTA HOD position of incorporating the IASP guidelines. It is hoped that all physical therapy programs incorporate the information in the manual into their curriculums. In addition, clinic sites should also use the manual to improve the clinical experiences for students on clinical rotations at their site. This manual provides a standard for programs and clinicians to match themselves to and provide them with the resources and examples needed to succeed in the change to improve care for our patients with pain by preparing students better.

REFERENCES

1. GBD 2-15 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet*. 2017;390(10100):1211-1259. doi: 10.1016/S0140-6736(17)32154-2
2. Institute of Medicine. Committee on Advancing Pain Research C, Education. *Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research*. National Academies Press; 2011.
3. Seth P, Rudd RA, Noonan RK, Haegerich TM. Quantifying the epidemic of prescription opioid overdose deaths. *Am J Public Health*. 2018;108(4):500-502. doi: 10.2105/AJPH.2017.304265
4. Fishman SM, Young HM, Lucas Arwood E, et al. Core competencies for pain management: results of an interprofessional consensus summit. *Pain Med*. 2013;14(7):971-981. doi:10.1111/pme.12107
5. Hoeger Bement MK, St Marie BJ, Nordstrom TM, et al. An interprofessional consensus of core competencies for prelicensure education in pain management: curriculum application for physical therapy. *Phys Ther*. 2014;94(4):451-465.
6. Wolff MS, Michel TH, Krebs DE, Watts NT. Chronic pain--assessment of orthopedic physical therapists' knowledge and attitudes. *Phys Ther*. 1991;71(3):207-214. doi:10.2522/ptj.20130346
7. Bement MKH, Sluka KA. The current state of physical therapy pain curricula in the United States: a faculty survey. *J Pain*. 2015;16(2):144-152. doi:10.1016/j.jpain.2014.11.001
8. Shepherd M, Courtney CA, Wassinger CA, Davis DS, Rubine B. Pain Education Manual: For Physical Therapist Professional Degree Programs. Academy of Orthopedic Physical Therapy - Pain Special Interest Group. https://www.orthopt.org/uploads/content_files/files/Pain_Manual_Draft_FINAL_6.25.2021%281%29.pdf. Published 2021. Accessed February 17, 2022.
9. Bond MA, Blevins SJ. Using faculty professional development to foster organizational change: A social learning framework. *TechTrends*. 2020;64(2):229-237.
10. Madsen S. Preparing faculty and staff for change. *Academic Leadership: The Online Journal*. 2008;6(1):15.
11. Cohen SP, Vase L, Hooten WM. Chronic pain: an update on burden, best practices, and new advances. *The Lancet*. 2021;397(10289):2082-2097.
12. Mahmood K. Do people overestimate their information literacy skills? A systematic review of empirical evidence on the Dunning-Kruger effect. *Communications in Information Literacy*. 2016;10(2):3.
13. Merriam SB, Bierema LL. *Adult learning: Linking theory and practice*. John Wiley & Sons; 2013.
14. Wassinger CA. Pain knowledge, attitudes and beliefs of doctor of physical therapy students: changes across the curriculum and the role of an elective pain science course. *J Man Manip Ther*. 2021;29(5):288-296.
15. Helm J, Mayhew T, Zimney K. The Effectiveness of Active Learning Approaches in a Pain Education Curriculum Within a Physical Therapy Program. *Journal of Physical Therapy Education*. 2021;35(3):218-226.
16. Ferreira PH, Ferreira ML, Maher CG, Refshauge KM, Latimer J, Adams RD. The therapeutic alliance between clinicians and patients predicts outcome in chronic low back pain. *Phys Ther*. 2013;93(4):470-478.
17. Babatunde F, MacDermid J, MacIntyre N. Characteristics of therapeutic alliance in musculoskeletal physiotherapy and occupational therapy practice: a scoping review of the literature. *BMC Health Serv Res*. 2017;17(1):375.
18. Jensen GM, Nordstrom T, Mostrom E, Hack LM, Gwyer J. National study of excellence and innovation in physical therapist education: part 1—design, method, and results. *Phys Ther*. 2017;97(9):857-874.
19. Jensen GM, Hack LM, Nordstrom T, Gwyer J, Mostrom E. National study of excellence and innovation in physical therapist education: part 2—a call to reform. *Phys Ther*. 2017;97(9):875-888.

PERFORMING ARTS

(Continued from page 114)

5. Varacallo M, Bordoni B. Hip pointer injuries. *StatPearls*. August 7, 2021.
6. Netter FH. *Atlas of Human Anatomy*. 5th ed. Saunders/Elsevier; 2011.
7. Kazley J, Bagchi K. Femoral Neck Fractures. *StatPearls*. May 19, 2021.
8. Ross JR, Gardner MJ. Femoral head fractures. *Curr Rev Musculoskelet Med*. 2012;3(5):199-205. doi:10.1007/s12178-012-9129-8
9. Hoge S, Chauvin BJ. Acetabular fractures. *StatPearls*. April 3, 2021.
10. Binkley JM, Stratford PW, Lott A, Riddle DL. The Lower Extremity Functional Scale (LEFS): scale development, measurement properties, and clinical application. North American Orthopaedic Rehabilitation Research Network. *Phys Ther*. 1999;79(4):371-383.
11. Martin RL, Sekiya JK. The interrater reliability of 4 clinical tests used to assess individuals with musculoskeletal hip pain. *J Orthop Sports Phys Ther*. 2008;38(2):71-77. doi:10.2519/jospt.2008.2677
12. Liederbach M. Perspectives on dance science rehabilitation understanding whole body mechanics and four key principles of motor control as a basis for healthy movement. *J Dance Med Sci*. 2010;14(3):114-124.
13. Bohannon RW. Considerations and Practical Options for Measuring Muscle Strength: A Narrative Review. *Biomed Res Int*. 2019 Jan 17;2019:8194537. doi:10.1155/2019/8194537

