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ORTHOPAEDIC PHYSICAL THERAPY PRACTICE

The publication of the Academy of Orthopaedic Physical Therapy, APTA

FEATURE:
Mechanical Diagnosis and Therapy Instruction in Accredited Physical Therapy Programs in the United States

APTA American Physical Therapy Association

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In this issue

Regular features

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

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Independent Study Course 31.2

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The authors of each monograph in this 5th edition have provided a comprehensive, contemporary evidence-based review. The first monograph describes the multifaceted process of clinical reasoning and utilization of evidence in physical therapy practice. Each of the 11 remaining monographs covers a major joint/region of the body, from the cervical spine to the foot and ankle. Each monograph starts with a review of clinically relevant anatomy and biomechanics followed by a presentation of the most evidence-based historical and physical examination procedures helpful in formulating a diagnosis, prognosis, and plan of care. This is followed by a discussion of common musculoskeletal conditions and their related optimal intervention strategies, again based on available evidence, supplemented by clinical expertise when evidence is lacking. Finally, at the end of each monograph, case scenarios are presented to invite clinical reasoning and the integration of the presented material. This collection of monographs, written by well-established expert clinicians, represents a unique and valuable source of information for physical therapists working with patients with musculoskeletal conditions.

Topics and Authors

1. **Integration and Application of the Scientific Method, Evidence-based Practice, and Clinical Reasoning**—Sean P. Riley, PT, DPT, ScD
2. **The Cervical Spine: Evidence-Informed Physical Therapy Patient Management**—Eric K. Robertson, PT, DPT, OCS, FAAOMPT; Mary K Derrick, PT, DPT, OCS, FAAOMPT
3. **The Temporomandibular Joint: Evidence-Informed Physical Therapy Patient Management**—Sally Ho, PT, DPT, MS, OCS; Kai-Yu Ho, PT, MSPT, PhD
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Learning Objectives

1. Understand different types of clinical-reasoning strategies used during physical therapy management of individuals with musculoskeletal conditions.
2. Conduct a thorough history/interview and perform a physical examination using evidence-based tests and measures for a variety of musculoskeletal conditions.
3. Interpret the results of a musculoskeletal examination to develop an optimal plan of care.
4. Detect red and yellow flags and understand their clinical implications.
5. Apply research evidence to clinical decision-making related to the diagnosis, prognosis, and treatment of musculoskeletal conditions.
6. Integrate knowledge of biological pain mechanisms (nociceptive, nociplastic [non-nociceptive], and neuropathic) as it relates to the physical therapy evaluation and treatment of musculoskeletal conditions.
7. Understand how psychosocial factors can influence the pain experience in the context of musculoskeletal conditions.
8. Discuss the importance of the therapeutic alliance and strategies to incorporate this alliance into clinical practice.
9. Integrate common self-report and performance-based outcome measures as part of the assessment process.
10. Discuss the relative role of diagnostic imaging and the clinical implications of positive/negative findings.

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ACADEMY OF ORTHOPAEDIC PHYSICAL THERAPY

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Editor's Note

These are exciting times for the Academy of Orthopaedics! The 5th edition of the Current Concepts of Orthopaedic Physical Therapy is now published! I don't know about you, but I have purchased the last several editions of these important monographs for our Academy and profession. I find the knowledge shared in these monographs to be comprehensive and well organized with clear language to articulate best practice. For those physical therapists that feel like they are in a rut in clinical practice, pick up the latest edition of Current Concepts and let me know how this has impacted your enthusiasm in providing care for your patients. The work that goes into these monographs is largely unknown by most of our members. I would like to thank Sharon Klinski and Guy Simoneau as well as the authors of each monograph for the blood, sweat, and tears that goes into each of these editions. Already, I have enjoyed comparing the changes that have occurred in just a short time in multiple areas of our orthopaedic practice. These are evident when you compare the 3rd edition to the 4th edition and now comparisons to the 5th. When you consider these changes in practice across areas, it excites me to see our progress!

As I write this editorial, voting for the upcoming elections has opened and by the time this issue of *OP* has been published, we will have elected a new President, a new Director, and a new Nominating Committee member. These individuals drive our Academy and make important decisions to improve our practice. As you may have noticed, we are spotlighting our board of directors and committee members on our website and through social media. These efforts help all of us to relate to and understand our members. Dr. Joseph Donnelly has done an excellent job across all areas of the Academy and has set up our incoming President for success. Thank you, Joe, for all that you have done in supporting *OP*, me, the Academy, and our Profession!

I also want to note the work that is being done across all the Special Interest Groups (SIGs) throughout the Academy. If you have not checked out the improved website, please take a look at your SIG to note the changes. It is more compact and user-friendly. In the near future, we are looking at having SIG presidents or SIG leadership present on current updates via social media through the website. We believe that this change will be more contemporary than the current format that is perhaps outdated in *OP* by the time that *OP* is published. SIGs are already moving towards this with updated podcasts on areas important to your specific area of practice such as the PASIG podcasts.

As you can see, the Academy is moving forward in multiple directions to reach our vision of becoming a world leader in providing resources to optimize movement and musculoskeletal health. Please reach out to me if you have any questions or if I can help you.

Respectfully submitted,
John Heick, PT, PhD, DPT
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Mechanical Diagnosis and Therapy Instruction in Accredited Physical Therapy Programs in the United States

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ABSTRACT

Background and Purpose: The purpose of this study is to determine the extent of McKenzie instruction in physical therapy first professional (entry-level), orthopaedic residency, and orthopaedic manual physical therapy (OMPT) programs in the United States. **Methods:** Program directors of physical therapy professional degree programs accredited by Commission on Accreditation in Physical Therapy Education (CAPTE), orthopaedic residency, and OMPT fellowship programs were recruited via email to participate in an anonymous 40-item electronic survey during the 2018 academic year. The survey was open to response for 4 weeks and program directors received a reminder email after the initial inquiry. The survey evaluated Mechanical Diagnosis and Therapy (MDT) instruction in curricula, faculty qualifications, attitudes and experience, and programs' future plans for teaching MDT. **Results:** Three hundred-and-fifty programs were surveyed and 96 programs responded for a response rate of 27.4%. Of the programs that responded, 84 (87.5%) had integrated the McKenzie principles into their curriculum to varying degrees. Twelve programs reported that McKenzie content was not included in their instruction. Faculty teaching MDT content appears to vary in levels of McKenzie training, with the majority having more than 13 years of experience employing McKenzie principles in their clinical practice. **Conclusion:** The survey indicates variability in the methodology and the extent to which MDT was integrated into the physical therapy curricula. This survey may serve as a starting point for programs to assess existing MDT instruction and to what extent that material is taught in existing and developing physical therapy programs.

Key Words: McKenzie Method, musculoskeletal disorders, physical therapy education

INTRODUCTION

Over 10% of all medical visits are directed toward musculoskeletal pathology or impairments in the United States,[1] and a number of these patients are referred to physical therapy. Physical therapy interventions for musculoskeletal disorders may include physical agents, stabilization exercises, manual physical therapy, and an exercise prescription based on the testing of repeated end-range movements, which is foundational to the Mechanical Diagnosis and Therapy (MDT) approach. Often referred to as the McKenzie Method, MDT is a musculoskeletal classification-based system developed by Robin McKenzie, a New Zealand physiotherapist.[2] The approach is efficacious in the management of spinal musculoskeletal disorders.[3]

In MDT, the patient performs repeated end-range movements, and the clinician's interpretation and analysis of the patient's response allows the condition to be classified into derangement, dysfunction, or postural syndrome categories. The derangement syndrome is a clinical presentation associated with mechanical obstruction of an affected joint. A derangement occurs when a patient has pain that is constant or intermittent, and the symptoms may dramatically change in location or intensity as the result of the particular end-range motion.[2] The performance of movements in the preferred direction may reduce the deformation of tissue structures, causing a reduction in the derangement and bring about abolition, decrease or centralization of symptoms. In this syndrome, movement is typically impaired but the performance of the appropriate repeated end-range movement results in an improvement in a mechanical baseline such as range of motion, neural tension, or a functional movement. Directional preference (DP) is an essential feature of the McKenzie classification system. The DP describes clinical phenomenon where a specific direction of repeated movement or sustained position results in a clinically relevant improvement in either symptomatic or movement baselines and is predictive of a favorable outcome in people experiencing low back pain.[4-10] Centralization is defined as the phenomenon by which distal pain originating from the spine is progressively abolished in a distal to proximal direction.[2] This is in response to a specific repeated movement or sustained position and this change in location is maintained over time until all pain is abolished. As the pain centralizes, there is often a significant increase in the origin of the pain. The movement that produces a centralization of symptoms would also be considered the person's DP. Clinicians who employ the MDT method use the results of the repeated end-range movement examination to determine an individual's DP.

The dysfunction syndrome is a clinical presentation associated with the mechanical deformation of structurally impaired soft tissues. The impairment of tissue may be caused by previous trauma or inflammatory or degenerative processes. Repeated movements are performed in the direction that places tension on adaptively shortened structures and produces end-range pain with each repetition. Alternatively, repeated compression of structurally impaired tissue could consistently reproduce the patient's painful symptoms at end-range. The pain subsides with a return to the neutral position. On every subsequent occasion, the same exercise generates the same response. There is no rapid change in range of movement. Thus, repeated movements are diagnostic of dysfunction syndrome and provide the clinician the specific repetitive movement needed for that patient to remodel adaptively shortened tissues.[2]

The postural syndrome is a clinical presentation associated with a mechanical deformation of soft tissues or vascular insufficiency arising from prolonged positional or postural stresses affecting articular structures, muscles, tendons, or periosteal insertions.[2] Pain is described as intermittent that is produced only by prolonged static loading on normal

tissues. Patients with postural syndromes will have no pain with movement or activity.

Following a thorough examination screening, the patient is classified into a category of derangement, dysfunction, postural, or other. Depending on the classification, the patient is treated with an appropriate intervention based upon the judgement of a clinician trained in MDT. The purpose of this study is to determine the extent of McKenzie instruction in physical therapy first professional (entry-level), orthopaedic residency, and orthopaedic manual physical therapy (OMPT) programs in the United States.

MDT and Physical Therapy Education

Courses on MDT are offered at various locations in the United States, and also in coursework of entry-level professional education or through residency and fellowship education opportunities.[11]

Currently, differences exist regarding the extent to which MDT is taught within DPT, residency, and fellowship programs, orthopaedic residency education, and OMPT fellowship education. Becoming certified in MDT requires licensure or registration as a practitioner, completion of MDT coursework parts A-D, and successful completion of the credentialing examination.[11] Coursework A-D is designed as a progression of body regions: Part A addresses the lumbar spine, Part B addresses cervical and thoracic spine, Part C addresses the advanced portion of the lumbar spine and lower extremities, Part D addresses the advanced portion of the cervical and thoracic spine as well as upper extremities, and Part E addresses advanced extremity content. Parts A and B consist of 26 hours of content over 3 days, and parts C and D consist of 28 hours of content over 4 days. Following the completion of Parts A-D, individuals may sit for the certification examination, and they may choose to take Part E although it is an optional component. Once credentialed, practitioners may advance to the Diploma program, which involves a 10-week internship and a 4-part oral/practical examination. An OMPT fellowship opportunity is also available for those who, after earning the McKenzie Diploma, choose to advance their education with a focus on OMPT techniques and clinical decision making.[11]

Evidence exists supporting the McKenzie approach in spinal musculoskeletal management,[12-15] and has also been shown to be an effective option for people with extremity disorders.[16-22] Extremity and spinal manipulation are also part of DPT, residency, and fellowship education and the amount of time devoted to teaching manipulation in physical therapy has been investigated by Boissonnault et al.[23]

Even though research regarding the effectiveness of MDT is emerging, there is currently no evidence as to the extent of MDT education in professional and post-professional physical therapy programs. Therefore, the purpose of this study was to determine the extent to which MDT is instructed at the professional and post-professional levels. The results from this study may be of value as an assessment tool for existing curricula within the framework of a program's educational philosophy and curricular plan. Additionally, the results may also be helpful for the development and facilitation of MDT instruction in entry-level physical therapy education programs, orthopaedic residency programs, and OMPT programs that do not currently address this content.

METHODS

Design

This cross-sectional study explored the extent of MDT instruction in physical therapy professional degree programs accredited by Commission on Accreditation in Physical Therapy Education (CAPTE) and the American Board of Physical Therapy Residency and Fellowship Education (ABPTRFE).

Participants

Physical therapy Program Directors were invited to participate in this study through email (**Appendix 1**), which involved completing a survey using Survey Monkey comprised of 40 questions about (1) whether MDT is being taught and, if so, how the content is being integrated into the curriculum; (2) which body regions were taught; (3) the qualifications and experiences of faculty responsible for teaching the material; (4) the textbooks and resources used by faculty; and (5) how student knowledge and skills were being assessed.

Recruitment Procedures

Three-hundred and fifty invitations to complete the survey were sent via email to program directors of physical therapy professional degree programs accredited by CAPTE and ABPTRFE. A letter of instruction was provided to each participant outlining the purpose of the study, an explanation of the anonymous nature of the survey, and that participation was voluntary. The survey included an option to forward the participant's email address to the McKenzie Institute, regarding further information and training about MDT. They were provided with a link to complete the survey through a web-based service (SurveyMonkey.com).

Ethical Considerations

Before the email asking program directors to participate, the study was approved by the Human Subjects Research Review Committee at Daemen College, Amherst, NY, USA.

Data Acquisition Procedures

Program directors were initially contacted in June 2018. SurveyMonkey automatically sends a follow-up email 2 weeks after the initial invitation, requesting survey completion if it was not already submitted. Three weeks after the second request, one final attempt was made to contact non-respondents however, the results remained anonymous to the researchers as to who or which institution(s) completed vs did not complete the survey.

Statistical Analysis

Descriptive statistics were calculated in aggregate for survey data to determine the following: current status of MDT instruction within physical therapy professional degree programs accredited by CAPTE, orthopaedic residencies, and OMPT fellowship programs, integration of MDT principles into program curricula, assessment of MDT content within programs, instructor qualifications relative to the teaching of the McKenzie Method, the demographics of the program or institute, and the MDT theories and principles taught.

RESULTS

Programs

A total of 96 programs responded to the survey (response rate = 27.4%). Of these programs, 84 (87.5%) had integrated the McKenzie principles into their curriculum. Of the 84 respondents, 23 indicated that McKenzie principles were integrated into a required, entry-level or post-professional course, 40 indicated that it was part of the required integrated practice expectation content, and 16 did not report having an entry-level program. Faculty teaching MDT content appears to be well qualified, with the majority having more than 13 years of experience using MDT in clinical practice. The primary reason for programs not teaching McKenzie principles is that it was not considered to be of high enough curricular priority for inclusion (n=4).

Status of MDT Instruction

Of the 96 programs that responded to

the survey, 84 (87.5%) had integrated the McKenzie principles and practice into their entry-level education programs (**Figure 1**). The programs currently not teaching MDT reported several reasons: lack of qualified faculty (n=4, 41.7%), lack of scientific evidence to guide what is taught (n=1, 10.4%), and the remainder provided individual responses within the other category, including eliminating the content to better follow low back pain clinical practice (n=1, 10.4%) and teaching concepts of McKenzie but not the entirety of the method (n=4, 41.7%). Also in a separate question, 10 of the programs that had not integrated MDT do not plan to incorporate it into their curriculum in the future (100%), and 2 respondents neglected to answer this question. Of the 84 respondents that had integrated the McKenzie principles and practice into their entry-level education programs, the majority had integrated the model into their curriculum over the past 6-10 years (n=49, 58.3%). Twenty-one of 22 programs reported integrating McKenzie principles into the practice within the past 0-5 years.

Table 1. How the MDT Principles are Taught in DPT Programs

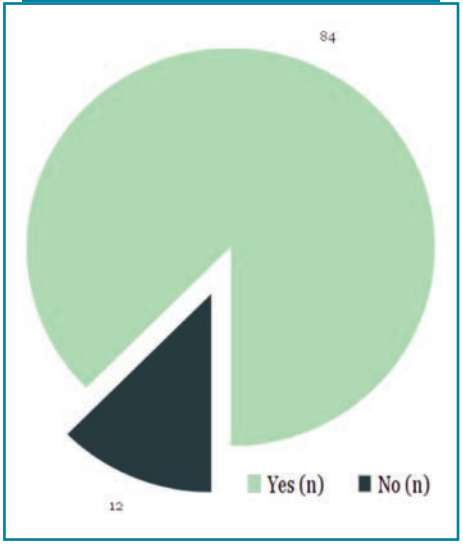
Responses	Entry-Level DPT (n=49)
Required course(s) (n=18)	18
Part of required integrated practice expectation content (n=30)	30
Online course module (n=0)	0
N/A (n=17)	1
Other (n=0)	0
Omitted (n=12)	-

(Note: 16 or 32.7% of programs indicated that this question was not applicable because their program is not an entry-level program (13 orthopaedic residency programs and 3 OMPT fellowship programs)

Integration into Curriculum

Eighteen out of 49 entry-level DPT programs (36.7%) indicated that McKenzie principles are integrated into a required course within their curriculum, 30 out of 49 (61.2%) indicated that McKenzie Method is part of required integrated practice expectation content (**Table 1**). If an orthopaedic residency or fellowship program director responded to this question, their answer was omitted because the question specifically pertained to entry-level DPT programs. A total of 12 responses were then omitted (10 orthopaedic residency responses and 2 OMPT fellowship responses). It is interesting to note that one response from an entry-level DPT program indicated that it was N/A to answer this question. Additionally, one orthopaedic residency respondent indicated both N/A and that they teach the McKenzie principles as part of required integrated practice expectation content, therefore the later response was ultimately omitted. When asked how much time should be available for instruction in McKenzie principles in their respective programs, 8 of the 71 respondents replied that more time should be available (11.3%), 63 indicated that the available time should remain as is (88.7%), and 0 indicated that the available time should be less.

Figure 1. Integration of the McKenzie Principles and Practice Within Entry-level DPT Programs



Most programs used a student to-instructor ratio for McKenzie-related laboratories of a 10:1 or less (n=38, 53.5%) or between 11:1 and 15:1 (n=24, 33.8%). When comparing the student/instructor ratio for McKenzie method laboratories to other laboratories, most reported no difference in student/instructor ratio (n=65, 91.6%), whereas 3 respondents (4.2%) reported a higher ratio, 2 (2.8%) reported lower ratio, and one (1.4%) reported that their program does not include a laboratory component. The majority of respondents reported that research is considered the most valuable educational tool used in teaching the McKenzie method: 33 stated that research was considered very valuable (47.8%), and 31 indicated that research was somewhat valuable (44.9%). Conversely, participants reported that multimedia, such as CDs and DVDs, was the least useful educational tool, and the majority did not use this tool at all (n=46, 71.9%).

Concerning percent instruction in McKenzie training by body region, the included regions were indicated by those programs that include McKenzie principles into their curriculum: 71 respondents reported the lumbar spine (100%), 61 reported the cervical spine (85.9%), 35 indicated the thoracic spine region (49.3%), 15 indicated the upper extremity (21.1%), and 13 indicated the lower extremity (18.3%). As shown in **Table 2** and **Figure 2**, most instruction was devoted to the lumbar spine.

Assessment of Content

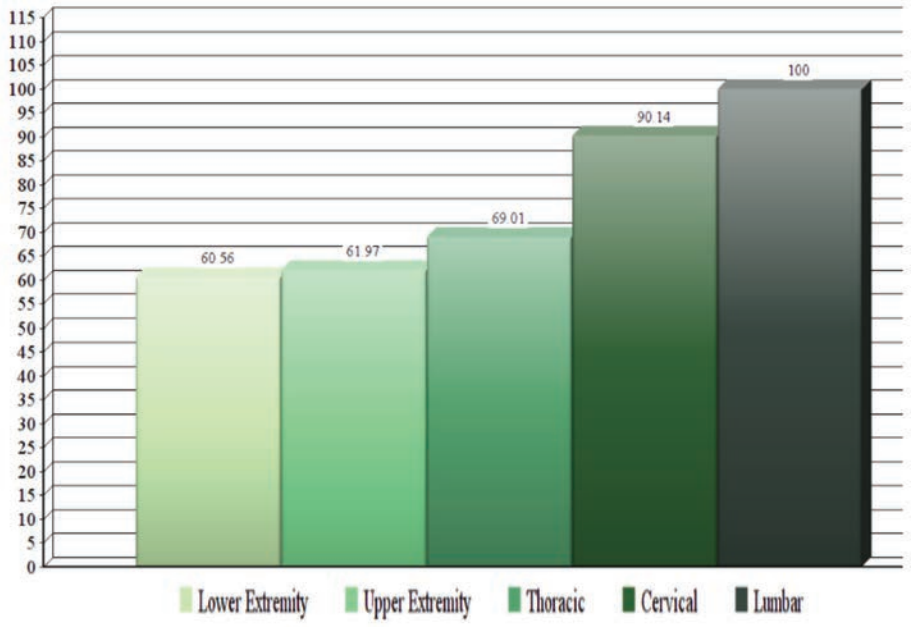
Student competency in the McKenzie method was most commonly assessed through written examinations (n=20, 30.8%). Additionally, 21.5% of respondents reported assessing student knowledge through practical skill-based labs (n=14), 12.3% assessed through practical, patient-based intervention (n=8), 4.6% assessed through clinical educa-

Table 2. The Percentage by Body Region that the McKenzie Principles are Instructed

Responses	Entry-Level DPT (n=123)	Orthopaedic Residency (n=58)	OMPT Fellowship (n=14)
Lumbar (n=71)	44	22	5
Cervical (n=61)	38	18	5
Thoracic (n=35)	24	9	2
Upper Extremity (n=15)	9	5	1
Lower Extremity (n=13)	8	4	1

(Note: None of the programs included all regions in their instruction)

Figure 2. The Percentage of Respondents Relating to Each Body Region



tion (n=3), and 4.6% assessed through case studies (**Table 3, Figure 3**). When asked to rate the level of competency of their program graduates to implement the McKenzie principles immediately upon graduation, 12 (26%) rated their graduates as "competent", 29 (63%) rated their graduates as "minimally competent", and 3 (6.52%) respondents rated their graduates as "not competent". Increased use of MDT during clinical internships and increased laboratory hours were the instructional methods that were thought to be most beneficial in influencing student knowledge and application of MDT.

Instructor Qualifications

With regards to the qualifications McKenzie instructors should have in order to effectively teach the McKenzie Method, 23 respondents from entry-level DPT programs indicated that instructors should complete continuing education programs (**Table 4**). Additionally, 20 respondents from accredited DPT programs indicated that instructors should receive clinical mentorship from qualified professionals, while 12 respondents indicating that they believe instructors should be Certified in MDT. Of the respondents at orthopaedic residency institutions, 14 indicated that they believe instructors should complete continuing education programs without specific level qualifications. Thirty-three respondents (33.7%) did not respond to this question.

Faculty demographic information indicated that 84.5% of the respondents were full- or part-time core faculty who were responsible for teaching the McKenzie material in the curriculum (n=60). Other faculty who participated in the instruction held either associated/adjunct faculty positions or were guest lecturers, representing 18.3% and 12.7% of the faculty, respectively (n=13, n=9). The majority of the faculty reported that the McKenzie principles have been taught in their program for 6 to 10 years (69.01%, n=49). Fifty-six percent of faculty reported that the McKenzie principles are taught as part of required and integrated practice expectation content (n=40), while 32% reported that the McKenzie principles are taught as required content in the entry-level or post-professional curriculum (n=23).

Thirty-five respondents reported receiving any entry-level education/training in the McKenzie method (50.0%). Regarding experience in using the McKenzie method, 47% reported having 13 or more years of experience (n=33). When respondents were asked to rate their qualifications to teach the McKenzie principles, most considered themselves "well qualified" (36%, n=22) or "moderately qualified" (49%, n=30). However, of the 69 instructors who reported the extent of their training related to the McKenzie Method, only 13.0% individuals had completed the Diploma Program (n=9) (**Table 5**). Furthermore, 68.1% reported completion of Part A (n=47), 65.2% reported completion of Part B (n=45), 44.9% reported completion of Part C (n=31), 36.2% reported completion of Part D (n=25), and 26.1% reported completion of Part E (n=18). Additionally, 24.6% reported completing individual mentoring with a clinical expert (n=17), 24.6% reported completing an in-service (n=17), and 4.3% reported having not completed any post-professional training or self-study in the McKenzie Method (n=3).