Follow Your Pathway to Success

Discover Barral Manual Therapies

In-Person Workshops

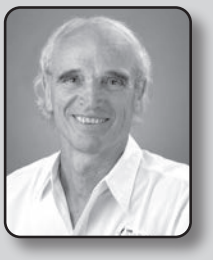
"I wish I had found this a little earlier – it completes a missing link in my education and I expect it will have tremendous impact on my patients as well as myself."
– E.R., Physical Therapist

Barral's Visceral Manipulation; The Abdomen (VM1)
*This is a Lab Class. Prerequisite is a 2-Day VM1-VC (Visceral Manipulation 1: Lecture Content; Distance Instruction).

San Francisco, CA*	May 20 - 22, 2022
Cleveland, OH	Jun 2 - 5, 2022
Dallas/Fort Worth, TX	Aug 4 - 7, 2022
Denver, CO	Aug 25 - 28, 2022
Albuquerque, NM	Aug 25 - 28, 2022
White Plains, NY	Sep 15 - 18, 2022
Edmonton, AB	Sep 22 - 25, 2022
Portland, OR	Sep 29 - Oct 2, 2022
Salt Lake City, UT	Sep 29 - Oct 2, 2022
Baltimore, MD	Oct 6 - 9, 2022
Minneapolis, MN	Oct 13 - 16, 2022
Phoenix, AZ	Nov 3 - 6, 2022
Asheville, NC	Nov 10 - 13, 2022
Seattle, WA	Dec 1 - 4, 2022
Vancouver, BC	Dec 8 - 11, 2022

Neural Manipulation 1; Neuromeningeal Manipulation: An Integrative Approach to Trauma (NM1)

Hartford, CT	May 20 - 22, 2022
Madison, WI	Aug 12 - 14, 2022
Phoenix, AZ	Aug 19 - 21, 2022
Detroit, MI	Sep 16 - 18, 2022
Vancouver, BC	Oct 14 - 16, 2022
Seattle, WA	Oct 28 - 30, 2022
Calgary, AB	Oct 28 - 30, 2022
San Diego, CA	Nov 4 - 6, 2022
Albuquerque, NM	Dec 9 - 11, 2022



Jean-Pierre Barral
DO, MRO(F), RPT
Developer

Additional dates & locations:
CALL
866-522-7725, Ext. 2
CLICK
Barralinstitute.com

THE BARRAL INSTITUTE
Putting Health In Your Hands

Inquire about our Core-Pak Training and Certification Package
SAVE MORE THAN 30%
SATISFACTION GUARANTEED!

APPROVED PROVIDER for Continuing Education

$100 PER MONTH

All classes subject to change. For updates due to COVID-19, please check our website for the most updated information.

Discover D'Ambrogio's NEW Virtual Format

"This is one of the best workshop experiences I've had. Very thorough, guided and supportive."
– R.F., Physical Therapist

Online Learning Workshops

Check website for your local time zone.

Energetic Balancing 2; Mind Body (EB2-MB-V)
May 12 - 14 & 19 - 21, 2022

Lymphatic Balancing: Lower Quadrant (LBLQ-V)
Jun 2 - 5, 2022

Total Body Balancing 1: Fundamentals (TBB1-V)
Sep 29 - Oct 2, 2022

Lymphatic Balancing: Upper Quadrant (LBUQ-V)
Nov 17 - 20, 2022

Win a FREE Entry-Level Workshop at DAmbrogioInstitute.com/win

Kerry D'Ambrogio
DOM, AP, PT, DO-MTP
Developer

Additional dates & locations:
CALL
800-311-9204, Ext. 2
CLICK
DAmbrogioInstitute.com

D'AMBROGIO Institute

Ask about DVD Home Study & Core-Pak Special Pricing

Barral & D'Ambrogio Institutes are endorsed by the International Alliance of Healthcare Educators.

TAKING ASSESSMENT AND REVIEWING... AND MOVING FORWARD

How We Got to This Point

With the change in Imaging SIG Presidents, this is an opportunity to reflect on some of the accomplishments of the SIG in recent years. Not that long ago, we were an Educational Interest Group with a modest number of members. In 2016 with 200 members, and now advancing to over 500 members, the Imaging SIG has evolved into an impactful organization within physical therapy on a national level. Take a moment to consider some of the SIG key objectives and accomplishments in recent years.

In 2015, the Imaging Education Manual was published as a guide document for physical therapist educational programs to include imaging content into curricula and to assure graduates of programs are competent in imaging decision-making. An effort has just been initiated to revise the Imaging Education Manual for current needs as circumstances have evolved since the initial publication of the manual. The revised manual will likely be published later in 2022.

In 2016, a "white paper" titled Diagnostic and Procedural Imaging in Physical Therapist Practice was published by the then Orthopaedic Section (now Academy of Orthopaedic Physical Therapy). This document recounted the long history of successful referral for imaging within certain areas of physical therapist practice in the United States as well as an established model in physiotherapy around the world. The "white paper" further established the need and benefit to patients for physical therapists to have imaging referral privileges.

In the summer of 2016 at the House of Delegates in Nashville, the Imaging SIG offered support for RC12-16 in which the membership of APTA charged the organization with undertaking the necessary measures to pursue imaging referral as being within the scope of physical therapist practice.

In 2017, the Imaging SIG members began presenting for American Institute for Ultrasound in Medicine (AIUM) webinars. Although AIUM was considered multi-disciplinary, this was the first time physical therapists began leading the webinars. Since then, approximately 4 webinars each year have been presented by physical therapists, further establishing physical therapists as not just competent, but expert users of diagnostic ultrasound. Notably, these webinars also crossed beyond our members to enjoin other segments of the physical therapy profession.