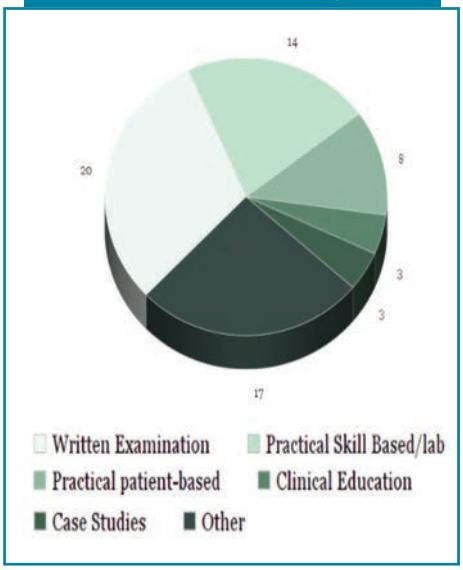
MDT Theories/Principles Taught

When asked which McKenzie theories or principles are taught in their current curriculum, 100% of respondents reported direction of preference/centralization (n=71), 90.1% reported teaching the principle of testing repeated end-range movements (n=64), 87.3% reported neck retraction and lumbar extension (n=62), and 16.9% reported other

Table 3. Student Assessment of MDT Principles Within Programs

Responses	Entry-Level DPT (n=40)	Orthopaedic Residency (n=21)	OMPT Fellowship (n=4)
Written examination (n=20)	13	7	0
Practical skill based/lab (n=14)	9	3	2
Practical patient-based (n=8)	4	4	0
Clinical education (n=3)	1	2	0
Case studies (n=3)	1	2	0
Other (n=17)	12	3	2

Figure 3. Student Assessment of MDT Principles Within Programs



(n=12). Within the other category, 7.0% of respondents reported teaching lateral shift correction in their curricula (n=5).

All but two faculty respondents reported practicing in clinical settings, with most working between 1 and 10 hours (39.4%, n=28). Sixty-nine percent of the physical therapy faculty respondents reported holding an academic doctorate (n=49). Sixty-three (90%) of the physical therapist faculty respondents reported holding an American Board of Physical Therapy Specialties clinical specialist certification (92.9% held a certification in orthopaedics or sports). Twenty-six (36.6%) of the respondents reported being a Fellow of the American Academy of Orthopaedic Manual Physical Therapists.

DISCUSSION

MDT Status in Education

This study examined the status of MDT education in accredited physical therapy programs within the United States. To our knowledge, the results provide the first description of MDT education in entry-level education programs for physical therapists in professional and post-professional therapy programs. While most responding programs (87.5%, n=84) stated that the McKenzie principles were currently included in their curricula, the results of the current study demonstrate some variability in the educational background and the years of experience the clinicians have using MDT in clinical practice. For example, 36.23% (n=25) have completed part D of MDT training and where 13.04% (n=9) of clinicians teaching MDT had earned their diplomas. Of the clinicians that are instructing MDT, only 47.83% (n=33) have more than 13 years' experience implementing MDT in clinical practice.

Recently, physical therapy programs have implemented various techniques, such as dry needling, into their curriculum. According to Matthews et al,[25] of the 75 programs that responded to a survey, 40 physical therapy programs (53.3%) integrated dry needling theory and practice into their entry-level education programs. Meanwhile, 8 programs (10.7%) planned to include such content in their curriculum in the future. All entry-level physical therapy programs, however, are now required to have joint manipulation within their curriculum as an entry-level skill. Therefore, various new hands-on techniques and approaches are gaining popularity within the physical therapy practice, demonstrating that the practice as a whole is continuing to grow and develop to parallel the production of new research. However, the MDT focus on patient independence and self-management strategies may decrease utilization of services.[2] Therefore, there is an increased emphasis on programs to include self-management strategies as ways to improve efficacy and reduce the cost of health care.

Nonetheless, the degree to which MDT is taught in entry-level programs, orthopaedic residencies, and manual physical therapy fellowships vary. Of the programs that did not include MDT in their curricula (12.5%, n=12), 100% of respondents were not interested in integrating the MDT content into their curriculum. Given the dramatic increase in interest in MDT over the recent years, as seen by the number of certification programs, continuing education courses, and scientific publications on the topic, these findings are surprising. Consensus on the role of the McKenzie principles in entry-level programs for physical therapists may provide useful information for programs and the profession.

Limitations

Several limitations exist that may have influenced the findings from this study. First, a 27.1% response rate was obtained (n=96). Although this is not considered a low response rate for a non-incentivized survey, an increased response rate would improve generalizability of the results.[24] This is evidenced by the fact that the survey was not completed by 72.9% of programs (n=254). Second, while the researchers requested that the survey be completed by the faculty member who was responsible for musculoskeletal content, this was a difficult criterion to control based on the nature of the data collection method. This may call into question the accuracy of the reported information,

Table 4. The Qualifications Faculty Members Have in Teaching McKenzie-related Material

Responses	Entry-Level DPT (n=45)	Orthopaedic Residency (n=19)	OMPT Fellowship (n=5)
Continuing Ed (n=36)	23	13	0
McKenzie Cert (n=18)	11	5	2
Mentorship (n=10)	8	0	2
Other (n=5)	3	1	1

Continuing Ed McKenzie Cert Mentorship Other

Table 5. Instructor Post-professional Training or Self-study in the McKenzie Method

Responses	Entry-Level DPT (n=135)	Orthopaedic Residency (n=60)	OMPT Fellowship (n=17)
Part A (n=47)	30	13	4
Part B (n=45)	28	13	4
Part C (n=31)	21	8	2
Part D (n=25)	16	7	2
Part E (n=18)	12	4	2
Diploma Program (n=9)	6	3	0
Individual mentoring with a clinical expert (n=17)	9	6	2
In-service(s) (n=17)	10	6	1
None (n=3)	3	0	0

especially if the individual who completed the survey was not the instructor responsible for musculoskeletal content. Third, there was a relatively high rate of incomplete surveys submitted. For example, 13 of the 98 surveys were started from individuals who included McKenzie content in their curricula but were not fully completed (13%). A possible reason for a large number of incomplete surveys was the potential perception that the survey was too lengthy and time-consuming to complete in one sitting. Another reason may be that the information requested on the survey was not easily accessible, or it may have required consultation from another faculty member to complete, so respondents may have stopped the survey and neglected to complete it at a later time. Despite these limitations, the findings from this study offer an initial representation of the status of MDT education in entry-level education programs for physical therapists in the United States.

CONCLUSION

Of the 96 programs that responded to the survey, 84 programs had integrated the McKenzie principles and practice into their entry-level education programs (87.5%). There appears to be variability in the methods in which the McKenzie principles are integrated into the programs' current curricula as well as in the depth and breadth of instruction and level of McKenzie instruction among faculty members. This variability in MDT curricula suggests a need for the development of curricular guidelines and resources for physical therapy program instructors who are interested in delivering McKenzie-related content.

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(References continued on page 209)

Appendix 1.

1. What is the educational level of your program? Choose all that apply?
   - ☐ Entry-level DPT
   - ☐ Orthopaedic Residency
   - ☐ OMPT Fellowship

2. In which state(s) is your Program located (choose all that apply)?

☐ Alabama	☐ Montana
☐ Alaska	☐ Nebraska
☐ Arizona	☐ Nevada
☐ Arkansas	☐ New Hampshire
☐ California	☐ New Jersey
☐ Colorado	☐ New Mexico
☐ Connecticut	☐ New York
☐ Delaware	☐ North Carolina
☐ Florida	☐ North Dakota
☐ Georgia	☐ Ohio
☐ Hawaii	☐ Oklahoma
☐ Idaho	☐ Oregon
☐ Illinois	☐ Pennsylvania
☐ Indiana	☐ Rhode Island
☐ Iowa	☐ South Carolina
☐ Kansas	☐ South Dakota
☐ Kentucky	☐ Tennessee
☐ Louisiana	☐ Texas
☐ Maine	☐ Utah
☐ Maryland	☐ Vermont
☐ Massachusetts	☐ Virginia
☐ Michigan	☐ Washington
☐ Minnesota	☐ West Virginia
☐ Mississippi	☐ Wisconsin
☐ Missouri	☐ Wyoming

3. What is the length of your Program including professional/technical coursework in weeks (including exam week and count exam week as 1 week)? (please enter as a number, ie, 116)

4. What is your target number of students entry-level or post-professional level cohort? (please enter as the type of program and a number, ie, entry-level and 45)

Program Type & Number of Students	Entry-level DPT	Orthopaedic Residency	OMPT Fellowship

5. How many students graduated in your class of 2017? (please enter as the type of program and a number, ie, entry-level and 45)

Program Type & Number of Students	Entry-level DPT	Orthopaedic Residency	OMPT Fellowship

6. To date, have you integrated the McKenzie principles into your program?
   - ☐ Yes
   - ☐ No

7. For how many years has the McKenzie principles been integrated into your program's curriculum?
   - ☐ 0-5 years
   - ☐ 6-10 years
   - ☐ NA

8. In our entry-level program, the McKenzie principles are taught as a(n)…(please mark all that apply)
   - ☐ Required course(s) in the entry-level or post-professional curriculum
   - ☐ Part of required integrated practice expectation content (ie, examination and intervention, therapeutic exercise, mentoring, etc)
   - ☐ Online course module
   - ☐ Not applicable as we do not have an entry-level program

9. In the post-professional program, how many hours does your program spend teaching McKenzie principles within each of the categories below? (please respond to each category below AND use whole numbers (ie, 0, 10, etc)

Face to face classroom lecture	
Laboratory	
Patient assessment	
Distance video instruction/demonstration	
Not applicable as we do not have a postprofessional program	

10. How much time should be available for instruction specific to the McKenzie principles in your curriculum?
- ☐ More time
- ☐ Remain as is
- ☐ Less time

11. Based on all of the McKenzie related hours of instruction in your curriculum, please indicate the percentage by region that is instructed. (total should equal 100, 0 indicates that material is not covered)

Lumbar	
Cervical	
Thoracic	
Upper extremity	
Lower extremity	

12. Which McKenzie Method theories/principles are taught? (choose all that apply)
- ☐ Direction of preference/centralization
- ☐ Neck retraction and lumbar extension exercises
- ☐ Repeated end-range movements
- ☐ Other (please specify)

13. For laboratories covering the McKenzie related content, what is your student:instructor ratio?
- ☐ 10:1 ratio or less
- ☐ Between 11:1 and 15:1
- ☐ 16:1 or greater
- ☐ Not applicable as our program does not have laboratory instruction of the McKenzie Method

14. For laboratories in which the McKenzie principles and skills are taught, what is the student:instructor ratio compared to other laboratories (ie, shoulder examination lab, manual physical therapy lab, etc)?
- ☐ No difference in student:instructor ratio
- ☐ Higher student:instructor ratio for the McKenzie Method skills
- ☐ Lower student:instructor ratio for the McKenzie Method skills
- ☐ Not applicable as our program does not have laboratory instruction for the McKenzie Method

15. How do you assess student competency in using the McKenzie Method, principles, or skills? (please check all that apply)
- ☐ Written examination
- ☐ Oral examination
- ☐ Practical skill based techniques (lab competency checks)
- ☐ Practical patient-based (real or simulated) examination
- ☐ Other assessment(s) (please specify)
- ☐ Clinical education/mentoring
- ☐ Case studies linked to simulated examination
- ☐ NA - Student competency is not assessed

16. Please indicate how valuable the following resources are in teaching the McKenzie principles and skills in your program.

	Do not use	Use; Not valuable	Use; Somewhat valuable	Use; Very valuable
Text books	☐	☐	☐	☐
Multi media (CD/DVD)	☐	☐	☐	☐
Research papers	☐	☐	☐	☐
Other ('apps', websites, etc)	☐	☐	☐	☐

17. How would you rate the graduates of your program(s) pertaining to their ability to implement the McKenzie Method as an examination system immediately upon graduation?

	NA program does not exist	Not Competent	Minimally Competent	Competent
DPT	☐	☐	☐	☐
Residency	☐	☐	☐	☐
Fellowship	☐	☐	☐	☐

Comments

18. Age in years for each person teaching this content (please enter as a number, ie, 35)

Demographic information regarding the primary musculoskeletal faculty member(s) responsible for teaching the McKenzie related information and skills.

19. Gender
- ☐ Male
- ☐ Female
- ☐ Non-binary
- ☐ If multiple individuals teach this content please specify how many of each gender here.

20. Please state which of the following reflects the academic position of the individual(s) teaching McKenzie related material within the program. (if more than one faculty member, please check all that apply)
- ☐ Full-time or part-time core faculty
- ☐ Associated/adjunct faculty
- ☐ Guest lecturer
- ☐ Other (please specify)

21. Of the instructors in your program who would teach this content, what is/are that person's HIGHEST (entry-level) physical therapy degree(s)? (please select one answer)
- ☐ BSPT
- ☐ MSPT
- ☐ MPT
- ☐ DPT
- ☐ If more than one person teaches the content, please specify which entry-level degree or post-professional credentials are required of your instructors.

22. How long ago did the instructor(s) receive his/her HIGHEST (entry-level) physical therapy degree? (in years)
- ☐ 1-5
- ☐ 6-10
- ☐ 11-15
- ☐ 16-20
- ☐ 21 or more
- ☐ If there is more than one instructor please indicate the number of years for each instructor here.

23. Please check any post-professional degrees/experiences the instructor(s) has/have completed and provide the area of study. (Select all that apply)
- ☐ MS
- ☐ MA
- ☐ ABPTRFE accredited orthopaedic/manual therapy residency
- ☐ ABPTRFE accredited orthopaedic/manual therapy fellowship
- ☐ PhD
- ☐ EdD
- ☐ DSc
- ☐ None
- ☐ Other (please specify) AND/OR if there is more than one instructor, please indicate each individuals post-professional credentials here.

24. Please indicate if the instructor(s) holds an American Board of Physical Therapy Specialties (ABPTS) clinical specialist certification in any of the following areas. (Choose all that apply)

- ☐ Orthopaedics
- ☐ Sports
- ☐ Geriatrics
- ☐ Pediatrics
- ☐ Cardiopulmonary
- ☐ Clinical Electrophysiological
- ☐ Neurology
- ☐ Women's Health
- ☐ None
- ☐ If there is more than one instructor, please indicate each individuals ABPTS certification here.

25. Is/Are the instructor(s) a member of the Orthopaedic Section of the APTA

- ☐ Yes
- ☐ No
- ☐ If there is more than one instructor, please indicate if each individual is a member of the Orthopaedic Section

26. Is/Are the instructor(s) a member of the American Academy of Orthopaedic Manual Physical Therapists?

- ☐ Yes
- ☐ No
- ☐ If there is more than one instructor, please indicate if each individual is a member of the AAOMPT

27. Is/Are the instructor(s) a Fellow of the American Academy of Orthopaedic Manual Physical Therapists (FAAOMPT)?

- ☐ Yes
- ☐ No
- ☐ If there is more than one instructor, please indicate if each individual is an FAAOMPT here.

28. On average, how many hours per week does/do the instructor(s) currently practice in a clinical setting?

- ☐ 0
- ☐ 1-10
- ☐ 11-20
- ☐ 21-30
- ☐ 31 or more
- ☐ If there is more than one instructor, please indicate the number of hours for each here.

29. For each of the following instruction methods, please indicate how each would impact your students' knowledge and application of the McKenzie Method, principles, or skills

	Not Beneficial	Somewhat Beneficial	Very Beneficial
Increase lecture hours	☐	☐	☐
Increase laboratory hours	☐	☐	☐
Increase use of the McKenzie Method during clinical internships	☐	☐	☐
Have a certified or Diplomate MDT instructor teach the course	☐	☐	☐

Comments

30. Did the instructor(s) receive any training in the McKenzie Method during his/her entry-level physical therapy education?

- ☐ Yes
- ☐ No
- ☐ Not sure
- ☐ If there is more than one instructor, please indicate yes or no for each here.

31. What post-professional training/self-study in the McKenzie Method has/have the instructor(s) participated in? (check all that apply)
- ☐ Part A
- ☐ Part B
- ☐ Part C
- ☐ Part D
- ☐ Part E
- ☐ Diploma Program
- ☐ Individual mentoring with a clinical expert
- ☐ Inservice(s)
- ☐ None

32. What do you think is the best way to increase the instructor's expertise related to teaching the McKenzie Method? (please rank each item 1-5 with 1 being not helpful and 5 being very helpful. Please complete ALL categories listed)
- ☐ Cert. MDT
- ☐ Clinical experience/mentor
- ☐ Dip. MDT
- ☐ Electronic media (DVD/CD/other)
- ☐ Other

33. How many years of experience has/have the instructor(s) had in using the McKenzie Method in clinical practice?
- ☐ 1-3
- ☐ 4-6
- ☐ 7-9
- ☐ 10-12
- ☐ 13 or more
- ☐ If there is more than one instructor, please indicate the number of years for each.

34. How would the instructor(s) rate himself or herself regarding qualification to teach McKenzie related material?

	Not qualified	Minimally qualified	Moderately qualified	Well qualified
Qualification to teach the McKenzie Method	☐	☐	☐	☐

If there is more than one instructor, please indicate how each would rate himself/herself here.

35. What qualifications do you think a faculty member should have to teach McKenzie related material? (check all that apply)
- ☐ Completion of a continuing education course(s)
- ☐ Clinical mentorship with qualified professional
- ☐ McKenzie certification
- ☐ McKenzie Orthopaedic Residency training
- ☐ McKenzie OMPT Fellowship training
- ☐ Other (please specify)

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The Functional Loss Clinical Reasoning Framework for the Neuromusculoskeletal Patient

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ABSTRACT

Background and Purpose: Ongoing change in health care makes it imperative for physical therapists to efficiently integrate information from the patient interview and examination to create a patient-centered plan of care. From the first contact, the patient's needs and expectations must be addressed by offering an explanation of their concerns and providing advice on self-management to facilitate patient health literacy and engagement toward a path of autonomous care while using the process to foster a strong therapeutic alliance. The purpose of this paper is to describe the utility of the Functional Loss Clinical Reasoning Framework (FLCRF) to enable the clinician to focus the patient-centered interview, provide simple explanations of the clinical presentation and present self-management strategies for patients with lumbar spine conditions. **Clinical Relevance:** The FLCRF can be of particular value for novice clinicians seeking to understand and integrate patient interview information and initial observation to facilitate early patient self-management while implementing other complementary intervention approaches or classification systems.

Key Words: interviewing, novice clinician, patient education

INTRODUCTION

Several deductive tools have been developed to assist clinicians in the early clinical decision-making processes including the ICF model[1,2] and the Patient Client Management Model.[3] While these tools are helpful, they tend to be broad in scope, not specific to patients with neuromusculoskeletal conditions and do not necessarily assist in decision-making related to patient-centered interviewing, understanding of activity limitations, and prioritizing self-management selection. The novice clinician, in particular, is faced with the need to understand and integrate clinical information with current physical therapy evidence to guide their decision-making without the benefit of years of experience to assist in organizing this information. Deductive frameworks specific to the patients with neuromuscular conditions, such as the Functional Loss Clinical Reasoning Framework (FLCRF)[4] can assist novice clinicians in efficient patient-centered interviewing and choice of early patient self-management interventions.

Before the development and investigation of many of the lumbar classification systems, Eileen Vollowitz, one of the founding faculty of the Kaiser Permanente Northern California Orthopaedic Manual Physical Therapy Fellowship, developed the FLCRF. The symptom patterns developed by Vollowitz[4] and implemented by other expert practitioners are the result of thousands of patient observations and successful outcomes in the management of patients with peripheral and spinal neuromusculoskeletal health conditions. The FLCRF acknowledges the value of "expertise" in the evidence-based triad, originally articulated by Sackett et al[5] and has been taught successfully in the Kaiser Permanente Northern California Orthopaedic Manual Physical Therapy Fellowship curriculum for over 30 years as a mechanism for the sharing of expert practitioner knowledge and clinical reasoning skills.

As a framework for facilitating clinical reasoning, the FLCRF assists the clinician to focus their interview questions, hone initial observation skills, make decisions regarding the vigor of the physical examination, develop targeted day one interventions, and educate the patient to be an autonomous problem solver for self-management. Self-management support has been described as "essential to the management of persistent musculoskeletal disorders."[6] Mackey et al noted the importance of fostering an environment that promotes patient empowerment, which could lead to improved adherence to self-management strategies.[7] Poor self-efficacy has been established as a frequent psychological factor in cases of persistent pain.[8]

There are numerous classification systems related to the evaluation and treatment of low back pain (LBP) in various states of validation including treatment-based classification,[9-12] mechanical diagnosis and treatment,[13,14] movement system impairment,[15-18] and O'Sullivan's biopsychosocial classification system.[19-22] The choice of which of these frameworks to use can be complex and confusing for the novice clinician[23] with many of these systems relying primarily on the physical examination. One of the defining characteristics of the FLCRF is the emphasis on the patient-centered interview process combined with initial observation.

While the FLCRF concepts can be applied to individuals with peripheral and spinal neuromusculoskeletal health conditions, this article will focus on the FLCRF in the context of managing patients experiencing LBP. Information derived from the patient-centered interview and observation is used to group patients into FLCRF symptom patterns that then guide early clinical decisions and self-management recommendations for LBP. It is beyond the scope of this article to address the range of physical examination priorities and interventions generated by the FLCRF that could be considered in LBP management. The purpose of this paper is to describe the FLCRF, first described by Vollowitz,[4] and to highlight its utility in enabling the clinician to focus a patient-centered interview, to provide simple explanations of the clinical presentation and to present self-management strategies in patients with lumbar spine conditions.

THE FUNCTIONAL LOSS CLINICAL REASONING FRAMEWORK

Vollowitz[4] postulated that the human movement system, even in its healthiest state, cannot tolerate being in one position too long, being still too long, bearing weight too long, or experiencing pressure too long. Individuals who have a decreased threshold to

these sensitivities experience functional loss, activity limitations, and participation restrictions. The initial iterations of the FLCRF[4] had 4 symptom patterns including position sensitive, weight-bearing sensitive, constrained posture sensitive, and pressure sensitive, to describe these decreased thresholds as functional losses. A fifth sensitivity, muscle effort sensitive, was added later, though never published (Personal communication, E Vollowitz 1989). From the interview and physical examination, a working functional loss hypothesis is developed by placing the patient presentation into one or more of the 5 symptom patterns with each pattern expressed as a minimal, moderate, or high degree of involvement.

The examination, and utility of the FLCRF, begins as the patient walks into the treatment area. Effective interviewing involves listening to the patient, especially noting aggravating and easing factors, and keen observation[24] as they sit or move around before the physical examination. Understanding the varying positions of flexion, extension, rotation, and side bending in weight-bearing and non-weight-bearing and how long a patient can tolerate or sustain each static posture allows the clinician to fully understand the functional needs of the patient. Within the FLCRF, the terms posture, position, and activity are used in the following manner: posture refers to the functional placement of the body in space and can include sitting, standing, supine, prone, or sidelying; position refers to the physiological placement of one segment relative to an adjacent segment, such as the position of the joint in flexion, extension, side bending, rotation or any combination of these positions. Similar to the ICF,[2] activity refers to the movement or function involved, eg, bending, lifting, rolling.

Understanding the functional needs of the patient and the likely positions, postures, and activities of provocation assist the clinician to decide which tests and measures are likely to recreate symptoms, the vigor of testing that the patient may be able to tolerate and whether selected tests and measures might need to be deferred. Equally important, advising the patient on day one regarding the management of posture and position as well as the other functional loss sensitivities may increase an individual's ability to eliminate participation restrictions.

Key Clinical Features for the Five FLCRF Symptom patterns

Patients who fit the **Position Sensitive** symptom pattern demonstrate consistent joint positions that aggravate and/or ease symptoms regardless of whether weight-bearing or non-weight-bearing and regardless of whether they are moving or static. Patients who are position sensitive typically have a preference toward a neutral position but may have a preference toward extension or flexion and the interview will elicit reports of symptoms that are provoked toward one position and eased toward another. Symptoms do not consistently worsen as the day progresses, but are dependent on the amount of time spent in an aggravating position or engaged in an activity related to that position. Waking from sleep and/or morning symptoms may be reported but tend to be related to the position involved in sleeping posture (eg, sidelying or supine) or a particular sleep surface (eg, too firm or sagging) that contributes to the position.