In 2017, the Imaging SIG offered its first scholarship for accepted presentations at Combined Sections Meeting. Since then, a deserving recipient has been awarded $500 for original research and presentation at CSM each year as the SIG supports original work and novel effort representative of imaging in physical therapist practice.

In the fall of 2019 spanning into the spring of 2020, an effort was initiated to assure consistency of imaging information in the AOPT Clinical Practice Guidelines. We have established progress to assure appropriate imaging information is included in all future published CPGs. Procedures are now in place to assure therapists have appropriated guidance for diagnostic imaging within the AOPT Clinical Practice Guidelines.

In 2020, a formal agreement was reached between AIUM, Inteleos, and APTA as facilitated by the Imaging SIG. This partnership has as a goal of the education and credentialing (RMSK) of more physical therapists in using diagnostic ultrasound. The intending goal was to improve reimbursement for physical therapists using diagnostic ultrasound with the established CPT codes for those procedures. Further, the recognition by these independent, external entities offers validation for physical therapists being expert users of diagnostic ultrasound.

The Imaging SIG Research Committee has done remarkable work in establishing a group of mentors for imaging research as published on the Imaging SIG web pages. The group has also recently undertaken a project to discover the optimal pedagogical approach for physical therapists learning the skills necessary for use of diagnostic ultrasound. Multiple presentations have resulted from this work in its early stages with many more likely to come as the evidence is gathered and analyzed.

In 2021, the Imaging SIG worked cooperatively with APTA toward amending the model practice act to include language with the Federation of State Boards of Physical Therapy that would be inclusive of physical therapists as primary contact clinicians having referral privileges for diagnostic procedures that would allow patient management decisions. This language encompasses referral for diagnostic imaging. At the time of this submission, the disposition of this proposal was not yet determined.

Multiple educational webinars have been hosted by the Imaging SIG, including that in October 2021 with the Chapter Presidents of the 4 states successfully bringing about legislative change to allow physical therapists to refer for imaging. Lance Dougher (Utah), Cindy Flom-Meland (North Dakota), Kip Schick (Wisconsin), and Michelle Collie (Rhode Island) described the processes they completed to successfully manage legislative change, including how they managed concerns by those not supporting such change. Sessions, such as these, remain available for members to view on the Imaging SIG web pages

Notably, the Imaging SIG has become much more established as an advocacy body for imaging in physical therapist practice in providing resources and support for state associations attempting to undertake initiatives for imaging in practice within those jurisdictions. Particularly noteworthy in this regard, in addition to the previously mentioned webinars, is that the Imaging SIG has worked with APTA State Affairs to establish a resource kit for states undertaking the initiative for gaining imaging referral privileges. This resource kit is linked on the Imaging SIG webpages as based on APTA's main web site.

The Imaging SIG has also attempted to support publication of peer-reviewed evidence for imaging in physical therapist practice, including publications in 2021 resulting directly from SIG activities. Two articles published in *Physical Therapy* last year exemplifies this: Keil et al. Referral for imaging in physical therapist practice: key recommendations for successful implementation. *Phys Ther*. 2021;101(3) and Rundell et al. Survey of physical therapists' attitudes, knowledge, and behaviors regarding diagnostic imaging. *Phys Ther*. 2021;101(1).

In the summer of 2021, two infographics were published by

the Imaging SIG toward informing about the benefits of physical therapists having imaging referral privileges. These were immediately used in some jurisdictions toward starting the effort toward gaining imaging referral privileges. Two additional infographics are being finalized toward physical therapists using diagnostic ultrasound.

In the summer of 2021, the Imaging SIG participated in webinars hosted by the Federation of State Boards of Physical Therapy and APTA State Affairs on the evolution of imaging referral in physical therapist practice.

Just recently, the Imaging SIG has undertaken the publication of micro-learning modules on our webpages. These are intended to be brief educational vignettes that practicing therapists can view and understand in the course of a busy clinical care day. These will serve within the context of the newly published and recently updated Clinical Practice Guidelines as well as updating new information as published by the American College of Radiology Appropriateness Criteria.

The Imaging SIG has also offered physical therapists multiple opportunities at advancing individual knowledge with Combined Sections Meeting pre-conference courses and educational sessions. These opportunities have been directed at the cutting edge of imaging in physical therapist practice, particularly with the use of diagnostic ultrasound to complement the clinical examination as well as referral for imaging as part of direct access/primary care and daily decision-making.

The future of imaging in physical therapist practice is very promising and the Imaging SIG is well-positioned to advocate and assist in that effort from multiple perspectives.

Moving Forward by Bruno Steiner, Imaging SIG President

Foremost, I wish to offer my deepest appreciation to Charles for his dedication to the role of Imaging SIG President for the past 6 years. Because of his heartfelt concern for the Imaging SIG, he has generously extended his help and time to transition me into the role, and he will undoubtedly be a force and guiding hand to help the Physical Therapy profession actualize the promise of Imaging Referral privileges.

Despite the challenge of Omicron, and the winter storms, which conspired to derail flight plans, CSM 2022 in San Antonio was an impressive summit of talented speakers, stimulating discussions, and vertiginous range of impressions and opinions on the many components and avenues of imaging privilege advocacy. Charles was my speed-dating guide as he chaperoned me to meet all the fascinating and impassioned voices and levers of influence to help us realize our collective aspirations. It was at that point I realized the critical work Charles Hazle put into his presidency to create an infrastructure of connectivity, collegiality, and collaboration. This is no small feat, when you are trying to prepare for the ground game to erode the unnecessary barriers to imaging privilege and fulfill the APTA's Vision 2020 primary care Physical Therapist.

And it was this foundational work from former presidents Charles Hazle and Doug White that culminated in my recruitment as an Imaging SIG member.

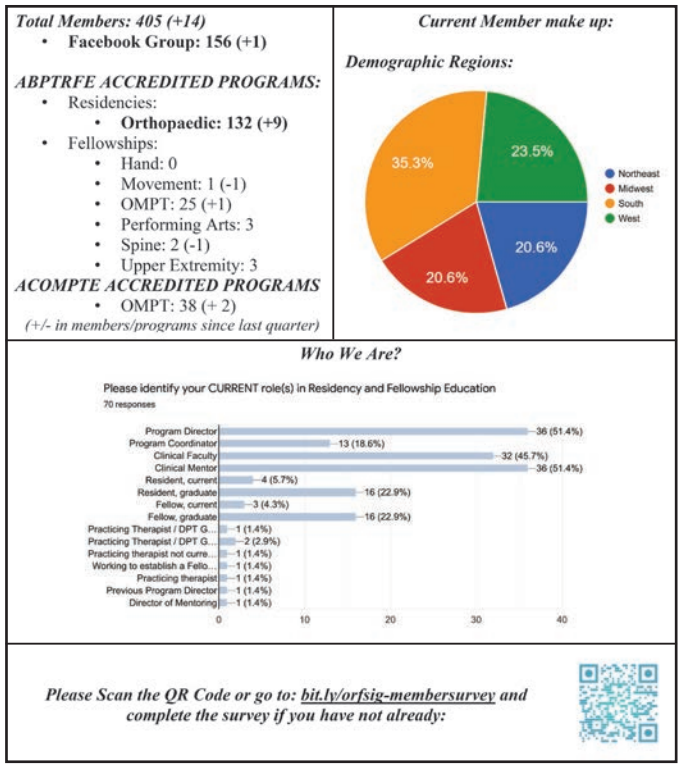
My point of introduction to the I-SIG in 2016 was marked by a frustration with the American Registry of Diagnostic Medical Sonographers' sudden denial of Physical Therapists from sitting in on the physician's RMSK exam. The RMSK is the board certification of musculoskeletal ultrasound diagnostic imaging. After numerous calls expressing my candid displeasure with this sudden about-face, I learned that the ARDMS had reinstated our privilege. I learned that it was the newly nascent Imaging SIG that deftly restored our right to sit for the exam. I read the Imaging SIG white paper, and I was hooked. Since then, the Imaging SIG, has constructively deepened its relationship with the credentialing body, which is now under a physician specific title of the Alliance of Physician Certification & Advancement. Both the APCA and ARDMS are under the aegis of Inteleos. The exam is very difficult, includes pathology and intervention, and results in a high failure rate for examinees. However, with seismic implications, of the 30 physical therapists who recently sat for the exam, 28 passed. Inteleos was extremely impressed. Given our educational background and dedication to our respective continuing education trajectories, I thought our physical therapists would do reasonably well. But 28? I admit, I am dumbfounded and humbled by our colleagues. If you want an outcome to show, well, that's it!

In the interim, we have also secured an ever-deepening relationship with the American Institute of Ultrasound in Medicine who recognize physical therapist-administered MSKUS, and actively seek MSKUS webinar content from us. These webinars provide CMEs and are watched by physicians and sonographers alike. You can imagine the grass-roots advocacy and credibility conferred to us with this continued effort. Much to the AIUM's satisfaction, we have contributed remarkable professional content and will continue to nurture this crucial association.

I, along with all my colleagues who practice MSKUS as an extension of our physical exam, strongly feel that this is a keystone to our professional credibility and proof of our role in imaging referral. And, I will further state that, if you wish to commit to a single act of critical advocacy, I implore you to learn MSKUS and sit for the RMSK and swell the ranks of our presence.

In closing, I would like to thank all the members who have generously shared their insights, concerns, and dreams and will continue to draw inspiration and consultation from your experiences and aspirations. We will need all voices, from the experienced passionate battle-weary advocates to our future standard-bearers who wish to see Imaging referral privileges realized and normalized. I am convinced we will get there.

ORF-SIG Dashboard:



PRESIDENT'S MESSAGE

ORF-SIG Members,

I am both excited and humbled to be leading the helm of the ORF-SIG. I first would like to give an enormous THANK YOU to Matt Haberl! He has been our guiding light and visionary for the past 7+ years. Our SIG would not be where we are today without his work ethic, passion, and never ending drive to support post graduate education. I can truly say Matt inspires us all to do more and leads by example every step of the way. Thank you, Matt!

I join the ORF-SIG leadership team after having been a program director for residency programs since 2007. I have started and directed residency programs in Sports, Pediatrics, and Orthopaedics at Howard Head Sports Medicine in Vail, Colorado (Sports), the University of Chicago Medicine (Orthopaedics and Pediatrics) and currently reside outside Philadelphia at Arcadia University (Orthopaedics). I value the broad experience I have had working in multiple settings and collaborating with multiple teams. I look forward to working with the AOPT to expand learning platforms and to collaborate within our SIG for curriculum designs and assessing graduate success. I look forward to working with all of you in the future and I am passionate for moving residency and fellowship forward as our profession continues to evolve. As we all know, many hands make for light work so get involved with the ORF-SIG to continue to move this tradition forward. I can honestly say this group of directors/residents and fellows inspire me daily. If you would like to **Get Involved** within the SIG, make sure to reach out to malloyma@arcadia.edu.