Clues from the initial observations that identify the position sensitive patient are commonly related to the thigh-torso angle (TTA), as the hip position has a strong relationship to the lumbar spine position.[25,26] The TTA is the angle between the thigh and the torso, with a 135˚ angle in the sagittal plane tending to place the spine in a neutral position. Angles larger than 135˚ tend to place the lumbar spine in more extension while smaller angles tend to place the lumbar spine in more flexion. A patient with a preference for lumbar extension may be more comfortable with a larger TTA (eg, standing, walking, supine or prone). Conversely, patients with a flexion preference may describe postures with a smaller TTA (eg, sitting in a lower chair with knees higher than pelvis). Patients who are more comfortable with a neutral lumbar spine may gravitate toward postures that maintain the TTA at about 135˚. They may report sitting on the edge of a chair with knees dropped, sitting on a high stool, sitting reclined, standing with one foot on a step or hooklying with pillows under knees (**Figure 1**). For example, if the patient is position sensitive with poor tolerance for a flexed position, one would expect that symptoms would be provoked in sitting, sidelying with hips flexed to 90˚ or beyond, and bending. These patients are often most comfortable in neutral or extended lumbar positions with a relief of symptoms once they move out of the provocative flexed position and may be observed early in the evaluation assuming postures with large TTA.

Self-management interventions for patients fitting a **Position Sensitive** symptom pattern of the FLCRF include learning to compensate for specific position sensitivities early in the treatment process to reduce functional limitations during work, recreation, and sleep. Educating a patient to choose postures with a TTA that matches their sensitivity can promote early self-management. The majority of current sedentary ergonomic seating advice is aimed at compensating for position sensitivity by providing the appropriate shape and degree of lumbar support and altering the TTA through adjustable seat pans and backrests. Sleeping recommendations may use pillows to influence the TTA, eg, in supine a pillow or two under the knees to decrease TTA, in sidelying support under the waist to control side bending or a pillow between the knees to control rotation.

The salient feature of patients in the **Weight-Bearing Sensitive** symptom pattern is the aggravation of symptoms by axial compressive loading, regardless of joint position, motion, or lack of motion. In patients with weight-bearing sensitivity, the patient will commonly report symptom descriptors such as "fatigue" or "tired" which may precede pain and symptoms that are more time-dependent (progressively worsening throughout the day) than activity-dependent (coming and going related to posture and activity). Typical aggravating factors include sitting, standing, walking, running, lifting weights, and strong muscle contractions which produce axial compressive loading (eg, the patient lying prone on a ball with active lumbar extension or performing sit-ups). Coughing or sneezing may be reported as aggravating factors due to the increased intra-abdominal pressure mimicking weight-bearing forces.[27,28] Activities involving vibratory forces may also amplify symptoms (eg, riding in a motor vehicle, operating heavy equipment). It has been the observation of the authors that in the Weight-Bearing Sensitive pattern, symptoms often progressively worsen throughout the day with upright sustained postures and are eased in the morning after sleeping through the night, by taking advantage of the buoyancy of water or by using an elastic corset. Initial observations consistent with this symptom pattern are manually unloading the trunk (eg, using armrests, self-traction, leaning against a wall) or diminishing the effects of gravity or muscle contraction (eg, reclined sitting, lying down) (**Figure 2**). With a high degree of weight-bearing sensitivity, a patient may report lying down for significant parts of the day or ask to lie down during the interview process.

In the **Weight-Bearing Sensitive** presentation, patient education and self-manage-

Figure 1. Individuals with Position Sensitive Lumbar Spines Who Prefer a Neutral Position May Gravitate Toward a Thigh Torso Angle Near 135° to Facilitate Lumbar Neutral

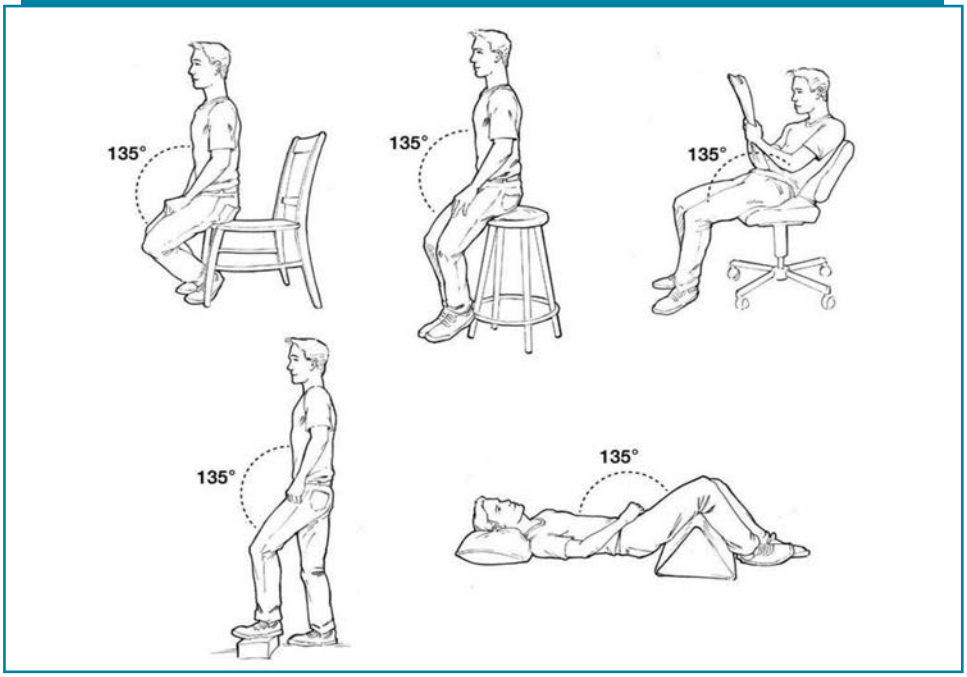
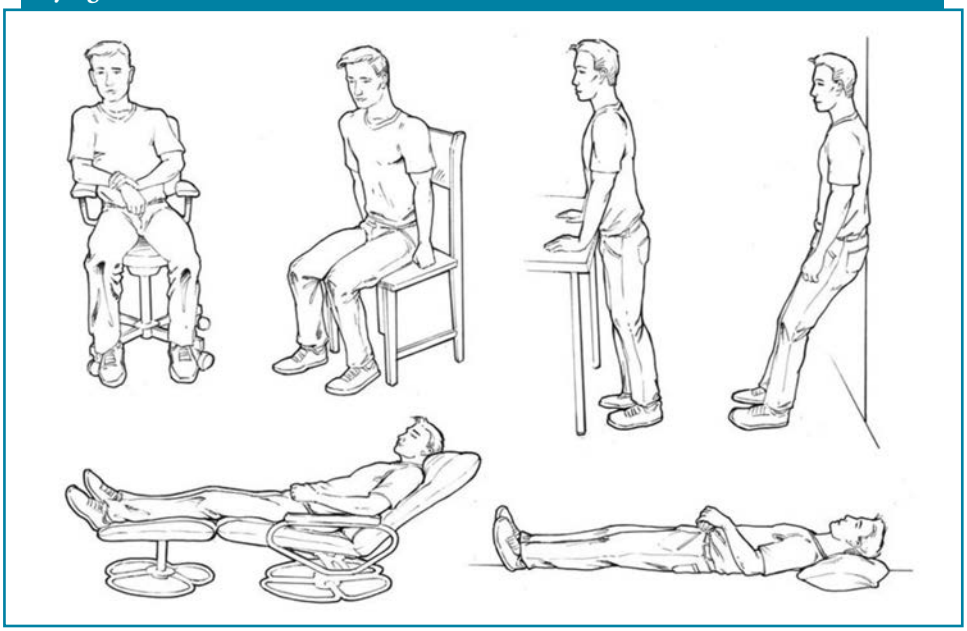


Figure 2. Weight-bearing Sensitive Individuals Ease the Symptoms Provoked by Axial Loading by Unweighting Their Torso Through Their Upper Extremities, Reclining, or Lying Down



ment emphasize un-weighting strategies that can be used throughout the day. An elastic corset can be quite effective in improving weight-bearing tolerance.[29] Furniture prescription should focus on proper-fitting armrests or well-adjusted upper extremity support on a work surface. With more severe weight-bearing sensitivity, reclining the task chair could be required. This modification requires other ergonomic changes, including a higher backrest and consideration of sightlines (monitor and hard copy) and location of manipulated objects (mouse, keyboard).[30,31]

The **Constrained Posture Sensitive** symptom pattern is characterized by lower threshold symptom provocation when constrained to one posture, regardless of the joint position (eg, lumbar spine in flexion or extension) or the degree of axial loading. Patients in this symptom pattern are impacted by the duration spent in a posture more than the posture itself. The duration of the posture required to trigger symptoms and the duration of time to ease once out of the position determines the degree of constrained posture sensitivity. During the patient interview, patients will commonly report "stiffness" as a symptom and will describe a 24-hour pattern of symptoms that are worse in the morning and ease during the day with activity but return during static postures. Symptoms that wake the patient at night and are worse in the morning are a hallmark of constrained posture sensitivity. Initial movements out of constrained postures are frequently provocative as well (eg, moving from sit to stand after prolonged sitting). Patients frequently report symptoms eased by therapeutic doses of nonsteroidal anti-inflammatory drugs, cryotherapy, midrange movement or short walks. Movement behaviors such as fidgeting, rocking, and pacing may be observed during the interview and examination and are highly indicative of this symptom pattern. An example of this symptom pattern would be a patient with complaints of morning stiffness after sleeping in the same position for a long time, awakening with LBP in the second half of the night, and improvement in back pain with exercise but not rest. These same reports are recognized as key diagnostic features of inflammatory LBP described in a validated clinical prediction rule for inflammatory LBP.[32-35]

For patients in the **Constrained Posture Sensitive** symptom pattern, self-management interventions should emphasize frequent movement, including scheduled walking breaks. Furniture prescription should facilitate motion (eg, a task chair with a spring-loaded rocking feature or a rocking chair) and encourage postural change (eg, sit-stand work surface) without interfering with function. Explaining constrained posture sensitive behavior and the potential link to inflammation could offer evidence to reinforce compliance with anti-inflammatory interventions.

The fourth symptom pattern of the FLCRF, **Pressure Sensitive**, is characterized by symptoms provoked by direct pressure from an external force and eased when the direct pressure is released. Pressure sensitivity can be local or referred within the concept of regional interdependence.[36] Referred pressure sensitivity has been demonstrated with lower pain pressure thresholds in remote areas that has been attributed to central sensitiza-

tion.[37] Patients may report waking from sleep when lying on a pressure sensitive structure or shifting weight away from pressure sensitive structures throughout the day. This weight shifting away from sensitive structures may be observed during the interview as well. Typical examples of pressure sensitive presentations include pain at the spinous processes related to pressure from a firm lumbar support, the greater trochanter when side lying on a hard mattress or the ischium, coccyx, or the posterior thigh while sitting on a hard surface.

Pressure Sensitive patient education should focus on relieving pressure. Furniture prescription and modification (eg, chairs, beds, and pillow) must compensate for pressure sensitivity with more compliant, contoured, or cut out surfaces or distributing the force by increasing the size of a support surface.

The final FLCRF symptom pattern is **Static Muscle Effort Sensitive**. Functional loss in the axial skeleton is typically related to reduced tolerance to low intensity sustained muscle effort, though muscle effort sensitivity can also be characterized by symptom provocation when muscles contract forcefully or repeatedly. There is evidence that weakness or dysfunction in lumbar local muscles, such as the transverse and oblique abdominals and multifidi, is associated with regional symptoms and altered postural control.[38-44] Van Dieen et al[45] proposed the existence of two phenotypes in motor control in patients with LBP, "tight control" and "loose control". In their proposed paradigm static muscle effort sensitivity might be represented by "loose control". The challenge in identifying static muscle effort sensitivity is that it can masquerade as a combination of weight-bearing and constrained posture sensitivity.

During the patient interview, the patient with static muscle effort sensitivity may describe symptoms of fatigue or pain aggravated by static, unsupported, upright postures such as sitting with no back support and standing, both of which require sustained muscle contraction. Walking is typically non-provocative due to the fluctuation in muscle contractions, a distinct separation from weight-bearing sensitivity. Symptoms will ease with postures requiring less muscle effort, such as reclining, lying down, slumped sitting, or sway-backed standing.

Observations in the static muscle effort sensitivity may include adopting postures that may allow a patient to minimize muscle activity and allow better tolerance in upright postures at the expense of neutral joint positioning. For example, patients in the static muscle sensitivity symptom pattern may demonstrate slumped sitting, sitting with legs spiraling around each other or the legs of the chair, sitting with one or both feet up, sitting on their legs, or wrapping arms around the body (**Figure 3**).

The **Static Muscle Effort Sensitive** self-management approach must focus on raising self-awareness of fatigue and dysfunctional movement strategies. A reclining chair with a high backrest will be most effective in minimizing muscle effort. A reclined task chair may require conversion of previously forward or erect tasks to reclined tasks (eg, adjustable monitor arm and keyboard tray). Once reclined, upper extremity tasks may require more muscle effort, so providing external upper extremity support can be critical.

Table 1 summarizes the key elements of the 5 FLCRF including aggravating and easing factors as well as simple terminology that can be used to question and describe the symptom patterns to patients. **Table 2** offers common questions posed to patients to determine the symptom patterns. Both tables may be especially helpful for novice clinicians.

The symptom patterns of the FLCRF are not mutually exclusive and it is common to have multiple patterns of functional loss expressed within a symptomatic area. For example, the same patient may have a high degree of position sensitivity manifested as significant pain with forward bending, lifting and sitting in a flexed posture while simultaneously experiencing minimally constrained posture sensitivity with several minutes of morning stiffness and brief stiffness when rising after prolonged sitting.

Functional loss symptom patterns are also dynamic throughout an episode of care. The dominance of each relevant symptom pattern may change as the condition progresses over time. For example, a patient with an acute lumbar presentation may report a high degree of weight-bearing sensitivity with symptoms provoked by sitting, standing and walking and eased by lying down as well as constrained posture sensitivity characterized by waking through the night requiring getting out of bed to return to sleep, prolonged morning stiffness, symptoms with moving from sit to stand after even brief periods of sitting and relief with nonsteroidal anti-inflammatory drugs and ice. Six weeks later the patient may no longer demonstrate weight-bearing or constrained posture sensitivity but show only a high degree of position sensitivity with an extension preference expressed as symptoms with forward bending, lifting and sitting which ease with standing or walking.

DISCUSSION

The novice physical therapist, without the experiential context of clinical patterns, requires guidance in organizing their thinking. The FLCRF provides guidance to formulate concise questions, ask appropriate follow-up questions, and help decide when to cease questioning. Understanding the rationale for each question builds the confidence of the interviewer and in turn facilitates the patient's confidence in their provider. Confidence in health care providers may enhance the therapeutic alliance which is one of the 'contextual' factors in patient care delivery that can improve overall outcomes of care.[46,47]

Figure 3. Static Muscle Effort Sensitive Individuals May Assume Various Postures by Wrapping Their Legs or Arms Around Each Other to Stabilize Their Trunk and Minimize Static Muscle Effort

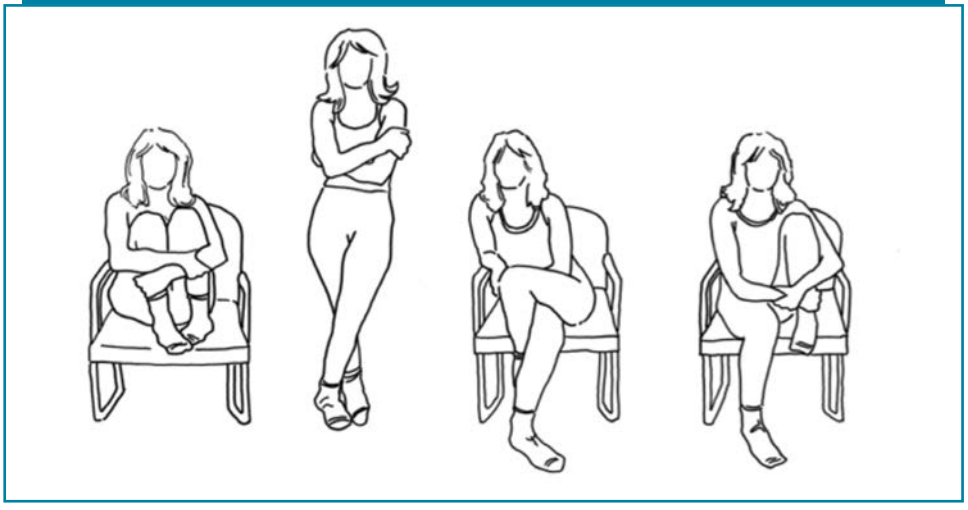


Table 1. Summary of FLCRS Patterns for Lumbar Region Presentations

	Position Sensitive	Weight-bearing Sensitive	Constrained Posture Sensitive	Pressure Sensitive	Static Muscle Effort Sensitive
Primary functional loss	• Decreased tolerance to specific joint position/s	• Decreased tolerance to axial compressive loading	• Decreased tolerance to a sustained position or posture	• Decreased tolerance to direct contact pressure	• Decreased tolerance to a sustained muscle contraction
Observation	• Reports symptoms in consistent joint position/s (eg, F, E, Rot, SB) • May assume postures near 135° TTA to control symptoms	• Unloading body weight by leaning on arms or against a wall • Preference for reclined or recumbent postures and avoidance of upright postures	• Shifting weight • Fidgeting • Rocking • Pacing • Frequent changes in position and/or posture	• Shift weight away from sensitive structures	Postures that minimize muscle effort (eg, slumped sitting, sitting with legs spiraled around each other, sway back standing)
Aggravating factors	• Postures or activities placing spine in specific provocative joint position/s whether WB or NWB	• WB postures (eg, sit, stand, walk, run) • Activities that increase spinal loading (eg, lift, cough, sneeze, Valsalva, heavy resistance exercise) • Axial vibration (eg, road vibration, operating heavy equipment)	• Stiffness when reversing joint position after a period of time in that position (eg, rising to standing after prolonged sitting, getting up after prolonged recumbency)	• Postures creating contact pressure over sensitive tissues or structures (eg, spinous processes, gluteals, greater trochanter	• Postures requiring sustained muscle effort (eg, erect sitting without back support, standing without support)
Easing factors	• Avoidance of symptomatic joint positions and postures	• Reclined sitting • Recumbency • Elastic or rigid corset or weight belt	• Motion (eg, walking, rocking, pelvic tilt)	• Avoiding pressure on sensitive structures	• Reclined sitting • Recumbency
24-hour behavior	• Night and AM depend on choice of postures and sleep surface. • Daytime: No consistent pattern	• Night and mornings symptom free in pure WB sensitivity • Worse through waking hours assuming continued WB	• Night and mornings: stiffness and/or pain is common • Daytime: no consistent pattern. Symptoms may be absent or present depending upon frequency of positional and postural changes	• No consistent pattern	• Night and AM: Symptoms are rare • Daytime: No consistent pattern

Abbreviations: F, flexion; E, extension; Rot, rotation; SB, side bend; WB, weight bearing; NWB, non-weight bearing; TTA, thigh torso angle

Implementation of the FLCRF may help novice clinicians implement deductive reasoning through the formation of functional loss hypotheses based on the patient interview. From thorough questioning around aggravating and easing factors and a 24-hour symptoms cycle, paired with observations of patient behavior, the functional loss hypothesis(es) can be supported or refuted. The hypothesis(es) will, in turn, direct the prioritization of self-management interventions. As an example, consider a patient who reports discomfort with sitting and forward bending, leading to a Position Sensitivity with an extension preference hypothesis. The interview should question the impact of standing, walking, lying supine or prone, or sitting with the lumbar spine biased toward extension. If this line of questioning confirms easing of symptoms with extension, a follow-up question might look at the response to sidelying in a fully flexed posture to clarify whether weight-bearing is required to trigger the position sensitivity. The clinician may expect that flexion-based examination procedures could increase patient symptoms and the clinician may decide to save these tests until the end of the exam or examine them with less vigor. Likewise, day one interventions could focus on patient education related to avoidance of flexed positions and promotion of extended positions.

As another example, complaints of waking at night and increased morning stiffness or pain might trigger hypotheses of constrained posture, position or pressure sensitivity. The clinical reasoning to confirm a constrained posture sensitivity hypothesis includes the expectation of consistent waking and morning symptoms regardless of sleep posture. To confirm a position or pressure sensitivity hypothesis, the expectation would be waking and morning symptoms linked to a particular posture. Additionally, the pressure sensitivity hypothesis would require a posture that produced pressure on a particular body region.

The FLCRF concepts can help to sharpen the clinician's observation skills as they watch the patient move during the interview process. With a mindset for developing a functional loss hypothesis, observation of postural and movement strategies may help to streamline the physical exam and inform sequencing to avoid excessive symptom aggravation. For example, a patient with weight-bearing sensitive low back pain may be observed

Table 2. Interview Questions to Assist with Classification Using the FLCRF

Category	Interview Questions
Position sensitive	• Are there consistent positions, postures, or activities that cause and ease your symptoms? If so, how long does it take for your symptoms to begin and what is the maximum you can tolerate? • If sitting, bending, standing, and walking all provoke symptoms, which one or two are the worst? • If you wake at night due to symptoms, are you in consistent postures, (eg, back, side, stomach)? • If lying on your back causes symptoms, do they improve with a pillow or two under your knees? • If you have increased symptoms in the morning, do you wake in consistent postures (eg, back, side, stomach)?
Weight-bearing sensitive	• Do all upright postures and activities cause symptoms whether sitting, standing, or walking? • From morning to afternoon to evening is there a pattern to your symptoms related to the time of day, or do they change by activity? • Do your symptoms improve, worsen, or stay the same as the day goes on regardless of your activity? • Do symptoms change when lying down or sitting reclined? If symptoms ease, how long does it take and how often must you do it?
Constrained posture sensitive	• Tell me how your symptoms change when you are in a static posture such as sitting, standing, or lying down for a prolonged time. • If one of these postures provokes your symptoms, how long does it take for symptoms to begin and what is the maximum you can tolerate? • Are you waking at night? If yes: o Is it related to a consistent posture (eg, back, side, stomach)? o How many times do you wake at night? o What do you have to do to return to sleep? o How long does it take you to return to sleep? • Do you consistently experience increased morning pain or stiffness? If yes: o Does this depend upon the posture you are in when you wake up? o How long does the morning symptom take to ease? • Does moving from sitting to standing provoke symptoms? If yes: o How long do you have to sit for this to occur? o How long does it take for symptoms to ease?
Pressure sensitive	• Tell me if there are sensitive parts of your body when you put pressure on them with sustained sitting or lying on your back, sides, or stomach.
Static muscle effort sensitive	• Do you feel pain or fatigue when you sit or stand erect without support? • Do you tend to sit on your legs or with your legs wound around each other? • Do you sit in the passenger seat of the car with a foot on the seat or on the dashboard? • Do your symptoms change when you lie down? If symptoms ease, how long does it take to ease?

unweighting themselves on stiff arms while sitting or may request to lie down during the interview. The patient with constrained posture sensitivity may be observed shifting their weight while standing or sitting. The patient who prefers to sit reclined and worsens when advised to sit erect may have a weight-bearing or static muscle effort sensitivity.

The organization of interview data and initial observations into symptom patterns within the FLCRF has the potential to facilitate clinical reasoning skills toward inductive reasoning through the early recognition of patterns of symptoms. Familiarity with each symptom pattern of the FLCRF can help to organize clinical information as it is gathered and, in the context of the patient's own story, assist the clinician in making management decisions.

The FLCRF is a clinical reasoning tool for the clinician to understand the patient's functional limitations and participation restrictions so they can translate the findings into patient-friendly language using understandable terms while avoiding pathoanatomical terminology.

Explaining the 5 symptom patterns of the FLCRF may be less threatening than pathoanatomical explanations and facilitate a patient to become an observer of their symptom behavior, helping them to "make sense of their pain"[48] and potentially diminish pain-related fear.[49] Perhaps the most valuable use of the FLCRF is the promotion of patient-centered and patient-driven care. The FLCRF seeks to engage the patient as an active participant in their rehabilitation, provides a roadmap of immediate intervention options, empowers patients to more effectively use compensatory postures and movement strategies to manage existing conditions and improves self-efficacy in management of symptoms. It also encourages problem-solving of ergonomic challenges and helps in making decisions on furniture modification or purchases.

Recent concerns have arisen regarding the utility of classification systems in general[50,51] faulting them for being "unidimensional and reductionist".[52] Karayannis et al[52] postulated that the variety of subgrouping schemas have evolved because one method cannot apply to the diverse pool of patient characteristics or represent the benefits of a diversity of assessment viewpoints. Recently, there have been attempts to look at the relationships between LBP classification systems.[52-56] Hodges[57] proposed a hybrid model integrating a variety of subgrouping schemas. While we recognize that the FLCRF lacks a psychosocial dimension, the FLCRF may complement the more established classification systems for LBP and evolving classification systems for other body regions.[58-62] Given that the FLCRF hypothesis is primarily derived from the interview process, combining with other classification

models that are more focused on the physical examination may lead to a more integrated management approach as suggested by Karayannis et al.[52] The FLCRF has a purpose in common with all of the classification systems: to guide clinical reasoning in the choice of corrective and compensatory interventions. The FLCRF moves beyond clinician centered interventions to provide actionable steps to facilitate patient empowerment in the management of their symptoms through environmental and ergonomic modifications.

The major limitation of the FLCRF is that it has not undergone the rigorous process of reliability and validity testing. Further research related to the refinement of symptom patterns and the development of an algorithmic approach to patient interviewing and examination is required. We must discover how this clinical reasoning framework intersects with the other classification systems currently in the literature.

CONCLUSION

The FLCRF serves as a deductive reasoning framework to complement the emerging classification systems currently proposed and under investigation in the literature. The FLCRF has been a valuable clinical reasoning tool in training orthopedic manual physical therapists in the Kaiser Permanente Northern California Orthopaedic Manual Physical Therapy Fellowship for over 30 years and has the potential to inform novice clinicians and other experienced clinicians interested in refining their interview skills and sharpening their observation skills to inform their clinical decisions. The FLCRF assists clinicians in educating patients on self-management issues including body mechanics, ergonomics and sleep hygiene and facilitates self-efficacy from day one of patient care. The FLCRF supports the collaboration between patient and clinician required for effective and efficient patient-centered care.

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Glenohumeral Internal Rotation Loss in a Non-throwing Older Adult

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ABSTRACT

Background and Purpose: Shoulder pain is a common musculoskeletal condition that impacts 14.7 per 1000 patients per year in a primary care setting. One cause of shoulder pain is glenohumeral internal rotation deficit (GIRD). This case report contributes to the limited research on optimal management of a non-throwing older adult referred to physical therapy with posterior shoulder pain, likely caused by GIRD. **Case Description:** The patient was a 75-year-old male with a 3-month history of insidious left shoulder pain. Range of motion and functional deficits were identified, and the patient's DASH score indicated 20% disability. **Outcomes:** After 5 visits over 6 weeks, the patient's DASH score improved to 7% disability and the patient reported no limitations with his daily functional activities. **Conclusion:** The pathomechanics of GIRD that may occur in the non-throwing patient are not well understood but were successfully managed in this case with multimodal physical therapy including manual therapy and exercise.

Key Words: clinical reasoning, GIRD, physical therapy, range of motion, shoulder

BACKGROUND

Shoulder pain is a common musculoskeletal condition that impacts 14.7 per 1000 patients per year in a primary care setting.[1] The shoulder complex consists of the lower cervical spine, upper thoracic spine, scapula, rib cage, sternoclavicular joint, acromioclavicular joint, and glenohumeral joint. Additionally, many muscles including the deltoid, pectoralis major, supraspinatus, infraspinatus, teres major, and teres minor contribute to the shoulder complex along with other tissues such as ligaments, articular cartilage, joint capsule, and bursae. Most of these tissues can be sources of nociception, making the path to a clear diagnosis challenging. The point prevalence of shoulder pain ranges from 6.9-26%.[2,3] Shoulder pain affects women more frequently than men and is more prevalent after the third decade of life.[2] In the United States there are approximately 4.5 million shoulder pain related patient visits each year.[4] Common causes of shoulder pain include rotator cuff dysfunction, adhesive capsulitis, and glenohumeral osteoarthritis. These conditions account for 10%, 6%, and 2% of persistent shoulder pain, respectively.[4] Common risk factors for shoulder musculoskeletal conditions include smoking, alcohol consumption, depression, sleep disorders, and sedentary lifestyle.[5,6]

The glenohumeral joint is a diarthrodial synovial joint between the humeral head and the glenoid fossa, thus allowing for movement in all planes, and is often called the "most mobile, least stable joint in the body."[7,8] Several passive and dynamic restraints contribute to the stability and mobility of the shoulder. Passive restraints include the glenoid labrum; joint capsule; superior, middle, and inferior glenohumeral ligaments; coracohumeral ligament; and coracoacromial ligament. Dynamic control of the glenohumeral joint comes from several muscles including the supraspinatus, infraspinatus, subscapularis, teres minor, teres major, and deltoid. The dynamic and passive structures of the glenohumeral joint create the spinning, rolling, and gliding of the humeral head necessary for normal movement.[9] Changes in these structures due to injury or degeneration can alter the normal mechanics of the joint and lead to shoulder pain.

Another cause of shoulder pain may be glenohumeral internal rotation deficit (GIRD). This condition is commonly seen in overhead athletes but can also occur in the general population. Repeated overhead, maximal external rotation may result in loss of internal rotation range of motion, posterior capsular tightness, scapular dyskinesia, and posterior rotator cuff tightness leading to changes in the glenohumeral joint center of rotation.[10,11] This change in arthrokinematics causes increased anterosuperior humeral head positioning during flexion and posterosuperior positioning during external rotation.[11] These alterations have implications for injury due to the increased compressive and tensile forces at the glenohumeral joint.[9,11] In cadaver studies posterior joint capsule contracture has been shown to alter joint kinematics and reduce range of motion.[12] Clinically, this posterior capsule contracture can manifest as a reduction in horizontal adduction and/or internal rotation range of motion.[12] In throwing athletes, loss of internal rotation range of motion can be normal and asymptomatic. This change in range of motion may be caused by excessive humeral retrotorsion, posterior capsule thickening, and/or muscular tightness.[11] In anatomic GIRD, the throwing arm may present with an 18-20° loss of internal rotation but have a symmetrical total range of motion.[13] This condition is considered pathologic when the loss of internal rotation is greater than 18-20° and a greater than 5° loss of total range of motion is present.[13] Glenohumeral internal rotation deficit has been associated with other pathologic conditions, including rotator cuff and glenoid labrum tears.[9]

Conservative treatment is typically the first step in treating GIRD. The rehabilitation process begins by addressing impairments such as posterior capsule tightness, periscapular muscle weakness, and scapulohumeral dynamic control.[9,14] Conservative care also consists of a structured "return to throwing protocol", with close monitoring of the patient's symptoms.[15] If 6-8 weeks of conservative treatment fails to resolve the impairments, magnetic resonance imaging or magnetic resonance arthrogram are recommended.[9] Magnetic resonance imaging may reveal rotator cuff tears, bony cystic changes, and glenoid chondral wear. Magnetic resonance arthrogram is more sensitive for articular surface rotator cuff tears and labral tears that may be present with GIRD.[9] Glenohumeral internal rotation deficit in the dominant arm of throwing athletes has been widely studied but the development of this condition in the general population is not well understood and minimal clinical research exists to guide management.[15] The purpose of this case study is to contribute to the limited research on optimal management of a non-throwing older adult referred to physical therapy with posterior shoulder pain, likely caused by GIRD.

CASE DESCRIPTION

History

The patient was a 75-year-old male who was referred to physical therapy with a 3-month history of insidious left shoulder pain. The patient described his pain as throbbing, aching, and dull that was primarily located in the superior-lateral aspect of his left scapula. He denied any pain in his neck, upper trapezius, periscapular area, or any other aspect of the left upper extremity. The patient rated his pain at 4/10 at worst, and 0/10 at best on the Numerical Pain Rating Scale. He denied any numbness or tingling. His pain was worse with overhead activity, lifting anything heavier than a coffee cup, activities such as cooking for more than 15 minutes and sleeping more than 3-4 hours. He got relief for 2-3 hours only with the use of a heating pad or when he took a nonsteroidal anti-inflammatory drug. There were no red flags including recent trauma or falls, unexplained weight loss, bilateral extremity numbness, history of cancer, changes in bowel or bladder habits, or unrelenting pain at night. He had no prior history of shoulder pain, shoulder injuries, or surgeries. His medical history included diabetes, depression, hypertension, high cholesterol, and lower extremity peripheral neuropathy.

The patient was retired but he provided care for his sister that included meal preparation, light housework, and laundry. He did not have to perform yard work or house cleaning, for which he had help. The patient did not have any previous treatment or shoulder imaging before his physical therapy appointment.

The patient's goal for physical therapy was to be able to sleep for at least 6 hours, lying on either side of his body without being woken up by shoulder pain. After the subjective information was gathered, several differential diagnoses were considered including cervical radiculopathy, rotator cuff tear, adhesive capsulitis, and impingement syndrome.

Evaluation

A Disabilities of Arm Shoulder and Hand (DASH) score was obtained. The DASH is a self-report measure that asks questions about pain and difficulty with various activities of daily living to generate a disability score that ranges from 0-100% with greater scores indicating a greater level of disability. The patient's score was 20% indicating disability with moderate levels of pain and difficulty sleeping, as well as mild difficulty opening a jar, performing household chores, and participating in social activities.

The initial examination included postural assessment, palpation, cervical range of motion screen, shoulder active and passive range of motion, manual muscle testing, special testing, and joint play assessment. Neurological examination was deferred at this time due to the patient's pain pattern as well as a lack of reported upper extremity paresthesia, radiculopathy, or motor weakness.

He displayed rounded shoulders, forward head posture, and increased thoracic kyphosis in standing. The patient's cervical range of motion was within functional limits in all planes, pain free with overpressure, and did not change the pain in his shoulder. Cervical special tests included Spurling's A, distraction, and upper limb tension test A, which were all negative. His left shoulder active range of motion assessment displayed 140° of shoulder flexion, 140° of abduction, full external rotation, and functional internal rotation in standing was to L5, a 25% loss. Passive glenohumeral rotation range of motion was measured, with the patient in supine the ABIR (internal rotation in 90° abduction) was 50° with a firm and painful end feel and 60° on the right with a normal end feel. The ABER (external rotation in 90° abduction) was 70° on the left with a firm and painful end feel, and 80° on the right with a normal end feel. The patient displayed normal right shoulder strength in all planes. However, on the left, strength was 4/5 for flexion, external rotation, and abduction. The impingement cluster described by Park et al[16] was negative with only 1 out of 3 special tests (infraspinatus test) being positive. The Empty Can, Drop Arm, and Speed's tests were negative. The scapular assistance test was positive for scapular dyskinesia as indicated by decreased shoulder pain with active elevation by the patient while the therapist assisted scapular upward rotation. Glenohumeral mobility was assessed with passive glides, indicating limitations both posteriorly and inferiorly on the left side. Finally, the patient reported tenderness to palpation throughout the left infraspinatus muscle belly. The subjective and objective data were synthesized to form a working clinical diagnosis.

Diagnosis

Based on the patient's subjective reports and objective findings, it was hypothesized that his pain was due to GIRD and posterior glenohumeral capsular tightness. This hypothesis was added to the differential diagnosis list by excluding other more common shoulder pathologies that did not fit the patient's presentation. This diagnosis was based on the location of symptoms, greater than 5° loss of total glenohumeral rotation range of motion, 10° loss of internal rotation range of motion, limited glenohumeral joint mobility, and tenderness in his left infraspinatus.[10,13] Subacromial impingement syndrome was ruled out due to the location of his symptoms and the negative impingement cluster. Cervical radiculopathy was ruled out by absence of numbness, tingling, or pain past the acromial clavicular joint; no reproduction of symptoms or limitations with cervical active motion with overpressure; and a negative radiculopathy cluster as described by Wainner et al.[17] The patient's presentation did not match adhesive capsulitis because of an absence of a greater than 25% loss of active and passive motion in 2 planes of shoulder range of motion and because the patient had more than 30° of external rotation.[18] Rotator cuff tear was not as likely based on the other examination findings including negative empty can, negative drop arm, and negative painful arc tests.[16]

Intervention

The patient was seen once per week for a total of 5 visits for 5 weeks. The interventions included manual therapy with scapular retraction, posterior capsule stretch, and sleeper stretch to initiate the patient's home exercise program during the first visit. The goal of the initial home exercise program was to address the patient's posture and to begin to normalize range of motion. Scapular retraction was instructed with the patient in the sitting position by asking the patient to draw his scapulae posteroinferiorly, held for 5 seconds, and repeated 10 times for 2 sets.

The posterior capsule stretch was performed in standing against a wall. The patient was asked to bring his arm into horizontal adduction, while keeping his scapulae against the wall, until a stretch was felt in his posterior shoulder. The patient performed the sleeper stretch in left sidelying with his arm abducted to 90°. The patient then internally rotated his left shoulder with the help of his right hand, until a stretch was felt in the posterior shoulder. The patient was instructed to hold all stretches for at least 30 seconds and repeat 3 times, for a total of 2 minutes per day and perform two times a day.

At his second visit, the patient reported less constant and less severe pain. He rated his pain at 1/10 and noted only one episode of 4/10 pain since the evaluation. The focus of the second session was to improve shoulder range of motion with manual therapy. Interventions included long axis distraction of

Figure 1. Mid-Range, Long Axis Distraction Mobilization of the Glenohumeral Joint

Figure 2. Mid-Range, Anterior to Posterior Mobilization of the Humeral Head

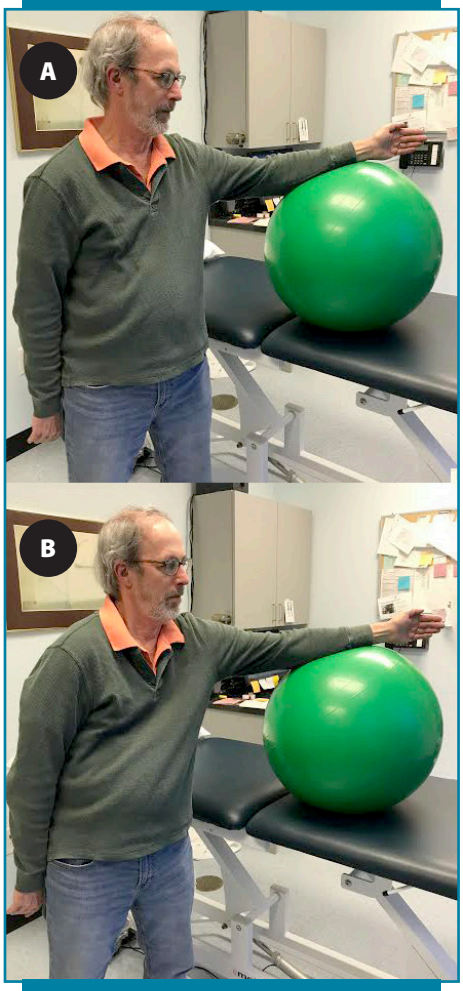
the glenohumeral joint (**Figure 1**), posterolateral glide of the humeral head (**Figure 2**), and manual stretching. Long axis distraction mobilization was performed with the patient in supine and therapist sitting. The patient's arm was abducted to approximately 30° and a long axis traction force was applied by the therapist with one hand, while the therapist's other hand blocked the scapula in the axilla. The posterolateral glide of the humeral head was performed with the patient in supine, with the arm abducted to approximately 60° and the therapist standing. A posterolateral force was applied to the humeral head at the anterior joint line. Grade 3, oscillatory mobilizations were provided for 45-second bouts and repeated 3-4 times based on the patient's tolerance for each technique. Following the intervention, the functional internal rotation range of motion improved as the patient was able to reach behind his back to L3 (L5 at initial evaluation).

For the next 2 visits, the patient was treated with a combination of joint mobilizations, posterior capsule stretching, and scapular strengthening. At the fourth visit with a notable decrease in pain levels, external rotator strengthening and resistance for periscapular exercise was added to the rehabilitation regimen. External rotation on the left was performed with the patient in sidelying with his arm at 0° of abduction using a 1-pound weight. Scapular strengthening was progressed to bilateral glenohumeral external rotation with scapular retraction using a level 2 (red) Theraband™. Both exercises were repeated 10 times and 2 sets were performed during the session. Periscapular strengthening exercises were also added to include the serratus anterior and lower trapezius muscles. Serratus anterior strengthening was performed by placing the patient's forearm on a theraball on a table and having him protract and retract his scapula in standing (**Figure 3**). The exercise to target his lower trapezius was performed by having the patient perform wall slides with a level 1 resistance loop around his wrists in standing (**Figure 4**). These exercises were both repeated 10 times for 2 sets. The patient was instructed to perform the strengthening exercises at least one time per day and stretching for a total of 2 minutes per day at home as well.

Outcomes

With the employed interventions, the patient demonstrated excellent improvement in pain, motion, and overall function. By the fourth visit, he reported being able to sleep through the night without being awoken by pain. His functional internal rotation improved enabling him to reach T10 behind his back. His flexion and abduction both improved to 165° and his strength also improved to 5/5 for flexion, abduction, and internal and external rotation. He completed the DASH at the final visit, with a change in his score from 20% to 7% disability, which met the minimal clinically important difference of 10 points.[19] After the course of treatment, the patient was able to perform self-care, home care, sleep, and reach with his left hand, all without limitation or pain. The patient met all short-term and long-term goals that were established at his initial visit before discharge.

Figure 3. Serratus Anterior Strengthening In Standing



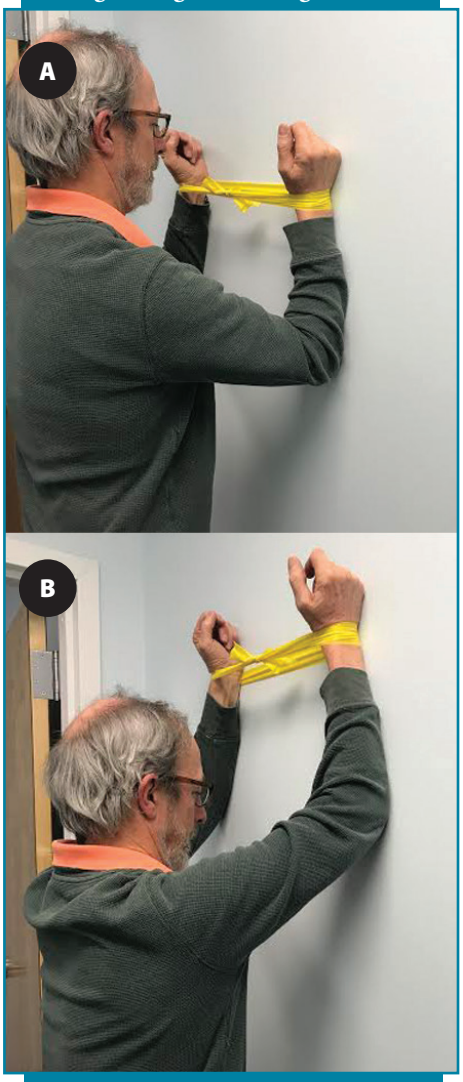
A, Starting position. B, End position.

Discussion

This case report describes the physical therapy management and successful return to a prior level of function for a patient with an insidious onset of posterior left shoulder pain. The impairments associated the with diagnostic hypothesis of GIRD and posterior glenohumeral capsule tightness were treated with a multimodal approach.

Evidence supports the use of the interventions applied in this case to treat the patient's impairments. Glenohumeral joint mobilizations can reduce pain, improve range of motion, and reduce posterior shoulder tightness.[20,21] Yu et al[22] suggest that an end-range joint mobilization can be used to improve internal rotation range of motion. These mobilizations may be addressing the posterior capsule contracture that is observed in cadavers or it may be producing hypoalgesia through neural pathways.[12,23] Joint mobilizations may decrease the excitability of central nociceptive pathways, which can

Figure 4. Lower Trapezius Wall Slide Strengthening in Standing



A, Starting position. B, End position.

lead to decreased pain.[22,23] These mechanisms have been suggested but are still uncertain. Another intervention that may improve range of motion and pain is posterior glenohumeral capsule stretching.[20,21,24] A reduction of this tightness may reduce anterior humeral translation and restore the normal center of rotation of the glenohumeral joint.[10] Additionally, scapular strengthening was a component of this patient's plan of care. Scapular strengthening can improve pain and function for patients with other forms of shoulder pain, but no direct link has been established for patients with GIRD.[14,25]

Currently, the majority of clinical research on GIRD focuses on overhead throwing athletes. The pathomechanics of this condition in the general, non-throwing population are not well understood. Non-throwing patients with GIRD may be mistakenly treated for more common shoulder conditions such as impingement or adhesive capsulitis. In this case being able to identify the patient's impairments of glenohumeral internal rotation range of motion loss, total glenohumeral rotation range of motion loss, and location of symptoms led to more appropriate interventions and a satisfactory outcome.

CONCLUSION

This case report outlines the clinical decision making used for an older patient with atypical shoulder pain. The treatment approach utilized exercises recommended for patients with GIRD despite the limited research for older, non-throwing patients. The use of evidence-based interventions to treat the patient's specific impairments created a positive result. Further research to better understand how GIRD also impacts the general population may lead to the more effective management of this condition.

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Survey of Ballet Dance Instructors and Female Dancers Concerning Perception of Dance-related Pain and Injury

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ABSTRACT

Background and Purpose: Up to 95% of ballet dancers sustain at least one injury yearly. Yet, investigators know little concerning dance instructors' and dancers' perspectives on dance-related pain. The purpose of this study was to gain an understanding of the perception of pain among ballet dance instructors and female dancers *en pointe* and their utilization of healthcare practitioners across the United States, specifically physicians/doctors and physical therapists. **Methods:** A non-probability survey was distributed online using REDCap™ secure web application targeting ballet dance instructors and dancers who train *en pointe*. **Results:** A total of 202 respondents ($n_{instructors}$=71; $n_{dancers}$=131 [21.9±7.6 y.o.]) completed the survey. Dancers reported performing at higher pain levels and seeing a doctor for dance-related pain less often than instructors perceived ($p < 0.01$). The majority of instructors and dancers reported the dance instructor determined pointe readiness (94% and 90%, respectively) while the remaining reported consulting either a physician, physical therapist, or "other". **Clinical Relevance:** Negligible utilization of health care practitioners by dancers indicate that this is an underserved, vulnerable population. **Conclusion:** This study provides evidence that dance-related pain is often ignored. High rates of injury may be due, in part, to the cultural norms of dancing in pain, refusal by many dancers to consult with health care practitioners, and apparent lack of communication between dancers and instructors.

Key Words: ballet dancers, health risk, pain perception, quantitative survey

INTRODUCTION

To most, the "Sugar Plum Fairy" dancing effortlessly *en pointe* (standing on the toes in pointe shoes with maximum flexion of the ankle joint)[1] is the iconic classical ballet dancer. However, few people who start dancing in their youth ever reach the professional level[2] and as many as 95% of those professional dancers sustain at least one injury yearly.[3-9] Although many of the fundamental risk factors of dance-related injury are known,[8,10-12] injury prevalence among ballet dancers has not changed since first studied in the 1960s.[13,14] Much of the dance medicine research to date focuses on epidemiology of injury, which emphasizes the need to develop concrete, operational definitions of injury and validate tests and measures for the dance population, such as those used in sports medicine.[15] Only recently have investigations included the high prevalence of dance-related pain[16-23] and explored the fundamental underpinnings the impact of dancers' pain perception have on their health and performance.[9,16-21,24-29] Encarnacion et al[30] quantified dancers' pain coping strategies using the Sports Inventory for Pain (SIP). The authors reported that dancers cope with pain differently than other athletes but found no significant differences between coping styles among ballet dancers, regardless of skill level.[30] Although not significantly different, the higher-skilled dancers who participated in their study, trended towards coping levels commensurate with other elite athletes in highly competitive environments,[30] further reinforcing the importance of describing how dancers perceive and manage pain.