THANK YOU,
Molly Malloy
President, ORF-SIG

Additional Resources:

Applicant Registry: Steve Kareha, Matt Haberl, Kirk Bentzen, Carrie Schwoerer

One big problem facing programs over the years is the ability to sustain consistent applicant bases despite using or not using RF-PTCAS. Based on your feedback, we have created two surveys to aid in this effort.

1. The first is to become a contact list library for our member programs of physical therapists and physical therapist students interested in learning more about orthopaedic residency and fellowship programs.
   a. Currently, we have 30 interested people who have signed up to receive more information about our programs.
2. The second is specifically for those qualified applicants who are excellent candidates and have already been vetted but applied to a program that does not have any available spots. The program denying admission may then provide the applicant with a flyer explaining the database and providing them the option to participate. Member programs may access these qualified, vetted applicants as needed by contacting Steve Kareha (stephen.kareha@sluhn.org). Updates on the numbers of candidates in this list will be provided quarterly to the membership.
   a. Currently, everyone who was on this list has been admitted into a program.

Residency & Fellowship Interest

http://bit.ly/2OH6zdX

Residency & Fellowship Qualified Applicants

http://bit.ly/3u0JR0s

Program Resident/Fellow/Faculty Spotlight: Caitlyn Lang, Kristine Neelon, Bob Schroedter

In October 2021, we launched a new and exciting monthly Program Spotlight feature of orthopaedic residency/fellowship programs, and their respective Resident/Fellow/Faculty nominated ambassadors. The Spotlight will allow one or more residency/fellowship programs a month to be showcased as a marketing, sustainability, and post-professional education advocacy vehicle. Programs will be able to highlight their program in various ways by highlighting current or graduated residents/fellows and or faculty to showcase their respective program and available positions. Please reach out if you are interested in showcasing one of your residents or fellows!

ABPTRFE Frequently Asked Questions Documents:

Recently, the American Board of Physical Therapy Residency and Fellowship Education (ABTPRFE) released updates to their Policies and Procedures including some changes to the Primary Health conditions and CoVid-19 accreditation recommendations. The ORF-SIG was able to work with the Chair of ABPTRFE, Mark Weber, and the Lead Accreditation Specialist, Linda Csiza. Together,they provided some further elaboration on several Frequently Asked Questions. Check out these documents here:

- Policy 13.5 Addition of Practice Sites FAQ
- Primary Health Conditions / Medical Conditions List FAQ
- CoVid-19 Temporary Guidance FAQ
- Program Sustainability: Applicant Sharing and Recruitment FAQ

RF-PTCAS: Kirk Bentzen, Steve Kareha, Megan Frazee, Carrie Schwoerer, Christina Gomez

If you are a newer program or need a refresher on some of the nuances of the processes and timelines, please review the following podcast: *Navigating RFPTCAS*, which can be found https://musc.hosted.panopto.com/Panopto/Pages/Embed.aspx?id=0841c14e-a3f7-4196-b654-acd90169c9e2. Presenters of this podcast included Ryan Bannister, Director-Centralized Application Services and Student Recruitment and Orthopaedic Residency and Fellowship SIG leadership, including Kirk Bentzen, Christina Gomez, and Steve Kareha.

Please contact Carrie Schwoerer (cschwoerer@uwhealth.org) with questions.

OTHER KEY RESOURCES:

ABPTRFE Updates: Community HUB

Don't miss out on the latest ABPTRFE Updates from Kendra Harrington:

- Updates to ABPTRFE Processes and Procedures
- What Sites Should, and Should Not, Be Included on the Participant Practice Sites?
- ABPTRFE Recent Actions
- July 1 Policy Reminder

ACOMPTE Website and Resources:

Orthopaedic Manual Physical Therapy Fellowship programs find ACOMPTE Information here:

APTE RF-SIG Resources: Christina Gomez

aptaeducation.org/special-interest-group/RFESIG/

You can also find more great information from the Academy of Education's Residency and Fellowship SIG (RFESIG). Here you will find a variety of Podcasts they have completed for Residency and Program Directors. Please make sure to check these out as well as the Think Tank resources.

- Virtual Site Visit
- RF-PTCAS Reminders

Take advantage of our member-only communication forums to share and develop ideas.

ORF-SIG Facebook group

bit.ly/orfsig-fbgroup

AOPT ORF-SIG Communities HUB

bit.ly/orsig-communityhub

PRESIDENT'S MESSAGE

I wanted to start this letter by sending a big thank you to all of you who attended CSM 2022, both the incredible presentation given by Lisa Bedenbaugh as well as our virtual business meeting. Of course, since I did not get to attend it in person, I missed the networking component and getting to meet hundreds of physical therapists and students interested in the field of animal physical therapy, but it helped to host a virtual Q&A on February 26th when Jenny and I got to connect with quite a few physical therapists and students interested in becoming an animal physical therapist.

For this quarter, Karen Atlas has written for us a very succinct summary on the legislative "battle" we have had in California, and with that in mind I would like to focus my message on the importance of getting involved. Although the resistance from a few, but unfortunately very loud, veterinarians and veterinary technicians and their trade associations who appear to be putting special interests above else have has thus far prevented us from achieving common language in California, please understand that we have successfully changed either the Physical Therapist or Veterinary Practice Acts in many states since the inception of animal physical therapy in the late 90s/early 2000s. However, there was one significant thing in common in every single one of those instances: a physical therapist (or group of physical therapists) interested and engaged in making a change.