Long-term health ramifications are rarely considered by dancers at any level, as dance-related pain and injury are part of the cultural norm.[17,19-21,27] Many dancers perceive that pain is mostly unavoidable in dance[17,19] and do not readily consult with health care practitioners when injured.[31,32] Many avoid communicating pain to dance instructors or choreographers. Some dancers interviewed described the fear of losing their job and performance roles.[20,24,29] Others reported feeling intimidated by the choreographer, stating that they viewed themselves as inferior within the hierarchy of the dance company.[20] Two surveys, one of adult dancers representing various dance forms from the United Kingdom[21] and another of injured dancers from a single, private dance school in the United States,[33] found similar results regarding the negative perception of dancers to report pain and injury. Both studies concluded that negative perceptions might prevent dancers from consulting with health care practitioners. Notwithstanding, a current review of the literature alludes to a paucity of evidence on how ballet dance instructors and dancers who perform *en pointe* perceive dance-related pain or how the specialized training regimens may contribute to their population-specific injury prevalence.

The purpose of this study was to gain an understanding of the perception of pain among ballet dance instructors and dancers who dance *en pointe* and their utilization of health care resources across the United States. The first aim of this study was to compare the perception of pain and dance-related injury of ballet dance instructors and female dancers. The second aim examined the perception of health care use among ballet dance instruc-

tors and female dancers after experiencing dance-related pain and when determining the dancers' pointe readiness.

METHODS

Study Design and Questionnaire

The University of Oklahoma Health Sciences Center (OUHSC) Institutional Review Board approved the study protocol. The self-assessment survey was created for this pilot study using the OUHSC Biomedical and Behavioral Methodology Core (BBMC) REDCap™ system. The inclusion criteria for the dancer respondents were that they are female and dance *en pointe*. The inclusion criteria for the instructor respondents were that they teach ballet in the United States. This study limited participation to instructors within the United States because the first half of the survey focused on gathering information about training regimens in the 3 common studio types in the United States: pre-professional, competition, and recreational studios. Although pre-professional and recreational studios are found worldwide, competition dance studios are unique to the United States.

To validate item clarity, a small subsample from the target population, including two dancers and two instructors, gave feedback on survey question content and readability, which necessitated reformatting of several questions before dissemination. Neither sample retesting nor statistical validation was conducted (eg, sensitivity, specificity, or Cronbach's alpha). Distribution of surveys occurred through snowball sampling on social media platforms (eg, Facebook, Instagram) and email blast specifically to ballet dancers and instructors using the online REDCap™ secure web application. Respondents answered the questions anonymously, no private health information was acquired, and participants could stop the survey at any time. The dancer survey questions were written at a sixth-grade reading level. Instructions for answering questions using the Wong-Baker FACES® Pain Rating Scale were written verbatim as instructed by the Wong-Baker FACES Foundation (**Figure 1**).[34]

Survey question one asked respondents if they were at least 18 years old. If they chose a positive response, then they were asked to consent to participation. Participants who responded negatively to question one indicated they are under the age of 18 years and were prompted to obtain parental consent. Branching logic directed the respondent to either the questions for the ballet dance instructor or dancer once they identified as either a ballet instructor or dancer (**Table 1**). The first subset of questions of training regimens was posed to all respondents (n=207). It included a question regarding the individual who determined when dancers are ready to commence pointe work. The dancers were given 5 answer choices (My Ballet/Pointe instructor, My doctor, Physical Therapist,

Figure 1. Wong-Baker FACES® Pain Rating Scale Used in the Current Study[34]

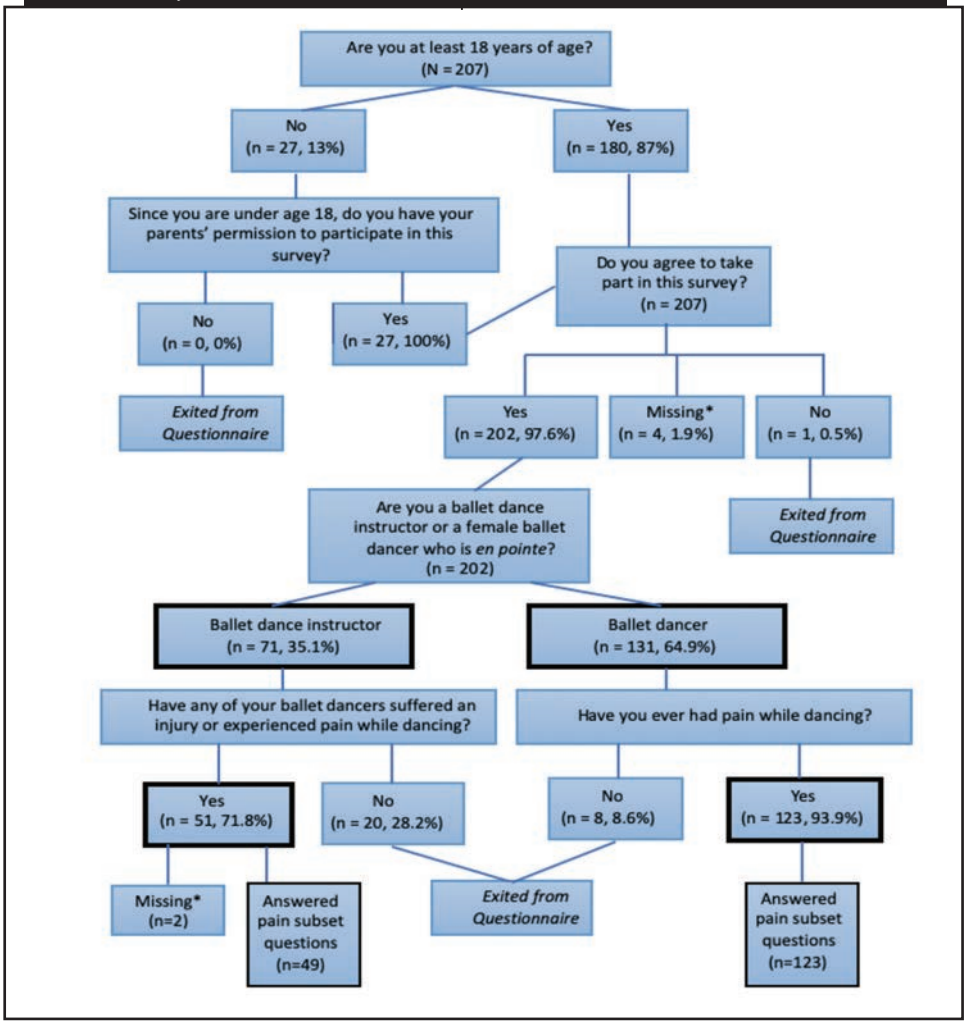
Instructions for Usage

Explain to the person that each face represents a person who has no pain (hurt), or some, or a lot of pain.

Face 0 doesn't hurt at all. Face 2 hurts just a little bit. Face 4 hurts a little bit more. Face 6 hurts even more. Face 8 hurt a whole lot. Face 10 hurts as much as you can imagine, although you don't have to be crying to have this worst pain.

Ask the person to choose the face that best depicts the pain they are experiencing.

Table 1. Branching Logic and Response Frequencies of the Survey Used in the Current Study



Other, I don't know) and the instructors were given 4 answer choices (Myself [Ballet/Pointe instructor], Physician, Physical Therapist, Other or Not Applicable). When respondents chose the option of "Other" or "Other or Not Applicable," branching logic directed them to a space to record their response. The subset of questions related to the dancers' pain experience was only asked of those who answered "yes" to the first pain subset question regarding dancers experiencing pain while dancing (**Table 1**). Using branching logic, a "no" answer signaled the web application to end the survey and directed the respondent to exit from the questionnaire. Descriptive frequencies and proportions using a Likert Scale (Never, Rarely, Sometimes, Almost Always, Always) and the Wong-Baker FACES® Pain Rating Scale (**Figure 1**) allowed for between group comparisons. The survey questions about pain perception and use of health care resources (**Table 2**) each reflected the main theme to enable group comparisons.

Table 2. Pain Subset Questions
Section headers asked respondents: ***In general, please rate the following.***

A. Instructor Questions		
Section	Question	**General theme**
Likert scale questions*	How often do your dancers keep dancing when they have pain?	Ability to dance in pain
	How often do your dancers report pain to their instructors?	Report pain to instructor
	How often do your dancers go to a doctor when they are in pain?	See a doctor when in pain
Wong-Baker FACES® Pain Scale questions	On average, what level of pain you think your dancers are in before they will tell you they are injured or in pain?	Report pain to instructor
	Of your top three dancers, what do you think is their highest level of pain they can tolerate to continue dancing without compromising technique or stage presence?	Before stage presence compromised
	What level of pain/injury do you feel you should insist the dancer sits out to prevent further injury or pain?	Stop to prevent further injury
	What level of pain/injury is appropriate for the dancer to be replaced by an understudy during a rehearsal?	To be replaced during rehearsal
	What level of pain/injury is appropriate for the dancer to be replaced by an understudy during a performance?	To be replaced during performance
B. Dancer Questions		
Section	**Question**	**General theme**
Likert scale questions*	How often do you keep dancing when you are in pain?	Ability to dance in pain
	How often do you tell your dance teacher when you have pain?	Report pain to instructor
	How often do you see a doctor when you have pain?	See a doctor when in pain
Wong-Baker FACES® Pain Scale questions	The level of pain you will tell your dance teacher you are hurting.	Report pain to instructor
	The highest level of pain you can hide from people watching you dance.	Before stage presence compromised
	The level of pain you should stop dancing so the injury does not get worse.	Stop to prevent further injury
	The level of pain you will stop dancing during a rehearsal.	To be replaced during rehearsal
	The level of pain you will stop dancing during a performance.	To be replaced during performance
* Likert scale question answer choices: Never, Rarely, Sometimes, Almost Always, Always		

Statistical Analysis

Due to the paucity of literature comparing the perception of pain between ballet dancers and instructors, the postulation that ballet dancers would report at least 10% higher pain level than instructors, formed the basis of the *a priori* power and sample size calculations. A range of *a priori* calculations of proportional differences between 10% and 30% yielded the total sample size ranges from 116 to 1,154 to achieve 80% power at an α of 0.01.

Likert scale responses of never, rarely, and sometimes were dichotomized as one response ("unable" or "never"), and the responses such as almost always and always were dichotomized as another response ("able" or "always"). Descriptive frequencies and proportions of dichotomized Likert responses reported among instructors and dancers were compared using Chi-square or Fisher's exact test, when appropriate. Wong-Baker FACES® Pain Rating Scale responses were assessed for normality among instructors and dancers. Initial assessment of the pain scale data using Shapiro-Wilks test of normality and data histograms indicated normal distributional assumptions were not valid. Therefore, the non-parametric Wilcoxon signed-rank test was used assuming the null hypothesis between groups. All statistical tests were computed using SAS 9.4 (Cary, NC). If the calculated p-value of the difference between groups was greater than 0.01, then investigators failed to reject the null hypothesis and concluded there is no difference between groups.

RESULTS

Respondents

Snowball sampling of the survey between February and May 2017 yielded 202 total responses from respondents who confirmed they were either a ballet dancer (**Table 3A:** n=131) or a ballet dance instructor (**Table 3B:** n=71). Of the 171 ballet dancers, 123 respondents (93.9% [99%CI: 88.5,99.3]) reported experiencing pain while dancing. Of the 71 dance instructors, 51 respondents (71.8% [99%CI: 58.1,85.6]) reported teaching a dancer who experienced pain or injury while dancing. The proportion of dancers reporting pain while dancing was higher compared to the proportion of instructors who reported teaching a dancer with pain or injury (**Table 3A:** X^2=18.77, df=1, p<0.01).

Likert Responses

Dancers were more likely than instructors to have an increased perception of dance ability while experiencing pain (X^2=40.1, df=1, p<0.01). Instructors perceived that their students report pain more than the dancers claim to report pain while dancing (X^2=25.7, df=1, p<0.01). Dancers reported seeing a medical doctor following dance-related pain significantly less often than dance instructors perceived this to be the case (X^2=29.5, df=1, p<0.01). These survey questions are listed in **Table 2** and descriptive frequencies and proportions of dichotomized Likert responses among dancers and instructors are reported in **Table 4**.

Wong-Baker FACES® Pain Rating Scale

Dancers reported dancing with a higher pain level before reporting pain compared to what instructors perceived students will tolerate before reporting (p<0.01). Dancers reported they hide that they are in pain at a greater level compared to the pain level instructors perceived their top 3 dancers could tolerate before compromising technique or performance (p<0.01). When asked the level of pain the dancer should stop dancing to prevent further injury or pain, dancers reported a higher level than the level the instructors perceived they should insist the dancer stops to prevent further harm (p<0.01). Dancers perceived a higher pain level is required to be replaced by an understudy during rehearsal, compared to perceived pain level the instructors report they would replace a dancer with an understudy during rehearsal (p<0.01). There was not a significant difference between instructors and dancers in the perceived pain level when a dancer should be replaced with an understudy during a performance (p=0.15). These survey questions are listed in **Table 2** and descriptive statistics for each of the pain scale variables are reported in **Table 5**.

Pointe readiness

Ninety percent of dance instructors reported they determine when their ballet dancers are ready to commence pointe. A physician reportedly determined pointe readiness 9% of the time while the remaining 1% selected "other" (n=1: "ballet mistress"; n=2 "Not Applicable"). Branching logic stratified dance instructor responses according to the three common studio types in the United States: pre-professional, competition, and recreational studios. The two instructors selected "not applicable" specifically regarding their subset recreational dancers who presumably do not train *en pointe*. Ninety-four percent of dancers reported their ballet teacher decided when they were ready to start pointe. A physician and physical therapist reportedly determined pointe readiness 3% and 1.5% of the time, respectively. The remaining 1.5% of dancers selected "other" (n=1: "My instructor spoke to a doctor about growth plates to see if they were mature enough."). None of the instructors chose "Physical Therapist" and none of the dancers chose "I don't know." Frequency data regarding the determination of pointe-readiness are reported in **Figure 2**.

Table 3. Ballet Dancer and Instructor Respondent Demographics for the Current Study

A. Ballet dancer demographics (n=131)

	Mean (SD)	Median	Min	Max
Age (y)	21.9 (7.6)	21	9	53
Age started ballet (y)	5.28 (3.81)	4	2	24
Age started pointe (y)	11.92 (2.70)	12	8	28

B. Instructor demographics of students (n=71)

	Mean (SD)	Median	Min	Max
Youngest dance student: age (y)	5.51 (3.22)	5	2	17
Oldest dance student: age (y)	24.03 (16.35)	18	3	80
Average age dancers start ballet (y)	4.70 (1.55)	5	2	8
Average age dancers start pointe (y)	11.93 (1.51)	12	10	15

Table 4. Frequency Counts for the Likert Scale Questions of the Current Study

A. Dancers experiencing pain while dancing ‡			
Pain/Injury	**Dancer or Instructor (p<0.01)**		
Frequency Col Percent	**Instructor**	**Dancer**	**Total**
Yes	51 71.83	123 93.89	174
No	20 28.17	8 6.11	28
Total	71	131	202
B. Ability to dance in pain *† ‡			
Ability to Dance in Pain	**Instructor or Dancer (p<0.01)**		
Frequency Col Percent	**Instructor**	**Dancer**	**Total**
Able	13 26.53	96 78.05	109
Unable	36 73.47	27 21.95	63
Total	49	123	172
C. Report pain to instructor *† ‡			
Report Pain	**Instructor or Dancer (p<0.01)**		
Frequency Col Percent	**Instructor**	**Dancer**	**Total**
Always	26 5306	19 15.45	45
Never	23 46.94	104 84.55	127
Total	71	123	172
D. See a doctor when in pain *† ‡			
Seek Medical Care	**Instructor or Dancer (p<0.01)**		
Frequency Col Percent	**Instructor**	**Dancer**	**Total**
Always	17 34.69	5 4.07	22
Never	32 65.31	118 95.93	150
Total	49	123	172

*Able and Always: dichotomized with responses of almost always and always; Unable and Never: dichotomized with responses of never, rarely, and sometimes
† Instructor: Missing 2 responses because 2 respondents exited the survey early.
‡ p<0.01

Post hoc power

The observed values from Aim 1 were used to calculate the *post-hoc* power. *Post hoc* power analysis revealed this study was adequately powered at 0.95 to detect differences between groups with the sample size of 202 and an observed effect size of 22.06%, assuming an α of 0.01.

DISCUSSION

The purpose of this study was to gain an understanding of the perception of pain among ballet dance instructors and dancers who are *en pointe* and their use of health care resources across the United States. Results from this study corroborate with previous authors that found dancers routinely continue performing through pain.[6,16,18-25,27,30,32,33,35] Nearly 94% of ballet dancers (n=123) reported experiencing dance-related pain and only 72% of ballet dance instructors (n=51) reported having taught dancers who experienced a dance-related injury or pain. Thus, comparing the perception of dance-related pain between groups was significantly different, with dancers reporting greater levels of pain than what dance instructors perceived. The differences between groups are supported by the aforementioned studies[21,33] that describe how dancers routinely choose not to inform their instructors or choreographers of dance-related pain or injury. The dancers' ability to dance in pain demonstrated an inverse relationship between group responses with 78% of dancers reporting "able" and 73% of instructors reporting "unable" to dance in pain. Nearly 85% of the dancers in the current study responded as "never" reporting pain to their instructor, whereas 53% of the dance instructors responded that their dancers "always" report pain. Further, the differences between group responses were reiterated when respondents rated the perceived level of pain the dancers' experience before reporting to the instructor. Synthesis of these results provides the rationale for why dance instructors perceived significantly fewer of their dancers' experience dance-related pain or injury than dancers reported.

The responses from the dancers in this study closely align with previous interviews of dancers who described the health risks they knowingly assumed when continuing to train and perform in pain.[19,20,36] Anderson and Hanrahan[24] found that professional ballet and contemporary dancers were not able to distinguish between performance pain (acute, routine discomfort, controlled by the athlete) and injury pain (chronic, outside of the individuals' control) irrespective of the severity of pain. Results from the current study reaffirm the conclusion that dancers push themselves beyond the pain level that they perceive will cause further harm and injury. Alarmingly, the median pain level where both groups perceived dancers should stop dancing to prevent further injury was lower than the levels, they perceived dancers should stop dancing in any of the other four scenarios presented.

Dance instructors were asked the pain level in which their "top 3" dancers could continue to perform without compromising their technique or stage presence. Inquiring specifically about their more advanced dancers was meant to create a focus for an otherwise broad-ranging question. However, the level of dancer respondents at their respective studios was not asked because both dancers in the testing subgroup reported that they did not know how to rank themselves and thought the question would confuse most of their peers.

The only variable that was not significantly different between groups was replace-

Table 5. Measures of Central Tendencies for Wong-Baker FACES® Pain Rating Scale Survey Questions: Mean (SD), Median, and Interquartile Range (IQR) by group (n=174: Dancers [n=123]; Instructors [n=51])

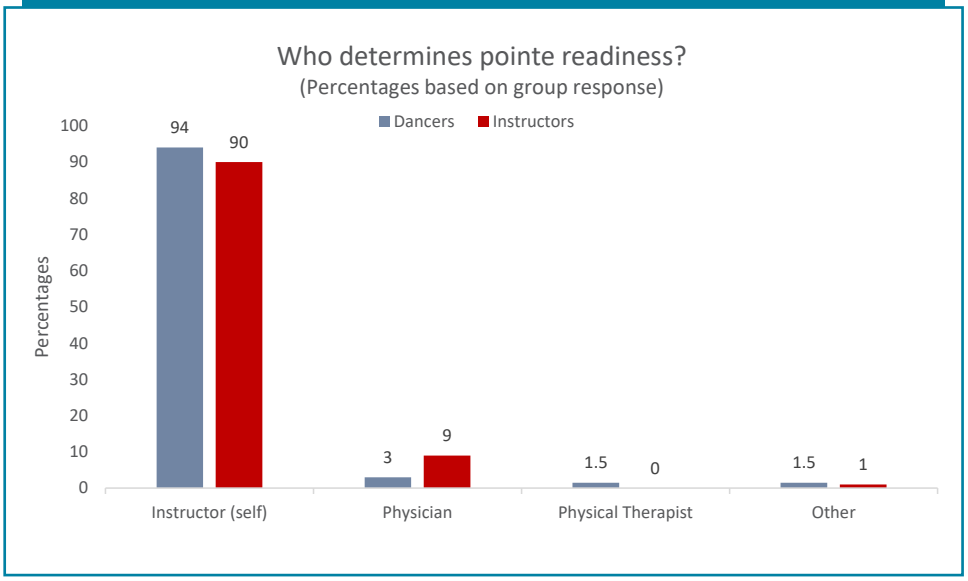
Survey Question: Asked to report "At what pain level" (0-10)	Median		Q1-Q3		Min-Max		Wilcoxon Exact test (p-value)
	Dancer	Inst	Dancer	Inst	Dancer	Inst	
Q1: Report pain to instructor	7	4	6-8	4-6	0-10	1-8	< 0.01*
Q2: Before stage presence compromised †	7	6	6-8	5-8	2-10	1-10	<0.01*
Q3: Stop to prevent further injury	6	5	5-8	4-6	0-10	1-9	< 0.01*
Q4: To be replaced during rehearsal	8	6	7-10	4-7	4-10	2-10	< 0.01*
Q5: To be replaced during performance	10	6	9-10	5-8	6-10	2-10	0.15

Abbreviation: Inst, Instructors
* p<0.01
† Referred question to the instructors "top 3 dancers"

ment of dancers during performance. These results corroborate with interviews of dancers who stated they have knowingly performed with significant injuries (eg, fractures) for reasons such as fear of admitting injury and having no one to replace them.[20,36] The old saying "the show must go on"[20] may provide insight as to why dancers who responded to this survey are willing to perform with a median of 20% more pain during a performance than a rehearsal.

There was a significant difference in the perception of when dancers see a doctor after experiencing dance-related pain with dancers reporting seeing a doctor less frequently than the instructors perceived. Both groups reported similar frequencies regarding the individual determining dancers' pointe readiness. Over 90% of the ballet instructors reportedly determined pointe readiness of dancers with little to no involvement from either a "physician" or "physical therapists". These results, coupled with the negative regard towards consulting with health care practitioners by dancers, indicate a need for better communication with the dance community. Future studies should include mixed-methodology with a quantitative survey followed by semi-structured interviews or focus groups that include both ballet dancers and instructors. This would allow further exploration of the barriers specific to ballet dancers *en pointe* and instructors from consulting with health care practitioners and allow for open communication between groups of dancers and instructors.

Figure 2. Question Pertaining to Who Determined Dancers' Pointe Readiness



Study Limitations

Questions posed to the dance instructors included "injury" in its inquiry without an operational definition of injury-type. This allowed respondents to use their perceived definition of injury. Future studies should allow for open-ended responses to expand the understanding of what "injury" means to dance instructors. The nature of the anonymous, non-probability sampling method via an electronic hyperlink negates the ability to know if only ballet dance instructors and dancers *en pointe* responded to the survey and if they only responded one time. Every attempt was made to convey the purpose of the survey in the introduction and explicitly describe the target population to reduce the chance of acquiring a non-probability sample.

Further, the total possible population of the survey distribution is unknown preventing calculation of the response rate. Future studies should include structured validation of survey questions, such as calculation of Cronbach's alpha and test-retest, and include a broader sample of instructors and dancers to increase the survey tools' generalizability.

Snowball sampling by electronic means may have limited the surveys' accessibility from those who do not use social media outlets, such as younger dancers, or those without a personal computer, tablet, or cellular phone. Self-selection bias may have occurred if dancers or instructors completed the survey based on a motivating factor. Likewise, non-response bias is a possibility if certain dancer-types were under-represented (eg, dancers who do not want to share their experiences, positive or negative, or have never been injured) or over-represented (e.g., dancers in chronic pain) causing estimator bias. Although self-report is the only way for individuals to convey their perceptions, the retrospective and potentially sensitive nature of these questions may have contributed to inaccurate recollection of past events and resulted in recall bias.[37]

CONCLUSION

Long-term consequences of routinely dancing in pain are often overlooked by dancers and frequently result in career-ending injuries, reducing quality of life.[17,30,36] The differences in perception of pain between the dancers and instructors observed in this study further bolster the evidence that dance-related pain and injuries are largely left untreated and impose significant health-risks, such as chronic musculoskeletal injuries. Negligible use of health care resources by dancers indicates that this is an underserved, vulnerable population with high prevalence of pain and injury.