Legislative issues are one of the, if not the, most important issues we face in our field. It not only affects our ability to treat animals as physical therapists, but it also trickles down into other potential issues such as liability and malpractice insurance, client reimbursement from pet insurance companies for services provided by physical therapists, continuing education credits with courses in animal physical therapy, and potential inclusion of animal physical therapy as a topic in physical therapy schools' core curriculum, to name a few. More and more physical therapists are getting certified to work with animals, and over the next few years this number will only continue to climb as animal physical therapy has become the fastest growing niche in physical therapy. This is great because we need numbers to make our voices heard! We need individuals who are willing to step-up and drive change, and we need the support in numbers from all physical therapists - not just those who are certified to work with animals.

If that is you, then let's connect! The Animal PT SIG is here to support you through this process. We know that it can be scary and complex, and we have the resources to help guide you. If I may be honest, we are facing a pivotal moment in the field of animal physical therapy. A moment that will help shape up this field for generations to come, and we need you to help drive that change. As Mother Teresa eloquently said, "I alone cannot change the world, but I can cast a stone across the water to create many ripples."

Thank you,
Francisco Maia, PT, DPT, CCRT
Animal PT SIG President
fmaia@orthopt.org

How Politics and Self-Interest Thwarted Positive Regulatory Change for California Consumers and their Animals:...a Call to Action!

Karen Atlas, PT, MPT, CCRT

The struggle is real for California animal healthcare advocates. As is often the case, understanding how we arrived where we are is critically important to finding common ground and resolution.

The California Veterinary Medical Board ("CVMB") has been trying to resolve the issue of regulating animal physical therapy (animal rehabilitation, or "AR") since 2004. The challenge stems from the fact that effective care for animals spans two professions whose interests, as well as those of consumers and their animals, unfortunately conflict.

Animal rehabilitation falls squarely between two licensing Boards: the CVMB and the Physical Therapy Board of California ("PTBC"). The provisions of the California Physical Therapy Practice Act are clearly limited to care for humans, while the Veterinary Medicine Practice Act does not define or otherwise directly address AR. Despite this gap in regulation, the CVMB contended that AR was an inherent part of veterinary medicine (even though there is no formal training in veterinary school to establish competency in this specialty area of practice). Based on this contention, the CVMB concluded that any veterinarian, who may or may not be qualified, could practice AR, while qualified physical therapists could not, unless they operated under "direct or indirect supervision" of a vet.[1] Since no regulatory language existed to specifically name qualified physical therapists as a legitimate provider of rehab services, they were legally lumped into the category of "unlicensed vet assistant (VA)." This defined the status quo.

The issue became a hot topic in 2015 when the first regulatory attempt by the CVMB was made. After years of debate within their own committee, the CVMB adopted language that mandated that the supervising veterinarian be onsite and be the primary veterinarian on record. This would have required clients to either change

vets if their preferred AR practitioner did not happen to work for their vet or pay twice to have both their vet and their preferred AR practitioner's supervising vet involved.

CVMB fails regulation attempt in 2015

In September 2015, the CVMB held a public hearing that garnered almost universal opposition (with the exception of 2 veterinarians who owned their own rehabilitation practices, and 1 registered veterinary technician [RVT]). Roughly 50 people spoke (and thousands of petition signatures were submitted) in opposition to the regulatory proposal during a multi-hour testimony. The Board then relied on a "staff summary," which proved to be an inaccurate representation of the extent of public discord.

Fortunately, due to strong public opposition and a timely decision by the U.S. Supreme Court on a related matter involving the Federal Trade Commission vs. North Carolina Dental Examiners,[2] the CVMB withdrew their proposed regulations in October 2015.

CVMB overrides AR Stakeholder's Task Force recommendation in 2017

The contentious conversations in Sacramento continued after the CVMB's first regulatory attempt in 2015 failed, sparking the interest of the California State Legislature during its Sunset Review process. The Sunset Review process in California requires that the Legislature formally review each professional regulatory board (typically every four years) to ensure they are upholding their duties to serve as a consumer protection agency. It is only the Legislature that can renew professional regulatory boards through statute, so these periodic reviews represent an important protection for consumers. Fortunately, the Legislature took notice that AR regulation had remained an unresolved issue for far too long, and formally tasked the CVMB to address it.

In response, the CVMB created a Stakeholder's Task Force comprised of 18 people (10 CA vets/RVTs/vet trade association members, and 8 others: 2 PTs, 1 non-CA vet, 1 Senate staff representative, 1 Assembly staff representative, 2 consumers, and 1 public member of the VMB). This Task Force formulated and approved very reasonable language as it related to the regulation of qualified physical therapists to practice on animals, and its recommendation was presented to the CVMB in April 2017.

To the great surprise and disappointment of those closely following this issue, the CVMB voted to reject their own Stakeholder's Task Force language based largely on misinformation provided by their own licensees and vet/vet tech trade associations. They re-worked the language to even more seriously limit consumer access to trained AR practitioners than the regulation that had been withdrawn in 2015: namely, that qualified physical therapists could work only under direct supervision of a vet and only after they had received advanced certification. (Notably, they voted just prior to this to allow any unlicensed assistant to practice under the same direct supervision provision, without requiring any training.)