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Management of Medial Patellar Luxation in Small Dogs and Cats: An Investigation into the Use of a Manual 3D Patellar Repositioning Technique

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I, Susan Davis, affirm that I have no financial affiliation, including research funding, or involvement with any commercial organization that has a direct financial interest in any matter included in this manuscript, except as disclosed hereto. No monies have been received or paid from or to any parties associated with this manuscript. Future honorariums or consulting fees may be anticipated if primary author1 is engaged to teach continuing education courses or classes in an academic institution or provide consultation to teach the 3D Patellar Repositioning technique or topics related to content in this manuscript. Conflict of interest statement disclosed hereto:

Baris and Davis worked together at the Popcorn Park Animal Clinic between 2008 and 2012, where Davis provided pro bono Physical Therapy under the supervision of Baris.

Dr. Frownfelter was Instructor at Northwestern University Programs in Physical Therapy when Dr. Davis was one of her students in 1976 and 1977.

ABSTRACT

Background and Purpose: Medial patellar luxation (MPL) is a common condition managed with surgery, medication, and observation. There is a lack of literature regarding specific conservative MPL intervention. Conservative treatment is important for milder non-surgical cases to prevent progression of luxation and future joint degeneration. The purpose of this retrospective study is to document and investigate the significance of manual 3D repositioning technique, developed by Dr. Susan Davis, on outcome scores of small dogs and cats having medial patellar luxation (MPL) grades one or two. **Methods:** Data from 37 eligible medical records were statistically analyzed using Wilcoxon signed-rank test. **Findings:** A statistically significant difference (p <.01) was found using manual 3D patellar repositioning in reduced lameness and improved functional scores for a combined sample size of 37 canine and feline patients between initial evaluation and discharge and in a separate analysis of 29 dogs (p < .01 lameness, p = .001 function). Results were inconclusive (p = .011 lameness, p = .014 function) in separate analysis of a smaller sample size of 8 cats. **Clinical Relevance:** Physical Therapy for MPL grades one and two should include manual 3D patellar repositioning in small dogs and cats. An average of 6 visits is effective, though neutered males may take longer. **Conclusion:** Manual 3D patellar repositioning is effective in reducing lameness and increasing function in small dogs and cats having MPL grades one and two.

Key Words: instability, mobilization, patellofemoral dysfunction

INTRODUCTION

Medial patellar luxation (MPL) is a common condition in small animals, treated surgically and conservatively. Patellar luxations can be medial, lateral, or bidirectional, but the majority are medial and found in small breed dogs weighing 50 pounds or less and cats.[1-4] Small dogs are 12 times more likely to develop MPL than large dogs.[5,6] Lateral luxations occur less frequently and are found mainly in large and giant breed dogs. Patellar luxations may occur bilaterally but 70% of diagnosed cases are unilateral.[2,7-9] Females are more predisposed than males and neutered dogs of both genders have three times the odds of developing patellar luxation.[1,6,9] Initial signs of luxation are popping patella, skipping gait with intermittent non-weight bearing lameness, and the dog or cat kicking or stretching the affected hind limb back. Disuse thigh atrophy on the affected limb may be observed as the animal shifts more weight onto the front limbs for function. Diagnosis is made on clinical findings with imaging used to assess the presence of skeletal deformity.[8] A classification system is used to identify levels of luxation into grades. Grade one is self-reduced by the animal using a backward kick or elongated stretch. Grade two can be manually relocated by the owner or practitioner and stay in place mostly. Grade three is frequent and continuous luxation that can be manually relocated but will not stay in place. Grade four luxation cannot be manually relocated.[10,11]

Authors suggest in the literature that surgery is used more commonly than conservative treatment of patellar luxation in animals. A literature search was performed using key words and MESH headings. One hundred and twenty-five studies were reviewed from Medline/PubMed, PEDro, PTNow, Cochrane Library, and VetSReviews databases. Surgery is primarily used to correct MPL grades 3 and 4 by soft tissue release and osseous techniques. Complication rates are low, with the most common adverse reactions being a failure to maintain reduction and infection. Prognosis is favorable, with a return to normal limb function within a few weeks. Post-operative physical therapy consists of integumentary care, joint range of motion, strength, and weight-bearing exercise. Conservative treatment for MPL includes mobilization grades 1 and 2, medication, rest, acupuncture, ice, hydro-

therapy, electrostimulation, cold laser, and kinesiotaping, strengthening, and weight control. The literature search did not yield studies relating lameness or functional outcomes with detailed intervention documentation, except for therapeutic exercise using resistance bands, closed chain activity, and stretching.[8,12] Studies on human patellofemoral syndrome show improved outcomes after several physical therapy visits of targeted quadriceps stretching and taping techniques that extended to 3 years after treatment.[13] Patellar mobilization and manual glides are established in humans for patellar instability followed up with therapeutic exercise.[14-19] If left untreated, MPL grades one and two may result in lameness, degenerative arthritis, pain, and progression to grades three and four.[9] Human patellofemoral pain studies suggest long term duration is the most consistent predictor of poor patient outcome.[20]

Several factors play important roles in the etiology and development of patellar luxation. Genetics affect small and toy breeds with a 12 times more likely development of MPL.[5,6] Medial patellar luxation have high heritability especially in Pomeranians with candidate genes having been identified for its development.[21] Osseous deformity, hypoplasia, shallow trochlear sulcus, limb deformity with bowing, valgus or varus, femoral and tibial torsion are contributing factors. Early spay and neutering, before sexual maturity, cause hormonal changes on bone affecting density, growth, and development.[9] Traumatic injury to the joint capsule or ligament, fascia imbalance, fracture, and misalignment of the quad mechanism also impacts patellar stability.[16] Medial instability may be increased by the trochlear groove,[8] Q angle,[22,23] angle of inclination,[24-26] length ratio of patella to patellar tendon,[27] amount of femoral anteversion,[24,26] tibial plateau angle,[28] and imbalance of the prime muscle movers which attach medially to the femur and tibia.[29]

As a society we have changed companion pets' lifestyles to indoor living, allowing pets to jump up and off furniture onto slippery wood and tile floors. Such practices can increase the chance of shearing ligament tears and patellofemoral disorders. One study found a reduced risk of puppies developing hip dysplasia if their housing and exercise conditions allowed off-leash activity and being born and raised on a farm.[30] This indicates that textured surfaces such as dirt or sand facilitate the development of deepened acetabular sockets.[31] Breeding practices may contribute to a congenital predisposition toward shallow trochlear grooves and/or reduced patella size. Pets born below the average weight for their breed were found to be at increased odds of MPL diagnosis.[9] Cat de-clawing results in a less active animal with their primary defensive mechanism taken away and indoor living required. Adverse behaviors and pain, including back pain, have been found in cats that have gone through de-clawing surgery.[32]

The purpose of this retrospective study is to document and investigate the significance of manual 3D patellar repositioning technique, developed by Dr. Susan Davis, on outcome scores of small dogs and cats having MPL grades 1 or 2.

METHODS

Development and Documentation of Manual Technique

The manual 3D patellar repositioning technique to rapidly relocate the patella is shown to sustain outcome and requires fewer numbers and frequency of return visits. It incorporates the screw-home mechanism in normal stifle arthrokinematics in three planes of movement: femoral rotation in the dorsal plane, stifle extension, and long axis distraction in the sagittal plane, and lateral patellar glide in the transverse plane.[15,33-35] The primary author has also taught pet owners to safely perform this technique at home, one or two repetitions at a time, once or twice daily. Manual patellar mobilizations should not be performed in isolation but in combination with stretching and other therapeutic exercises.[12]

VIDEO 1 (Canine example)
https://www.youtube.com/embed/3EwTnbMgzMA
VIDEO 2 (Feline example)
https://www.youtube.com/embed/JJM5CW8xHkE

Study Design

This retrospective investigation involved small dogs and cats having MPL grades one or two that were treated with a manual 3D repositioning technique. There was no control group due to the lack of use of physical therapy interventions for this diagnosis and the lack of a subset of comparison data on the outcomes of past veterinary patients treated with only medication or home observation to form a control group. The investigation aimed to document the 3D patellar repositioning technique, determine if it was statistically significant in reducing lameness scores and improving functional scale scores in small canine and feline patients with MPL grades 1 or 2 from Initial Evaluation (IE) to Discharge (DC) and compare outcome results between canine and feline species. It was hypothesized that the physical therapy technique of 3D patellar repositioning would display a statistically significant difference in reducing lameness scores and increasing functional scale scores between IE and DC for both canine and feline patients. Inclusion criteria were identified as the canine or feline patient having MPL grades 1 or 2 and weighing 50 pounds or less, and canine or feline owner consent to be included in the study. Exclusion criteria were identified as the canine or feline patient having MPL grades 3 or 4; the 3D patellar technique was not included in physical therapy intervention; incomplete documentation in the medical record; and the presence of significant co-morbidities. The co-morbidities deemed significant were: the patient having cranial cruciate ligament (CCL) insufficiency on the ipsilateral side: neuropathies, myelopathies, paralysis, or aggressive behavior.

The Wilcoxon signed-rank test was chosen as the statistical test as it compares differences between 2 related groups of participants with 2 sets of scores, that did not meet normality criteria of ordinal data measurements. The criterion of significance level $p < .01$ was selected as the study decision rule for ordinal data on which to reject the hypotheses.

Data Source and Variable Selection

Fifty medical records consisting of 41 canine and nine feline patients were identified from a database having MPL diagnosis and treated in homes, veterinary clinics, and animal shelters between April 2008 and June 2019. Thirteen patient records were eliminated per the exclusion criteria: 5 dogs with grade three or four MPL having surgery, 3 dogs had paralysis and neuropathy co-morbidities, 4 dogs and 1 cat had incomplete scoring documentation. A total of 37 (29 dogs, 8 cats) met inclusion criteria. Nominal variables were selected as species, record ID number, breed, gender, age, weight, and the number of physical therapy visits. Ordinal variables were lameness score at a trot (**Figure 1**), at IE, and at DC, Canine or Feline Functional Scale Score (**Figure 2**) on IE and DC. Trot was defined as a diagonal, 2-point locomotion pattern.

Study Management

The records were shuffled and picked randomly for data extraction. The first data collector extracted variable information on 50 individual collection sheets. The secondary data collector confirmed data and deciphered handwriting in the medical record. Dis-

Figure 1. Degree of Lameness at a Trot Score

Degree of Lameness at a Trot	Score
No Lameness, Full weight bearing on all strides	0
Subtle, Mild Lameness with partial weight bearing	1
Obvious, Moderate Lameness with partial weight bearing	2
Obvious, Marked Lameness with intermittent non weight bearing	3
Full, non-weight bearing lameness all gait cycles	4

Figure 2. Canine or Feline Functional Scale Used in the Current Study

Canine or Feline Functional Scale Assign number to each: 1-5 Maximal Score = 70	Fully Dependent 1	Moderate Assist 2	Minimal Assist 3	Occasional Assist 4	Fully Independent 5
Positions self to urinate					
Positions self to defecate					
Transfers to/from lying to sit					
Transfers to/from sit to stand					
Transfers to/from lying to stand					
Able to roll over to supine					
Can scratch and groom face					
Able to ascend stairs or steps					
Able to Descend stairs or steps					
Can walk or climb up an incline					
Can get in/out of car/Litter Box					
Able to negotiate on/off couch/perch					
Able to Run					
Able to Jump or Leap					

agreements in data collection were reached by consensus or if disagreement remained, the interpretation of the first collector was accepted as final as she was the veterinarian and not the provider of physical therapy treatment. By having the veterinarian provide the final decision on a physical therapy treatment, the authors limited bias. Considerable effort to eliminate or reduce potential bias was made by the following practices: blinding of all medical records, handling each record in the same manner, establishing inclusion and exclusion criteria well in advance of data extraction, automatically excluding any records having missing or incomplete outcome data, confirming data entry by two persons, preventing the treating therapist from having the final decision on data interpretation, using randomization in the extraction sequence order, and the presence of homogeneity of 37 subjects. Identical lameness and functional outcome measures were used throughout the study. Extracted data were entered into SPSS Statistics for Windows, IBM Version 26.0 (Armonk, NY) and verified for accuracy.

Statistical Analysis

Descriptive statistics were calculated and the Wilcoxon signed-rank test was performed for the combined canine and feline sample size of 37, followed by a split file Wilcoxon signed-rank test on separate species to examine the results of the manual 3D repositioning technique on the changes in lameness and functional scale scores at IE and DC. A 95% CI was included. Authors assigned a value of $p = < .001$ when the statistical program generated a value of $p = .000$. Effect size was run for combined and individual species groups and defined as small for $r = 0$ to 0.4; medium for $r = 0.5$ to 0.7 and large for $r = 0.8$ or greater. A regression analysis was performed to adjust for patients receiving concurrent medication as an unmeasured potential confounder.

RESULTS

Nominal Descriptive Statistics

Statistics were obtained for canines and felines comprising a total of 37 patients. Canine patients comprised 78% of the sample size ($n = 29$) and feline patients 22% ($n = 8$). Genders in the study included 6 intact females, 9 intact males, 7 spayed females, and 15 neutered males. Ages ranged from 0.25 to 14 years with mean 3.83 (±SD = 3.51). Patient weights ranged from 5 to 50 pounds with mean 20.48 (±SD = 13.76). The number of treatment visits ranged from two to 35, with the weighted mean average = 6 and median = 16.5. Neutered and spayed animals had more physical therapy visits than intact animals with intact females having the fewest number of visits (**Figure 3**). The percentage breakdown by species and breed is displayed (**Figure 4**).

Ordinal Data

Data for combined sample size and split file per species are summarized in **Table 1**, **Table 2**, and **Table 3** with a priori significance (2 tailed) $p = .000$, $p = < .0001$ assigned. Effect sizes for lameness score from IE to DC were large ($r = 0.85$). In regards to functional scale score, results indicate a medium effect ($r = 0.67$). Sum of ranks difference in lameness (630) and function (231) for 37 patients indicates manual 3D patellar repositioning technique impacts lameness reduction to a greater extent than functional improvement.

Based on results, lameness scores were significantly reduced and functional scores significantly improved between IE and DC. For canines, lameness scores were significantly reduced and function was significantly improved between IE and DC. For felines, lameness score reduction and functional scale score improvement between IE and DC was inconclusive. In the regression analysis, the percent of variance was estimated as +.2516 for z values. The adjusted critical values for z did not affect the final decision ruling lameness score reduction or functional scale improvement between IE and DC.

DISCUSSION

The novel 3D patellar repositioning technique was effective in reducing lameness and improving function for 37 patients. Nine (24%) patients had reduced lameness of one grade, 16 (44%) had reduced lameness of two grades, 7 (19%) had reduced lameness of three grades, 3 (8%) had reduced lameness of four grades, and 2 (5%) had no change in lameness. Inconclusive findings in the split file by feline species regarding lameness and functional scores are likely due to a small sample size and should not discourage clinicians from using the 3D repositioning technique in cats having MPL. The combined results for small dogs and cats are consistent with the literature in human physical therapy studies on improvements in patient outcomes using manual mobilization, stretching, and taping to relocate patellar position.[13,14,17-19]

Physical therapists need to be aware of factors beyond specific manual techniques that impact patient outcomes. For example, patients on concurrent medication may have better

Figure 3. Visit Number by Gender for the Current Study

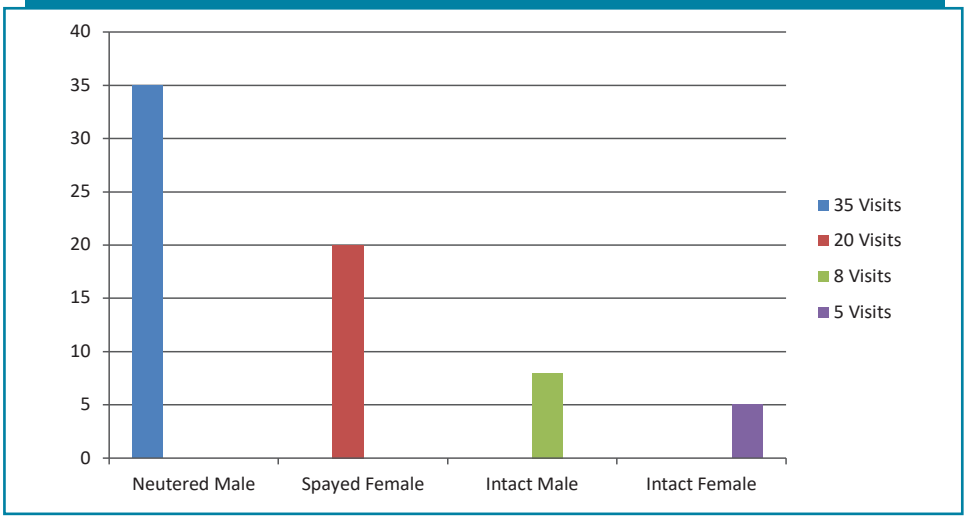

Figure 4. Percent Sample by Breed for the Current Study

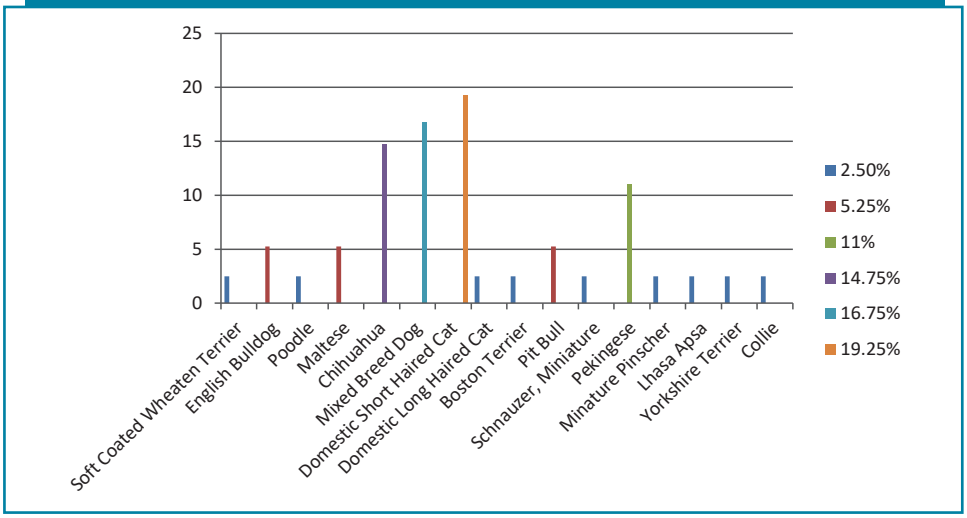

Table 1. Wilcoxon Signed Ranks for Combined Sample and Split File by Species

	Lameness Score Initial Evaluation to Discharge	**Functional Scale Score** Initial Evaluation to Discharge
Combined Sample Size All Species (***n* = 37**)	***Z*** = -5.19 (*p* = < .01)	**Z** = -4.06 (*p* = < .01)
Canine (***n* = 29**)	***Z*** = -4.58 (*p* = < .01)	***Z*** = -3.32 (*p* = .001)
Feline (***n* = 8**)	**Z** = -2.53 (*p* = .011)	**Z** = -2.45 (*p* = .014)

outcomes with physical therapy. Eight patients in our investigation received concurrent anti-inflammatory (Rimadyl, Metacam) and pain (Tramadol, Buprenex) medication. The effect of medication was not measured in this study. Medications may have favorably impacted intervention and patient performance, and are commonly used in MPL conservative care. In human care of the hip and knee, the use of medication to reduce pain and inflammation in combination with physical therapy interventions is well documented.[36,37] A literature search for veterinary studies comparing the use of medication with physical therapy failed to yield results. The 3D patellar repositioning technique is not meant to be used in isolation or as a substitute for medication.

Clinicians working with small dogs and cats should be aware that functional scoring may not be as indicative of patient status

Manual Technique of 3D Patellar Repositioning

compared to lameness in trotting. During a trot, the absence of weight bearing on a limb is visible. In many functional skills, a small animal may compensate like a human for a faulty limb by off-loading and weight re-distribution onto unaffected limbs during the activity. A cat, for example, may be scored as independent in jumping onto a perch, navigating on 3 points of contact or with partial weight-bearing in one limb.

Patients were from the caseload of a single practitioner. Data integrity were limited by observation of patient outcomes, the performance of the technique, and accuracy of documentation. Reproducibility of the manual 3D technique by another practitioner may impact results but the authors believe it can be reproduced by an experienced physical therapist or veterinarian. A randomized control study would further test its validity concerning lameness and functional outcome scores.

The authors offer the following suggestions for future research: determine the effect of manual 3D patellar repositioning on prevention or progression of the affected limb developing into MPL grade three or four or degenerative joint disease over 6 months or longer; and study the effect on outcomes using physical therapy with and without medication. Larger sample sizes of felines should be investigated in future studies. Lameness can be tested with greater accuracy using a kinetic gait analysis laboratory.

CONCLUSION

The 3D patellar repositioning along with an animal physical therapy intervention was found to be significant in reducing lameness at a trot and improving function from IE to DC in a combined sample size of small dogs and cats with MPL grades of 1 or 2 and weighing 50 pounds or less. The findings were inconclusive in a smaller sample size of 8 cats. This study adds to current knowledge with the introduction and documentation of a novel

Table 2. Wilcoxon Signed Rank Test Statistics for Combined Sample

	Positive Ranks	N	Mean	Sum		Negative Ranks	N	Mean	Sum
Lameness Score DC -IE	Negative ranks	35[a]	18.00	630.00	**Lameness IE - DC**	Negative ranks	0[a]	.00	.00
	Positive ranks	0[b]	.00	.00		Positive ranks	35[b]	18.00	630.00
	Ties	2[c]				Ties	2[c]		
	Total	37				Total	37		
Functional Scale Score DC-IE	Negative ranks	21[d]	11.00	231.00	**Function IE-DC**	Negative ranks	0[d]	.00	.00
	Positive ranks	0[e]	.00	.00		Positive ranks	21[e]	11.00	231.00
	Ties	16[f]				Ties	16[f]		
	Total	37				Total	37		
Wilcoxon Signed Ranks	**Test Statistics**						**Test Statistics**		
Lameness DC-IE	*Z* -5.198				**Lameness IE - DC**	*Z* -5.198			
	Asymp. Sig 2 tailed .000					Asymp. Sig 2 tailed .000			
Functional Scale Score DC-IE	*Z* -4.061				**Function IE - DC**	*Z* -4.061			
	Asymp. Sig 2 tailed .000					Asymp. Sig 2 tailed .000			

Positive Ranks
- **a. Lameness Score DC < IE**
- **b. Lameness Score DC > IE**
- **c. Lameness Score DC = IE**
- **d. Functional Scale Score DC < IE**
- **e. Functional Scale Score DC > IE**
- **f. Functional Scale Score DC = IE**

Negative Ranks
- **a. Lameness Score IE < DC**
- **b. Lameness Score IE > DC**
- **c. Lameness Score IE = DC**
- **d. Functional Scale Score IE < DC**
- **e. Functional Scale Score IE > DC**
- **f. Functional Scale Score IE = DC**

manual technique 3D patellar repositioning, using normal stifle joint arthrokinematics. It provides a targeted, specific, and effective intervention option in animal physical therapy clinical practice. The 3D patellar repositioning technique can be used in clinical practice by small animal rehabilitation professionals in a variety of veterinary settings. An average of 6 visits will provide desired outcome results from IE to DC and neutered males may take longer to achieve goals.

ACKNOWLEDGEMENTS

Special thanks to my clients and their pets for allowing independent video and photography of the 3D patellar repositioning technique from Susan Davis: Andrea Crosta with her pets Templeton, Biscuit, and Dexter; Ben and Catherine Konopacki with their pet BooBoo.