Animal Physical Therapy Coalition and AB3013

In the wake of this disappointing development, and recognizing that the majority of vets, physical therapists, RVTs and consumers had a like-minded desire for common sense regulation and legislation, I founded the Animal Physical Therapy Coalition (APTC) to work collaboratively toward a solution that more effectively meets the needs of all stakeholders. The reality is that the various stakeholder interests with respect to AR are generally more

aligned than at odds. In the 'real world' of practice, many vets enjoy the option to refer (provide medical clearance) to a qualified physical therapist, understanding that it is often the best option for their animal patients. Physical therapists are accustomed to working collaboratively within a multidisciplinary model of healthcare, with the expectation of a reasonable amount of autonomy after completing advanced training specific to animals. Consumers certainly want increased access to more qualified professionals who can give their animals the care they need, where they need it. (It has been well documented that California has an access to care crisis with respect to AR [worsened now by the COVID-19 pandemic]. The most notable gaps in service are for equines and small animals in rural areas that have been grossly underserved.3]

In response to the unnecessarily restrictive regulation proposed by the CVMB in 2017, the Coalition introduced the Animal Physical Rehabilitation Bill (AB 3013) in 2018, intending to codify the original Stakeholder's Task Force recommendations. Unfortunately, vet and vet tech trade associations once again came out in full force with misleading campaigns to successfully kill the bill, effectively preserving the veterinary monopoly in animal healthcare in the state of California. (While the bill did pass through the first policy committee with zero 'no' votes after the author and sponsor accepted all amendments, it was held on suspense by the Committee on Appropriations, likely based on the CVMB's artificially inflated cost estimate for the state to implement the proposed law.)

CVMB succeeds in passing onerous AR regulations in 2018

Shortly after the fall of AB 3013, in June 2018, the CVMB pushed forward with their regulatory agenda. Due to the lengthy regulatory processes, another public hearing was not held until 2020

(this time virtually due to the COVID-19 pandemic) where again, thousands of petition signatures, letters, and verbal testimony in opposition were offered for consideration. The hearing was clearly not objective, with the Board relying on pre-written responses to opposition, seemingly indifferent to the concerns raised in public testimony. Further, the Board President repeatedly used inaccurate information (including egregiously false statements about one of the canine rehabilitation certification programs) to support the direct supervision mandate. The President arguably should have recused herself from the process due to conflict of interest, as she is a veterinarian who owns a practice offering animal rehab services.

Nevertheless, the CVMB voted on final language to move their highly controversial regulatory language forward and it was enacted on January 1, 2022. This language now defines AR as a practice of veterinary medicine and mandates all non-vet licensees to work under the direct supervision of a veterinarian. This was a major change to the status quo; whereby non-vet licensees were allowed to work under the direct or indirect supervision of a veterinarian. As a result, practices that were operating lawfully fell out of compliance as of January 1 and are now facing clinic closures, worsening the access to care crisis for consumers and their pets.

Notably, in the eyes of the CVMB (and PTBC), physical therapists working on animals in California are still considered "unlicensed VAs" since they are not licensed by the CVMB. The only way to elevate qualified physical therapists out of the category of "unlicensed VAs" is to pass a legislative bill to allow the CVMB to have legal authority over the physical therapists (one regulatory board cannot have purview over another licensed professional from a different discipline). So, while the CVMB does have the authority to create new regulations into their own practice act, they are unable to legally include licensed and qualified physical therapists as legitimate providers of physical therapy services for animals unless legislative approval is granted.

What's next for California?

It is clear a legislative remedy is needed to increase safe access to qualified animal physical therapists. On January 28, 2022, the consultants for the Senate and Assembly) Committees on Business and Professions hosted a meeting of stakeholders (including the CVMB President, CVMB legal counsel, California Veterinary Medical Association (CVMA) Executive Director, CVMA lobbyist, APTC President, APTC lobbyist, California Physical Therapy Association (CPTA), DVM representative of a PT animal rehabilitation training program, and the CVMB and PTBC Executive Officers). This meeting was held specifically to provide fact-based presentations to ensure each side would be operating from the same set of facts to prevent any future undermining of a legislative remedy.

We are hopeful that now that stakeholders will presumably be operating from the same set of facts, true progress can be made to increase consumer access to qualified animal physical therapists.

Successful regulation in other states should pave the way for California

There are a number of states (Colorado, Nevada, Nebraska, to name a few) that have successfully changed their practice acts to allow animal-loving consumers access to qualified physical therapists while simultaneously protecting them from unqualified individuals. Some states achieved this through changes to both the Veterinary and Physical Therapy Practice Acts, and some made their changes only to their Veterinary Practice Acts. Several states completed their changes in a matter of a few years without the contentious issues that California has endured.

Proponents of the direct supervision model in California cite risk of animal harm as their key argument, despite that an indirect model requires completion of additional physical therapy training specific to animals, as well as veterinarian diagnosis and referral to practice. However, with other states forging ahead of California with common sense legislation and regulations, there is now a wide body of evidence that increasing access to consumers through an indirect model is indeed safe for animals. There have been no complaints of harm or negligence against a qualified physical therapist in any of the other states who practice animal physical therapy by referral/medical clearance. If this model was not safe, the board authorities would have cited the harm. Instead, boards in these states have reported that they have had no issues with implementation or enforcement, and that their regulations have served their state constituents well.

How can you help?

First, if you are not already a member of the APTSIG, sign up today. It is free to join if you are already a member of the Academy of Orthopaedic Physical Therapy. Just go to the website to sign up: https://www.orthopt.org/content/special-interest-groups/animal-physical-therapy

Second, understand that numbers matter. We need you. The more individuals who step up and use their voice for good is how we, together, can create the change we are all seeking. If your state does not have legislation and regulation in place for animal physical therapists to practice under reasonable controls, now is the time to get involved. Reach out to your state Physical Therapy Association (PTA) and find out how you can help to move the ball forward. If your state association is not taking notice (as many are occupied with fighting larger battles within the profession), then consider forming an association or coalition dedicated to this important issue, and work collaboratively with your state PTA.

If you practice in California, please follow the California Association of Animal Physical Therapists Facebook page (which is now the APTC page) or our website: www.caapt.org so you can respond to any and all 'calls to action'. We will provide specific instructions on how you can use your voice to make a difference. We all need to get involved, so those in power realize this issue matters and change is necessary. It has taken nearly 18 years to get to this point in California…the time is now to achieve change for the benefit of the animals, the people who love them, and our incredible profession. Join the movement!