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Table 3. Wilcoxon Signed Rank Test Statistics for Split File by Species

Wilcoxon			N	Mean	Sum			N	Mean	Sum
Signed Ranks	Positive Ranks					Negative Ranks				
Species										
Canine Lameness	DC - IE	Neg	27[a]	14.00	378.00	IE - DC	Neg	0[a]	.00	.00
Score		Pos	0[b]	.00	.00		Pos	27[b]	14.00	378.00
		Ties	2[c]				Ties	2[c]		
		Total	29				Total	29		
Canine Function	DC - IE	Neg	14[d]	7.50	105.00	IE - DC	Neg	0[d]	.00	.00
Score		Pos	0[e]	.00	.00		Pos	14[e]	7.50	105.00
		Ties	15[f]				Ties	15[f]		
		Total	29				Total	29		
Feline Lameness	DC - IE	Neg	8[a]	4.50	36.00	IE - DC	Neg	0[a]	.00	.00
		Pos	0[b]	.00	.00		Pos	8[b]	4.50	36.00
		Ties	0[c]				Ties	0[c]		
		Total	8				Total	8		
Feline Function Score	DC - IE	Neg	7[d]	4.00	28.00	IE - DC	Neg	0[d]	.00	.00
		Pos	0[e]	.00	.00		Pos	7[e]	4.00	28.00
		Ties	1[f]				Ties	1[f]		
		Total	8				Total	8		
	Test Stats					Test Stats				
Species	Lameness DC - IE	Function DC - IE				Species	Lameness IE - DC	Fun IE -	ction DC	
Canine	*Z* -4.582	*Z* -3.325				Canine	*Z* -4.582	*Z*	-3.325	
	Asymp. Sig 2 tailed .000	Asymp. Sig 2 tailed .001					Asymp. Sig 2 Tailed .000	.001		
Feline	*Z* -2.533	*Z* -2.456				Feline	*Z* -2.533	*Z*	-.2456	
	Asymp. Sig 2 tailed .011	Asymp. Sig 2 tailed .014					Asymp. Sig 2 tailed .011	0.14		

a. Lameness Score DC < IE
b. Lameness Score DC > IE
c. Lameness Score DC = IE
d. Functional Scale Score DC < IE
e. Functional Scale Score DC > IE
f. Functional Scale Score DC = IE

a. Lameness Score IE < DC
b. Lameness Score IE > DC
c. Lameness Score IE = DC
d. Functional Scale Score IE < DC
e. Functional Scale Score IE > DC
f. Functional Scale Score IE = DC

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Congratulations to our 2021 Honors and Awards Program Recipients

Name	Award
Gail D. Deyle, PT, DPT, DSc, FAPTA, Board-Certified Clinical Specialist in Orthopaedic Physical Therapy	Catherine Worthingham Fellow
Deborah Lynn Givens, PT, DPT, PhD, FAPTA	Catherine Worthingham Fellow
Morey Joel Kolber, PT, PhD, Board-Certified Clinical Specialist in Orthopaedic Physical Therapy	Dorothy Baethke-Eleanor Carlin Award for Excellence in Academic Teaching
Jason M. Beneciuk, PT, DPT, PhD, MPH	Eugene Michels New Investigator Award
Daniel Rhon, PT, DPT, DSc, Board-Certified Clinical Specialist in Orthoapedic Physical Therapy	Eugene Michels New Investigator Award
Anne Thackeray, PT, PhD, MPH	Eugene Michels New Investigator Award
Ronald Lee Meade, PT, DPT	F A Davis Award for Outstanding Physical Therapist Assistant Educator
Gail M. Jensen, PT, PhD, FAPTA	Helen Hislop Award for Outstanding Contributions to Professional Literature
Ricardo A. Fernandez, PT, PhD, Board-Certified Clinical Specialist in Orthopaedic Physical Therapy	Humanitarian Award
Mark Donald Bishop, PT, PhD, FAPTA	Lucy Blair Service Award
John D. Heick, PT, DPT, PhD, Board-Certified Clinical Specialist in Neurologic, Orthopaedic, and Sports Physical Therapy	Lucy Blair Service Award
Robert Latz, PT, DPT	Lucy Blair Service Award
Marilyn E. Miller, PT, PhD, Board-Certified Clinical Specialist in Geriatric Physical Therapy	Lucy Blair Service Award
Carrie Pagliano, PT, DPT, Board-Certified Clinical Specialist in Orthopaedic and Women's Health Physical Therapy	Lucy Blair Service Award
Stuart H. Platt, PT, MSPT	Lucy Blair Service Award
Gabriel E. Yankowitz, PT, DPT	Lucy Blair Service Award
Lori Michener, PT, PhD, ATC, FAPTA, Board-Certified Clinical Specialist in Sports Physical Therapy	Marian Williams Award for Research in Physical Therapy
Trevor Staples, SPT	Mary McMillan Scholarship Award
Dawn Sunshine Brown, PT, DPT	Minority Faculty Development Scholarship Award
Ivan J. Iton, SPT	Minority Scholarship Award
Bana Odeh, SPT	Minority Scholarship Award
Steven Michael Short, PT, DPT, Board-Certified Clinical Specialist in Sports Physical Therapy	Outstanding Physical Therapist Fellow Award
David Charles Harris, PTA, MBA	Outstanding PTA Award
Melissa C. Kolski, PT, DPT, Board-Certified Clinical Specialist in Orthopaedic Physical Therapy in Clinical Teaching	Signe Brunnstrom Award for Excellence
Todd Eldon Davenport, PT, DPT, MPH, Board-Certified Clinical Specialist in Orthopaedic Physical Therapy	Societal Impact Award
Alicia J. Emerson, PT, DPT, Board-Certified Clinical Specialist in Orthopaedic Physical Therapy	Societal Impact Award

Award recipients were recognized during the Honors & Awards Ceremony, held September 12. We applaud these individuals for their outstanding accomplishments and are thankful for the support you provide to your members.

Congratulations to newly certified and re-certified Orthopaedic Certified Specialists!
A total of 727 physical therapists passed their OCS exam this year. Well done, AOPT members!

PRESIDENT'S MESSAGE

Rick Wickstrom, PT, DPT, CPE, CME

This is a great time to reflect on why we are here, who we are, and where we are going in volunteer initiatives by the Occupational Health Special Interest Group (OHSIG) and plan next steps for our occupational health practices. From the start of my service as OHSIG President in 2019, I have felt engaged and inspired by the vision and inclusivity of AOPT's President, Joseph Donnelly, PT, DHSc, FAPTA and other Board members. Joe's focus on strategic planning at all levels of AOPT prompted me to work with our OHSIG leaders to revise our mission, vision, and strategic initiatives with consideration of our alignment with other AOPT special interest groups and committees.

Why we are here is reflected in our OHSIG Vision statement to *Lead the world in optimizing movement, musculoskeletal health, and work participation from hire to retire*. To accomplish this vision, OHSIG members must focus more attention on implementing direct-to-employer services that demonstrate value with workplace population health management. We must be bold in our delivery of *Total Worker Health*® interventions that integrate worker well-being with worker safety and health promotion principles. Every therapy referral of an injured worker should be viewed as a portal opportunity to forge a relationship for direct-to-employer services. For example, a starting point may be to ask the injured worker for permission to contact safety or human resources to obtain a written description of job duties and physical job demands. When information is not adequate, this may create an opportunity to facilitate an interactive visit with the worker at the job site to clarify physical demands or identify workplace interventions to address within a job-specific plan of care. Successful resolution of participation barriers for an injured worker may be leveraged to position the therapist as the preferred provider for other therapy referrals or contracts such as providing functional employment screens of new hires or wellness movement exams to promote suitable physical activity. Success with improving client employer outcomes may be leveraged in presentations to groups of employer professionals such as Safety Councils to lead employer programs from hire to retire.

Who we are is reflected in the depth of incredible passion and expertise of our Occupational Health SIG volunteers. The OHSIG has many volunteer opportunities for networking that are organized under our standing committees for Practice, Membership, Research, and Communications. We appoint members to serve on committee teams that are tasked to address one or more OHSIG initiatives. For example, our Practice Committee that is led by Lorena Payne just completed a major initiative of publishing evidence-based Clinical Practice Guidelines in the *Journal of Orthopaedic and Sports Physical Therapy* that are titled "Clinical Guidance to Optimize Worker Participation After Injury or Illness: The Role of Physical Therapists." Researching, writing, and publishing this CPG has been a process that engaged a large group of experts who invested thousands of hours over the past 6 years to see this project through. It replaces our OHSIG Current Concepts document for Advanced Work Rehabilitation Guidelines that was consensus-based and led by the same lead author, Diedre Daley, PT, DPT. This CPG is meant to be used in conjunction with other published CPGs related to specific health conditions.

Where we are going is reflected in our accomplishments and ongoing strategic initiatives that relate to AOPT Goals for:

(1) **Diversity, Equity, and Inclusion:** Our Communications Committee led by Cory Blickenstaff has been coordinating with AOPT staff to implement an expanded member profile to encourage networking among members on the new AOPT website. We are pleased to have individual partners from occupational therapy and other disciplines joining OHSIG to foster diversity and collaboration in occupational health practice. We are planning an OHSIG member survey to get feedback on Occupational Health Advanced Practice credential program and other advocacy issues being considered.

(2) **Value and Payment:** Our OHSIG Membership Committee led by Caroline Furtak is implementing our initiative to establish OHSIG members to serve as state resource liaisons to grow payment for services and facilitate presentations that demonstrate the value of occupational health physical therapy. Ideally, we want to encourage networking among members in all states to share examples that foster a favorable environment in workplace and clinic-based practice.

(3) **Positioning and Public Awareness:** Positioning our members as experts in managing movement. Our OHSIG Research Committee led by Marc Campo is implementing our initiative to establish an advanced practice educational credential to position our members as experts in occupational health services. Stay tuned for the launch of the first of 3 required courses in January 2022 that will address workplace population health management, functional job analysis, design of functional employment exams, and early intervention to prevent needless work disability. This will be followed by advanced program Clinical Care of Workers with Participation Restrictions. Our Steering Committee is developing the credentialing component that includes an interactive webinar for current concepts and an Occupational Health Capstone project with a focus on one or more practice areas.

(4) **Evidence to Best Practice:** Our Practice Committee led by Lorena Payne is now engaging a new sub-committee of members to create infographics and develop educational presentations to disseminate the OHSIG's evidence-based Clinical Practice Guideline to APTA components (state chapters and all academies) and stakeholder groups (ie, therapy providers, employers, payers, case managers, adjusters, medical providers, regulatory agencies).

Employers are recovering from the negative impacts of COVID-19. Our new normal provides opportunities to focus more on direct-to-employment services that optimize movement and function from hire to retire.

Some states have confusing or conflicting regulation that may limit how physical therapists function as the entry point practitioner for workplace injury and disability management. Assignment of diagnostic labels by a healthcare practitioner is usually limited to their scope of practice. For example, a psychologist would not order x-rays to diagnose a foot fracture and a podiatrist would not examine the eyes to diagnose and treat cataracts. The physical therapist is well-positioned to diagnose and certify work restrictions because of our practice focus on physical activity progression to alleviate disability from a broad range of health conditions. As such, we must advocate for inclusion as acceptable medical sources to provide objective medical evidence of physical impairment and functional limitations for disabling conditions.

IMAGING INFOGRAPHICS

The Imaging SIG has recently developed two infographics to assist in advocacy for the physical therapist referral for imaging as a part of practice. These evolved from a contest initiated in January with several initial submissions. An Infographics Work Group then selected two and suggested edits along with additional input from those successful in achieving imaging referral privileges in their states. The end results are two downloadable infographics now available on the Imaging SIG web pages. The two are similar in purpose with one being a simple presentation of the message and the other going into greater detail with the purpose of perhaps serving different audiences. The personal stories about the two infographics authors were included in the July issue of *OPTP.*

Currently, an infographic is being developed about physical therapists using diagnostic and rehabilitative ultrasound to augment clinical reasoning in patient care. Timeline for completion of this project is late 2021.

AIUM WEBINARS

Webinars for AIUM presented by physical therapists have continued with Ted Croy and Jon Umlauf presenting "Improve Your Lateral Ankle Injury Management" on August 14. The recording of this webinar is available at aium.org. at the "Learning Center" and "On-Demand Webinars."

Additional webinars are planned for November from the perspective of exploring the dimensions of changing one's practice by the incorporation of ultrasound. The purpose of these two sessions is to allow practitioners an expanded understanding of how ultrasound can enhance clinical practice in multiple settings. These sessions will include multiple presenters from various practice settings, highlighting numerous applications. More details will be forthcoming soon.

MORE WEBINARS

On July 14, the Federation of State Boards of Physical Therapy hosted a webinar entitled "Imaging Referral by Physical Therapists: Progression of PT Education, Advocacy, Practice, and Regulation." The speakers were Chuck Hazle (Imaging SIG President), Daniel Markels (APTA Manager of State Affairs) and Jeanne Dekrey (North Dakota Board of Physical Therapy President). While being an open webinar, the target audience was principally state regulators. A similar webinar was presented on August 18, this time sponsored by APTA with component leaders as the main audience. Daniel Markels and Chuck Hazle reprised their presentations while the third speaker on this occasion was Cindy Flom-Meland (APTA North Dakota Board President).

On October 12 (approximately the time of publication of this issue of OPTP), the Imaging SIG sponsored a webinar of the leaders of the 4 states having successfully passed legislation for physical therapist referral for imaging. These leaders have shared their stories of accomplishment while allowing others to understand the variables and processes required to achieve such specific legislative change.

COMBINED SECTIONS MEETING 2022

Hopefully, we will all be physically present in San Antonio for CSM 2022. At the time of this submission for publication, uncertainty about CSM remained due to the effects of the pandemic.

One change that will occur for CSM 2022 and will continue indefinitely is that SIGs will no longer hold member meetings at CSM. Time, space, and accessibility have continued to be more problematic for such meetings. Thus, AOPT has adopted a policy wherein the SIGs will host their member meetings on the web approximate to the time of CSM. As of this writing, there is planned a SIG Meet and Greet social event in San Antonio, involving all the AOPT SIGs, similar to the one held in Denver in 2020. More details about this event for CSM attendees will be forthcoming. The date and time of the Imaging SIG member meeting relating to CSM has yet to be determined.

As you may remember, the Imaging SIG had an ultrasound imaging pre-conference course scheduled for CSM 2021 in Orlando. With the virtual format of CSM, the course was refocused to a single day with conceptual content and demonstrations. The originally planned course was resubmitted and accepted for CSM 2022 in San Antonio, albeit with an altered format. The course, entitled "Musculoskeletal Ultrasonography of the Upper Extremity with Special Focus in Sport and Performing Arts" is still planned but with participants completing preparatory work independently prior to the one-day "hands on experience." The presenters for this course will be Jon Umlauf, Colin Rigney, and Dirk Hartog. For those interested in becoming familiar with the use of diagnostic ultrasound in the upper quadrant, this is a course for you by physical therapists for physical therapists with particular emphasis on conditions occurring in performers and athletes.

The educational session to be presented by the Imaging SIG for CSM 2022 is entitled "Demonstrating Competencies in Physical Therapist Referral for Imaging" and is focused on the educational perspective of imaging referral by physical therapists. The topic is, in effect, teaching the teacher of imaging, highlighting various methods and resources available to assist in educating students and clinicians in imaging referral. The outstanding line-up of speakers includes Bill Boissonnault, Aaron Keil, Michelle Collie, Michael Ross, and Michael Crowell. Brian Young, Imaging SIG Vice President, will moderate the session. As you may recall, the Imaging SIG published the Imaging Education Manual in 2015 and the content of this session is paired with the effort of revising and updating the Imaging Education Manual.

RHODE ISLAND: IMAGING REFERRAL PRIVILEGES

In July, Rhode Island passed legislation allowing for physical therapist referral for imaging. Rhode Island joins North Dakota (2021), Utah (2018), and Wisconsin (2016) in taking the specific legislative route to allow for physical therapist referral for imaging. Other states have achieved similar results, but have done so through administrative processes.

(Continued on page 246)

PRESIDENT'S MESSAGE

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

PASIG MISSION

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

GRATITUDE

As I reflect on the work of the PASIG in 2021, it is abundantly clear that this SIG thrives because of the dedication of a great leadership team. I am so grateful for all the behind-the-scenes activities and committee work executed on behalf of our 752 members.

I want to give an extra big shout out to the PASIG VP-Education, Rosie Canizares. Rosie is completing her 6th year as PASIG VP. We will be electing a new VP that will begin in 2022. One of the big responsibilities of the VP is to ensure that we have Performing Arts content in the educational programming at CSM each year. Rosie has secured programming for CSM year after year and has overseen several pre-conference courses as well. The role of the PASIG VP has expanded to include maintaining our list of performing arts clinical education sites, overseeing our Independent Study Course (ISC) Task Force (on track for a 2022 publication date), and our Podcast Strategic Initiative. Rosie also serves on the AOPT DEI Committee. Thank you, Rosie, for your leadership in PASIG!

PASIG PROGRAMMING AT CSM

Mark your calendars for CSM February 1-5, 2022 – San Antonio, Texas!

In 2022, the PASIG will co-sponsor two CSM preconference hybrid courses [1-day live]:

- Tuesday, February 1: At the End of Your Rope: Rehab Solutions for Climbers and Aerialists
  Jared Spencer Vagy, PT, DPT; Lynnette Ching-Ling Khoo-Summers, PT, DPT; Emily Scherb, PT, DPT
- Wednesday, February 2: Musculoskeletal US of Upper Extremity with Special Focus in Sport and Performing Arts | Co-sponsored with Imaging SIG
  Mohini Rawat, DPT, MS, ECS, OCS, RMSK; Jon A. Umlauf, PT, DPT, DSc; Dirk Hartog, PT, DPT, OCS, CSCS; Colin Rigney, PT, DPT

We will gather for the "Meet & Greet" on Thursday evening, February 3: 7:00-8:30 pm

The PASIG Educational Session will be on Saturday, February 6: 8-10 am

- Performing Arts Care in a New World: Re-Imagining Our Approaches to Training, Rehabilitation, and Resilience-Building
  Brooke Winder, PT, DPT; Marisa Hentis, PT, DPT; Kristen Schuyten, PT, DPT, MS; Tiffany Marulli, PT

PASIG STUDENT SCHOLARSHIP PROGRAM

To recognize students for their contribution to performing arts physical therapy and to assist in defraying the cost of attending the Combined Sections Meeting (CSM), the Performing Arts Special Interest Group (PASIG) will support up to two $500 scholarships for one entry-level student and one post-professional student presenting research at CSM. If your student abstract was accepted for presentation at CSM, be sure to apply!

The PASIG is also a sponsor of an International Association of Dance Medicine (IADMS) Student Research Award.

PASIG PRACTICE PEARLS PODCAST

We are excited to announce that the PASIG Practice Pearls Podcast series is now available to members on our website! Our goal is to produce 4 podcasts per year (1 per quarter). You can hear directly from PASIG members as they share their clinical pearls and wise words of wisdom. In the first two episodes as listed below, you will hear how two performing arts physical therapists have managed to be "show ready" by discussing all things emergency management--from backstage to how to best prepare your team. They can both be accessed here: https://www.orthopt.org/content/special-interest-groups/performing-arts

- Podcast #1
  Laura A. Schmitt, PT, DPT, ATC
- Podcast #2
  Dawn Muci, PT, DPT, ATC

With gratitude, the PASIG would like to acknowledge the hard work of Marissa Schaeffer, who conducted the interviews, and Janice Ying for overseeing the inaugural episodes and editing. Thanks also to our content experts, Laura Schmitt and the PASIG's PR Chair, Dawn Muci. The next round of Podcasts will be organized by Sarah Edery-Altas and Isabella Scangomor.

PASIG PERFORMING ARTS FELLOWSHIP

2021 marks 5 years since the publication of the Performing Arts Description of Fellowship Practice (DFP). The DFP is based on the analysis of practice results conducted by members of PASIG as part of petition requirements for seeking ABPTRFE recognition of this area of practice. The PASIG continues to support performing arts fellowship training as means of advancing one's practice in this sub-specialty area.

There are currently 4 performing arts fellowship programs:

- The Ohio State University [Tiffani Marruli, tiffany.marulli@osumc.edu.]
- Johns Hopkins Medicine [Andrea Lasner, alasner1@jhmi.edu]
- Harkness Center for Dance Injuries at NYU Langone [Mark Hall, Mark.Hall@nyulangone.org
- Columbia University Irving Medical Center /West Side Dance PT [Laurel Daniels Abbruzzese, la110@cumc.columbia.edu.]

For information about Fellowships, please contact: our Fellowship/Advisory Panel Chair, Tiffani Marruli, tiffany.marulli@osumc.edu

PASIG SWAG

We sold $1,400 worth of PASIG merchandise this year in support of our Strategic Initiatives. We know that our members will want to show off their PASIG pride at CSM and other professional events, so be sure to order in time. All promotional items are available on the web: https://www.orthopt.org/content/special-interest-groups/performing-arts/pasig-promotional-items

PASIG CALL FOR MEDIA!

We need more diverse and authentic photos and videos of performing arts physical therapy for several of our PASIG initiatives. Please consider taking some quality photos and short (20-40 seconds) video clips of you wearing PASIG apparel working with performing artists in diverse settings. We will be sending details directly to our members via Facebook and our listserv. We want to feature our own members in our efforts to highlight the unique skills and talents of performing arts physical therapy.

STAY CONNECTED

Don't miss out on PASIG news and member spotlights! Be sure to follow Twitter handle: @OrthopedicAPTA, Instagram handle: @APTA_Orthopaedic, and Facebook: @PT4Performers.

If you missed the Spotlight Series on social media, archived posts are also on the web. https://www.orthopt.org/content/special-interest-groups/performing-arts/member-spotlight

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.

AOPT SIG | FOOT & ANKLE
ACADEMY OF ORTHOPAEDIC PHYSICAL THERAPY, APTA

Hello AOPT Foot and Ankle SIG members!

The FASIG is writing this newsletter as we start optimistically planning for the Fall. With increasing numbers of in-person classes, meetings, and conferences but also a concerning increase in COVID cases in the presence of the delta variant, it is hard to know what is in store for the next 6 months. However, we are excited about the opportunity to gather for conferences such as the American Orthopaedic Foot and Ankle Society (AOFAS) Annual Meeting in Charlotte, NC in September 2021 and the Combined Sections Meeting in San Antonio, TX in February 2022. Hopefully we are able to return to these professional events safely.

Other important news:

- The foot and ankle fellowship initiative is underway with the Practice Analysis Survey out the door! We are now awaiting and gathering data from this survey that has been distributed across the AOPT and the Sports Academy. The final report to the American Board of Physical Therapy Residency and Fellowship Education (ABPTRFE) is on-target for submission by the end of 2021. Many thanks to the practice analysis coordinators, project consultant, and the entire task force working on this.
- The FASIG Practice Committee together with guidance from the AOPT Public Relations Committee has created infographics to share information about common foot and ankle pathologies. These will be shared across the AOPT as a resource for members. Versions may also be developed to inform patients about common conditions and what to expect when seeking treatment. The current infographics are posted to the AOPT_FASIG webpage. A special thanks to the FASIG Practice Chair, Megan Peach DPT, OCS, CSCS, who has spearheaded this work until now. We are currently looking for a new Practice Committee Chair to replace Megan as she moves into a new role. Please reach out to anyone on the FASIG leadership if you are interested.
- Our thanks to Dr. Jay Hertel and Dr. Corbett for the author spotlight on Chronic Ankle Instability. We want to also thank Drs. Hastings, Jeong, and Zellers for their author spotlight on Heel Rise Assessment in patients with Diabetes. Dr. Abbis Jaffri has done a great job with these author spotlights as the FASIG Research Chair; thanks, Abbis for leading this work
- Make sure to check out our quarterly newsletters posted to our website (listed below) if you did not catch them in your email! Dr. Jennifer Zellers at Washington University works closely with a great group of student FASIG members to develop these newsletters. They include summaries of our SIG activity, member spotlights, and a citation blast for hot-off-the press foot and ankle research.

We wish everyone in the AOPT and FASIG well and look forward to how the remainder of 2021 might unfold.

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. I am excited to report that the **Pain Education Manual for Physical Therapist Professional Degree Programs** is available on the AOPT website and can be accessed at https://www.orthopt.org/uploads/content_files/files/Pain_Manual_Draft_FINAL_6.25.2021%281%29.pdf. The Pain Education Manual will help to standardize entry-level physical therapy education across programs in the United States.

The Pain SIG will be sponsoring a CSM Preconference course entitled: Modern Pain Curriculum for DPT Students: Application of the Pain Education Manual for DPT Educators. The course will be held on Tuesday, February 1, 2022. Mark Shepherd, PT, DPT, OCS, FAAOMPT has shared that the course will have online aspects and in person live instruction.