---

[1] "Direct Supervision" means: (a) the supervisor is physically present at the location where animal health care job tasks are to be performed and is quickly and easily available; and (b) the animal has been examined by a veterinarian at such time as good veterinary medical practice requires consistent with the particular delegated animal health care job task. "Indirect Supervision" means: (a) that the supervisor is not physically present at the location where animal health care job tasks are to be performed, but has given either written or oral instructions ("direct orders") for treatment of the animal patient; and (b) the animal has been examined by a veterinarian at such times as good veterinary medical practice requires, consistent with the particular delegated animal health care task, and the animal is not anesthetized as defined in Section 2032.4.

[2] The North Carolina Dental Examiners vs. Federal Trade Commission U.S. Supreme Court case set an important precedent for Boards who may not have proper governance oversight, and who therefore may act in the best interest of their profession rather than the consumer by creating unnecessary barriers to access (ie, prevent a competitive marketplace, in conflict with anti-trust protections for the consumer).

[3] Multiple CVMB meetings, testimonies provided during public and sunset hearings, letter submissions by consumers and DVMs, and most recently during the January 28, 2022, stakeholder's meeting hosted by Joint (Senate and Assembly) Business and Professions Committee consultants.

Index to Advertisers

A Must Read for Every Physical Therapist Who Works in Orthopaedics!

Current Concepts of Orthopaedic Physical Therapy, 5th Edition

Take a look at a Case Scenario

The patient is a 28-year-old male with the diagnosis of acute low back pain (LBP). Almost 2 weeks ago, the patient was working on his car when he felt a "pop" in his low back. He indicates that his pain was mild to begin with but has progressed to a 7/10 when it is at its worse. Aggravating factors include forward flexion of the lumbar spine. The patient notes that he has not had any medical care to this point for his LBP, however this is not his first incidence of LBP. Three years ago, he had a similar incident of LBP and went to a chiropractor to receive a manipulation. He noted that he did not receive any benefit from the manipulation and if anything felt worse afterwards. He denies any radicular pain and no motor/sensory disturbances.

During history intake, the patient also mentioned that he had some increased pain at night but no other sign of serious pathology. Because of this, your next course of action should be:

a. Immediately refer the patient to a primary care physician because of the presence of a "red flag."
b. Inform the patient that they need to have imaging as soon as possible to rule out serious pathology.
c. Continue to evaluate the patient but wait for him to follow-up with his primary care physician prior to any strenuous treatment.
d. Continue to perform an evaluation and treat the patient, while encouraging him to return to normal activities.

The correct answer is d. Continue to perform an evaluation and treat the patient, while encouraging him to return to normal activities. The presence of a single red flag is very rarely associated with any serious pathology and with an otherwise healthy individual an immediate referral to a physician is unwarranted. Imaging would not be appropriate for this patient and early intervention that includes exercise and education could help the patient reduce his pain and return to normal function.

The patient was given the Fear Avoidance Back Questionnaire (FABQ) and scored a total of 12 points. On the objective examination you note his range of motion was within normal limits for the spine and both hips. The correct course of action is to:

a. Perform a spinal manipulation as the patient meets 4 of the 5 criteria of the clinical prediction rule for a positive outcome.
b. Focus solely on therapeutic exercise to regain motion into lumbar flexion.
c. Focus solely on education, with specific focus on pain neuroscience education.
d. Approach the patient with a treatment paradigm that includes exercise, manual therapy as needed (with the focus on mobilizations), education, and reassurance.

The correct answer is d. Approach the patient with a treatment paradigm that includes exercise, manual therapy as needed (with the focus on mobilizations), education, and reassurance. While the patient does meet the criteria for the clinical prediction rule for spinal manipulation, he has had a negative experience with the technique in the past. Evidenced-based medicine includes, in one of its pillars, patient preference and in this particular scenario a manipulation is not likely to produce benefits. Both therapeutic exercise and education are great choices for this patient but have their best effects when used in conjunction.

Upon assessment of the spine, the physical therapist feels as if there is some hypermobility in the L3 region. Furthermore, the passive lumbar extension test and prone instability test (2 tests which are purported to assess for motor control of the lumbar spine) are both positive. In addition, while spinal flexion seems to aggravate the symptoms, extension seems to alleviate some of his pain. Therefore, the best course of action would be:

a. Focus on motor control exercises exclusively until the hypermobility improves.
b. Focus on directional preference exercises exclusively until lumbar flexion is no longer an aggravating symptom.
c. Perform a combination of motor control and directional preference exercises, along with other general exercises the patient feels would be beneficial.
d. Refer the patient to a primary care physician due to the lumbar instability.

The correct answer is c. Perform a combination of motor control and directional preference exercises, along with other general exercises the patient feels would be beneficial. Remember, currently there is no conclusive evidence that directional preference, stabilization, or motor control exercises are any better than general exercises. They all can help the patient improve. Therefore, the therapist should feel confident in their choice if the patient is included in the decision process and is comfortable with the exercises.

Based on the information provided in this case, in addition to the exercise approaches listed above, what other intervention is appropriate given the patient presentation?

a. Graded activity/exposure.
b. Dry needling.
c. Mindfulness.
d. Psychologically informed physical therapy.

The correct answer is b. Dry needling. This patient has few yellow flags and is not exhibiting excessive psychosocial symptoms. The best additional intervention that might be appropriate is dry needling, as it has been preliminarily suggested to be beneficial when used in combination with exercise.

Orthopaedic Physical Therapy Practice
2920 East Avenue South, Suite 200
La Crosse, WI 54601

ACADEMY OF
ORTHOPAEDIC
PHYSICAL THERAPY