Pain Specialization Update: Derrick Sueki, PT, PhD, DPT, GCPT

Pain specialization continues to move forward. Since our last report, the workgroup has met to discuss the results of a pilot survey. This survey was distributed to 30 pain experts from around the nation. Pain specialization leaders Marlon Wong and Derrick Sueki, along with consultant Jeannie Bryan Coe, are preparing the final version of the survey for resubmission to the American Board of Physical Therapy Specialties (ABPTS). Once the final survey is approved, we will distribute the survey on a broader scale. The results of this survey will be used to describe pain specialization in the field of physical therapy. The Description of Specialty Practice for Pain Specialization will be reviewed by the ABPTS. Then a vote will be conducted by the ABPTS Board determining whether Pain can become an area of specialty practice. A huge thank you goes out to the Subject Matter Expert group providing their expertise along the way. The SME group includes Marlon Wong (leader), Sonya Bariess, Marie Hoeger Bement, Dana Dailey, Nancy Durban, Rob Johnson, Meg Sion, Derrick Sueki, Kory Zimney, and Jeannie Bryan Coe (consultant).

Vice President: Eric Kruger, PT, DPT, PhD

Currently, I am working on reviewing previous surveys of members regarding educational opportunities and strategizing with the AOPT regarding greater engagement and microlearning opportunities.

Nominating Chair: Rebecca Vogsland, PT, DPT

The Nominating Committee has a small slate this cycle with a single nominating committee role on the ballot. Please follow this link if you are interested in running for this elected position. https://www.orthopt.org/content/governance/committees/nominating/2021-aopt-sig-election

Additionally, we have been working with the Pain SIG leadership to develop descriptions for work-group chairs as well as members and getting these opportunities out to those who have expressed interest in getting involved. We continue to welcome all who would like to be involved in the Pain SIG. We are looking for people who are interested in helping to serve on the Research and Public Relations committees. Please reach out if you are interested in becoming involved. Together we are stronger!

Research Chair:

Currently accepting CVs and statements of interest for this appointed position. The Research Chair will be introduced via e-mail blast when an appointment has been made.

Public Relation Chair: Katie McBee, DPT, OCS

Katie is working with the Academy of Orthopaedic Physical Therapy organizing a closed Facebook page for our members. This is the first phase of our public relation plan. Please contact our Nominating Committee Chair, Rebecca Vogsland or Katie McBee if you are interested in helping with developing and designing public relation projects.

Residency and Fellowship Chair: Katie McBee, DPT, OCS

Katie continues to work on pathways for post-professional training. Currently, the workgroup is pursuing avenues towards pain residency training as the process parallels specialty certification. In the future, we will need to find candidates and institutions for residency. She is working on collaborating with other programs.

In closing, the Pain SIG would like to thank President, Joseph M Donnelly, PT, DHSc and our SIG liaison, Beth Collier, PT, DPT, OCS, FAAOMPT and all of the AOPT office personnel for their continued support and guidance.

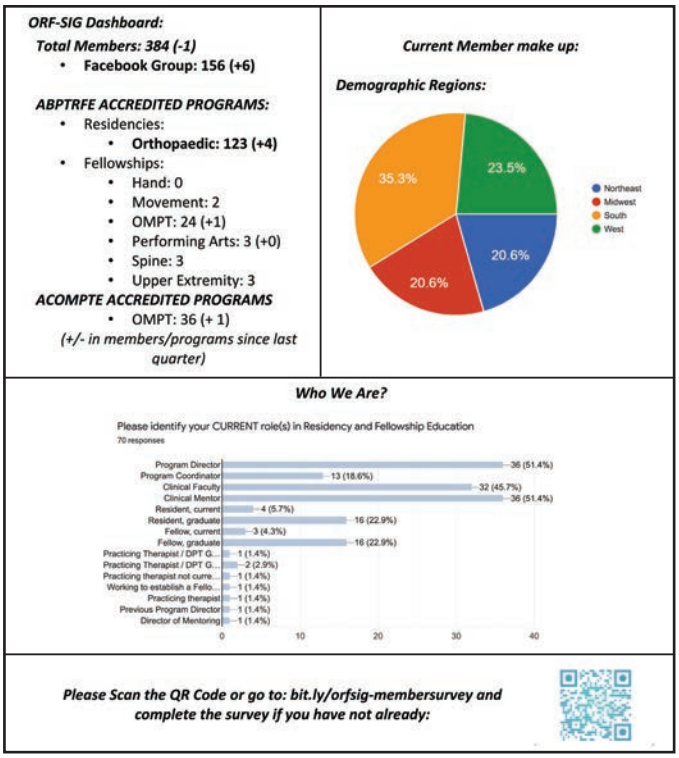
IMAGING SIG

(Continued from page 243)

ELECTION SOON

At the anticipated time of the publication of this issue of OPTP, AOPT elections are just around the corner. For the Imaging SIG, the office of President and member of the Nominating Committee will have elections in November. The selected individuals will take office after CSM in February. Please take the time to get to know the candidates, based on their statements and video presentations, and vote during November. More information about the elections will be forthcoming from AOPT.

ORF-SIG Dashboard:



PRESIDENT'S MESSAGE

ORF-SIG Members,

Recently, I represented our residency program at a local physical therapy school to discuss the benefits of residency and fellowship education to 1st and 2nd year students. The physical therapy program did an excellent job bringing in various specialty programs including sports, neurological, woman's health, and acute care. After a short introduction regarding residency and fellowship education, the students were asked to move into break-out rooms of their choice based on the type of program interest. As the specialty teachers were moved to their rooms, we anxiously waited for students to trickle in and learn more about post professional opportunities in orthopaedic residency and fellowship education. As time ticked by the room sat silent…tick tock, tick tock, and after a few minutes not one student crept into the room.

As speakers sat in the room contemplating the little interest in orthopaedics, several hypotheses were thrown around. *Was this due to the students being exposed to their orthopaedic residents who serve as teaching assistants? Is it that our entry-level orthopaedic training is making more students fully prepared to enter the workforce? Are students more fearful of evaluating and treating the spine since this has historically been a misconception of the differences between Sports and Orthopaedics?* Several other speculations were discussed with only one truth-this current class did not feel they needed to learn more about orthopaedic residency education.

One could say, *"Well we are just doing a great job…they have all the tools they need"*. While it would be great if this were the case, unfortunately this is not what I am hearing from program directors and their number of applicants. Every month I receive an email or two asking if the ORF-SIG can in some way assist with a program to increase applicants. To further evaluate our members' concerns, the ORF-SIG has put a special focus on looking at **Program Sustainability**.

To tackle this project, we recognize that **sustainability** is built upon several different facets. These include:

Recognition: Identifying what barriers may be in place for reaching potential residents/fellows, including geographic, financial, and perceptual biases.

- To address this, the ORF-SIG has put a sub-committee together to evaluate possible applicant shortages based on residency/fellowship program density in specific regions of the country. Using the ABPTRFE aggregate data, we will be looking at several factors including access to programs and/or positions, potential salary/tuition influences, etc. If you would like to assist, please contact mhaberl@orthopt.org.
- Additionally, the ORF-SIG has been reaching out on social media platforms to identify perceived barriers from student physical therapists and new graduates. Initial feedback has been that recent graduates want/need a break from school-based learning. Perhaps our focus needs to shift to the benefits of Mentorship vs Education?
- Alongside this, we are actively sending out campaigns to educate the public regarding the benefits of residency and fellowship training/specialty certification. Look out for some great infographics for you to share the benefits with your patients and student interns!

Representation: Highlighting the value of programs, graduates, and impact of residency and fellowship education on personal/professional goals and influence on company culture.

- The ORF-SIG is connecting its members with potential residents/fellows through a variety of options:
  - The development of an Applicant Registry on our website for potential applicants to be shared with our members.*
  - Monthly Program Faculty/Mentor/Graduate highlight creating an opportunity for members to highlight their program and openings to increase residency/fellowship recognition.*
  - Regional Virtual Residency/Fellowship Career Fairs for programs to meet with potential applicants.
  - In-Person Residency/Fellowship Career Fair for programs to meet with potential applicants at the annual APTA Combined Section Meeting.

Regulation: Understanding the impacts of accreditation standards as well as the different pathways to specialty practice.

- The ORF-SIG has created a variety of FAQ documents regarding regulation changes due to COVID, Addition of Practice Sites, and Primary Health Conditions.*
- Additionally, collaboration with the Academy of PT Education Residency and Fellowship SIG regarding regulatory reminders to assist programs in a variety of topics- RF-PT-CAS, Virtual Sites Visits, etc.*
- The ORF-SIG is considering other forms of education to provide to residency/fellowship stakeholders to further en-

courage applicant interest in residency and fellowship education.

*Access to these resources can be found at the end of this message.

Currently, orthopaedics makes up more than 58% of all American Board of Physical Therapist Specialists certifications. Come work with the ORF-SIG to continue to move this tradition forward. If you would like to Get Involved within the SIG, make sure to reach out to mhaberl@orthopt.org.

THANK YOU,
Matt Haberl
President, ORF-SIG

REFERENCE

1. ABPTA Certified-Specialists Statistics. Accessed August 3, 2021. https://specialization.apta.org/about-abpts/abpts-certified-specialists-statistics

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 Residency and Fellowship Physical Therapy Centralized Application Service (RF-PTCAS). Based on your feedback, we have created 2 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

We are proud to launch this 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. Look for social media blasts in the coming weeks and for ORF-SIG website information on how to communicate interest and to apply!

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

We hope that everyone has had a good summer. As summer winds down, it is essential to attend to preparations for the next RF-PTCAS admissions cycle. Please watch your e-mail and the APTA Hub for these instructions.

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 include 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

Gait Instability Under Low Back Pain Referral: Underlying IDH Wild-Type Astrocytoma

Zachary M. Stapleton PT, DPT, OCS[1], Lauren Momberger PT, DPT[2], Daniel T. Ginat MD, MS[3]

[1]University of Chicago Medical Center – Therapy Services Department, Chicago, IL
[2]Northern Rehab Physical Therapy Specialists, DeKalb, IL
[3]University of Chicago Medical Center – Radiology Department, Chicago, IL

BACKGROUND

Low back pain (LBP) is one of the most common reasons adults are referred to outpatient physical therapy. It is estimated that up to 80% of individuals experience LBP at some point in their life, with an incidence of 1-36% occurring in a single calendar year.[1] Similarly, falls have become an increasingly prevalent health and safety concern for older adults. One in 4 adults over the age of 65 experiences at least one fall per calendar year, with 1 in 5 falls leading to serious injuries or eventual death.[2] Many factors contribute to increased fall risk in older adults including: delayed postural responses, sensory impairments, inactivity and muscular deconditioning, depression, fear of falling, medications,[3,4] and a variety of different environmental components.[5] Given this and the large quantity of healthcare costs associated with treating the consequences of/injuries from falling, reducing fall risk has become quite important in current medical practices across all domains.[1]

Physical therapy has shown to be an effective, conservative treatment option for individuals presenting with both LBP and fall risk.[4] The LBP Clinical Practice Guidelines recommend using treatment-based categorization after performing a thorough examination and assessment of a patient's body structure/functional deficits, activity limitations, and participation restrictions.[6] Similarly, a comprehensive exercise program focusing on muscular strength, power, and balance training has shown to be an effective treatment option for individuals experiencing multiple falls or wishing to reduce fall risk.[4]

Although most cases of LBP are not associated with sinister pathology, it is possible that undiagnosed malignancy, fracture, or other neurologic compromise could be the cause of the LBP in patients referred for physical therapy. Given that the etiology of insidious-onset high risk for falls can be multifactorial, it is imperative that the patient presenting with multiple falls receive a thorough examination. New evidence suggests that typical screening questions often asked to assess for sinister underlying pathology in individuals with neuromusculoskeletal disorders are not the most effective at determining the true presence of an underlying disease process. In many cases, the recognition of these red flags, based on current guidelines, neither improves nor worsens the probability of identifying underlying pathologies such as fracture or malignancy. Instead, performing a comprehensive examination and thorough evaluation process in conjunction with these screening questions is considered the best step to take in proceeding with caution in these cases.[7] The purpose of this case report is to outline the residency trained physical therapy clinical reasoning process behind the evaluation, treatment, and urgent referral of a patient presenting with repeated falls and gait instability despite having been referred by his primary care physician (PCP) to physical therpay with a diagnosis of LBP.

CASE PRESENTATION

A 68-year-old male with a body mass index of 44.47 kg/m^2 and a past medical history including hypertension, hyperlipidemia, coronary artery disease, heart failure with preserved ejection fraction, obstructive sleep apnea, history of prostate cancer (staged as Clinical T1c NxMx adenocarcinoma Gleason 9, but was in remission after radiation and hormone therapy) was referred by his PCP for physical therapy evaluation and treatment of LBP. Pain started 3 weeks prior to physical therapy exam after a mechanical fall from tripping over a step in his home. He landed on the floor, sustained no other injuries, and described the LBP as, "muscular", above the bilateral iliac crests with no symptoms of radicular or referred pain. Although he was referred for pain, it had completely self-resolved in the 2 weeks since visiting his PCP. Instead, his primary concerns included progressive left lower extremity weakness and balance problems spanning the previous 3 months that contributed to falls or near falls 3 to 4 times per month. When asked, the patient attributed his leg weakness to side effects from previous hormone therapy and increasingly sedentary lifestyle. He denied any weight loss over the past 3 months, paresthesias, numbness, or night pain. At baseline he used a walker for bilateral, persistent knee pain with ambulation, was generally sedentary and deconditioned, and could complete all of his activities of daily living with

modified independence. After the onset of the progressive left leg weakness, he resorted to using a wheelchair for mobilizing in the community, a single point cane in the home, and moved in with his sister for assistance with heavy household chores. He came to physical therapy evaluation without any recent imaging studies.

EXAMINATION FINDINGS AND DIFFERENTIAL DIAGNOSIS

The physical examination revealed multiple benign and a few concerning findings. Vital signs were within a normal limit given he was taking metoprolol, enalapril, and furosemide (blood pressure: 129/57 mmHg, pulse: 66 BPM, SpO_2 on room air: 95%). Lumbar active range of motion that required contact guard assist (CGA) for impaired balance did not elicit any painful symptoms and was grossly 75% of a normal quantity in all directions. Substantial proximal left hip and left knee strength deficits bidirectionally in all cardinal planes of motion when compared to the right side were noted, however, there was no asymmetric weakness at the ankles or toes. He was able to ambulate 70 feet with CGA and a single point cane but then required a rest break due to fatigue. Multiple gait deviations were noted to be of moderate concern; he walked with more pronounced compensated Trendelenburg sign on the left than on the right side, decreased hip extension bilaterally, decreased foot clearance bilaterally, small step/stride length but equal bilaterally, and reduced trunk rotation bilaterally. His lower extremity dermatomes were intact to light touch sensation. The following fall risk assessments were performed: Five Time Sit To Stand Test, Rhomberg stance, and standing endurance test. He demonstrated the following respective performances: 43 seconds with bilateral upper extremity assist and CGA, unable to perform due to weakness and instability, and limited to 30 seconds with CGA and increased weight shift to the right. His Western Ontario and McMaster Universities Arthritis Index score was 56%. A list of concerning body structure/functional deficits was developed and included left hip and thigh weakness and impaired muscular endurance. From these deficits, activity limitations were established as difficult: walking, getting out of a chair, and navigating stairs. From these activity limitations, the patient's individualized participation restrictions were outlined as difficulty caring for his home and spending time with his family due to high fall risk and gait instability.

The differential diagnosis for gait instability is vast and should include non-muskuloskeletal sources. In this case, there was no concern for an acute central or peripheral neurogenic process at the time of evaluation given his vital signs were within a normal limit, he denied any upper extremity symptoms, his concerns were chronic and described as slowly progressive in nature, his gait deviations were consistent with those seen in individuals with hip-spine syndrome and were not classically neurogenic, and the neurologic screen (myotomes and sensation) was normal.[8] Given the prevalence of hip-spine syndrome that could be causing a lumbar 3 through 5 nerve root degenerative radiculopathy in combination with the data collected from the examination, the physical therapist felt comfortable treating the patient with substantial caution.[9] Caution was placed at the forefront of the management of this patient because he did not display any ankle or toe weakness that would be typically associated with this type of degenerative radiculopathy and because of the new onset of the weakness in the setting of a history of prostate cancer without any recent low back or pelvic imaging.[10–12] Immediately after the initial evaluation, the physical therapist conferred with the referring PCP over discrepancies between the referral diagnosis and the patient's presenting status. The PCP was receptive to concerns and supported physical therapy treatment with a request for a progress update in 5 to 6 weeks' time.

TREATMENT, RESPONSE, FOLLOW-UP

The patient received a total of 4 weekly treatment sessions focusing on closed-chain functional mobility training and strengthening alongside gait training, each week showing slight improvement. Improvements were noted to be reduced time and frequency of rest breaks, improved tolerance to larger volumes of exercise, and reported compliance with the developed and prescribed home exercise program. He was encouraged to walk around the house 5 to 10 times per day and to limit sitting in the chair to no more than an hour at a time.

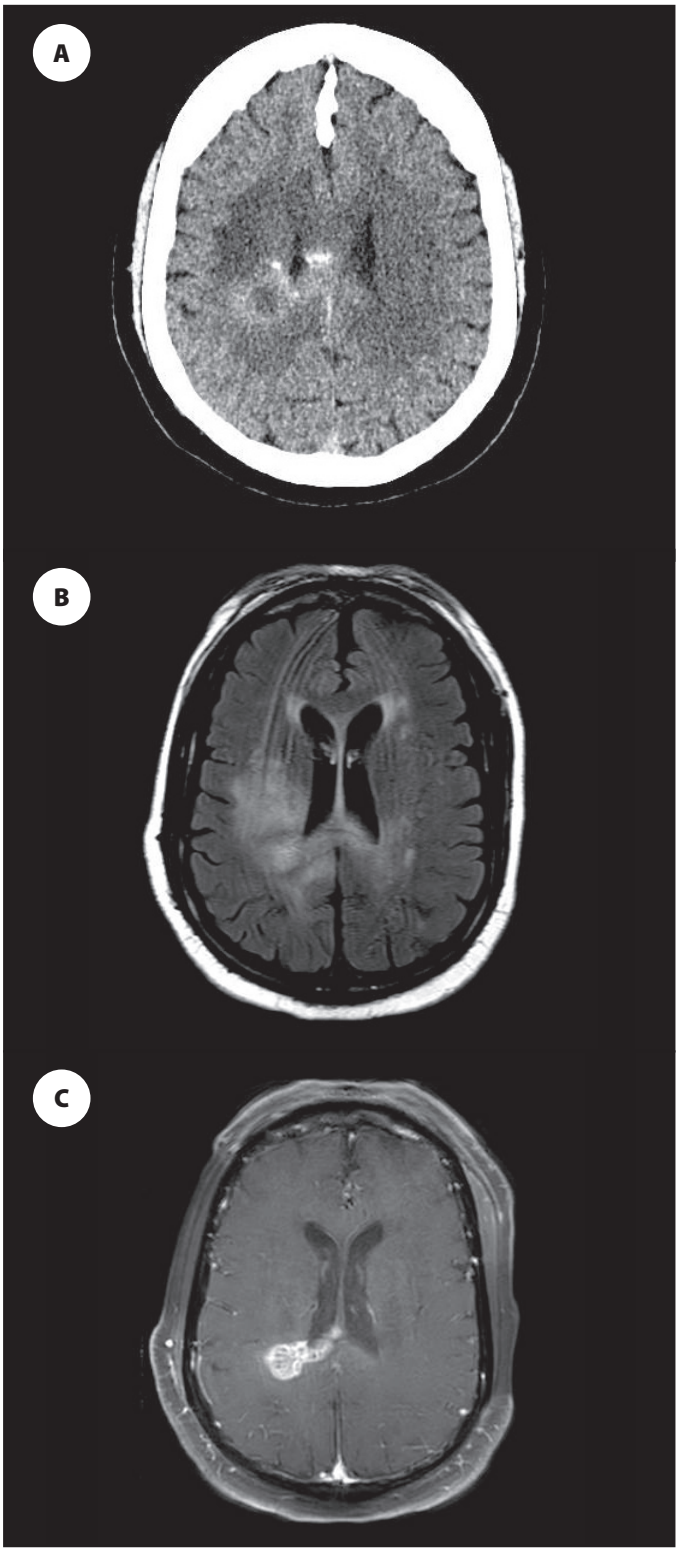
During the 5th treatment session, the patient demonstrated a significant decline in sit-to-stand and stand-to-sit transfer independence, a slight delay in answering questions but no definite aphasia, and acutely progressed weakening of the entire left leg. These signs were present despite a relatively normal blood pressure reading of 129/42 mmHg and pulse of 52 BPM, and denial of any other feelings of malaise. The physical therapist concluded this to be a very abnormal response to treatment and brought him to urgent care for assessment. Cranial nerve examination demonstrated subtle right sided facial droop and left upper extremity weakness was also discovered. The PCP in urgent care concluded a differential diagnosis of metastatic progression or acute neurologic process was appropriate and that he should be worked-up through the emergency department (ED). Computed tomography (CT) of the head in the ED revealed a brain tumor, but abdominal, chest, and pelvic CT were negative for prostate cancer metastases. Brain magnetic resonance imaging (MRI) and eventual biopsy staged the tumor as a primary, grade two IDH wild-type astrocytoma, MGMT promoter non-methylated, with 5% MIB-1 spanning the right anterior frontal lobe into the corpus callosum.

The patient was discharged from outpatient physical therapy to the care of neuro-oncology. He received care in the form of hypofractionated radiation therapy (forty Gy in 15 fractions) with concurrent and adjuvant temozolomide for this unresectable tumor.[13] He eventually expired between 10 and 20 months after diagnosis of this brain tumor, cause of death is not accessible in the medical record. See Figure 1.

DISCUSSION

This case emphasizes the importance of a thorough physical therapy examination and assessment at 2 points within the plan of care of a patient with undiagnosed gait instability; after the initial evaluation when the patient presentation was inconsistent with the referral and again after an acute change in status. Based on the analysis of the data collected after the first assessment, one could argue that imaging of the pelvis or lumbar spine should have been more strongly considered given the history of prostate cancer. This was not a significant concern of the physical therapist because his prostate cancer had been treated and resolved 2 years prior to the initial physical therapy evaluation; he had been attending regularly scheduled appointments and the urologist had no concerns for metastases. Also, the patient denied any pain in the pelvis or lumbar spine and these areas are commonly associated with metastasis of prostate cancer.[14,15] Additionally, the patient did not certify

Figure 1. Results from Diagnostic Brain Imaging Performed After Physical Therapist Urgently Referred Patient for Further Examination Based on Changes in Neurological Status



A, First head imaging study, performed in the ED. Axial non-contrast CT image showing a heterogeneous infiltrative mass that contains calcifications in the right cerebral hemisphere with extension into the posterior corpus callosum. B, Axial T2-weighted, FLAIR-weighted MRI. C, Post-contrast T1-weighted MRI. Both B & C performed as an outpatient after being discharged from the ED show an infiltrative mass in the right cerebral hemisphere with multifocal enhancement and extension into the corpus callosum.

that any of the typical screening red flags for malignancy applied to him; he denied any unexplained changes in weight, malaise, or night pain. It is because of the history of prostate cancer and the insidious onset of these rather concerning symptoms that the physical therapist contacted the referring physician for consultation and diligently analyzed all responses and changes in symptoms during each visit.

Further focus could be extended to the importance of deep tendon reflex testing in this case. A recent case study highlighted the limited clinical utility of hyperreflexia from deep tendon reflex testing for diagnosing a space occupying lesion in the cerebrum.[16] Positive hyperreflexia findings do not provide much additional value in terms of diagnosis due to the number of healthy individuals who are benignly hyperreflexive or have reflex asymmetry.[17] Similarly, a negative result provides even less insight. A more prudent consideration may have been to assess the Babinski Reflex or for the presence of clonus to quick-stretch as these tests have demonstrated better validity for this diagnosis. Despite all of this, the patient's concerns were unilateral, chronic, and stable-appearing, which is why reflexes were not assessed at the initial evaluation. Future assessments of chronic gait instability could potentially benefit from including the Babinski Reflex and clonus assessment.

The second crucial moment in the care for this patient was when he demonstrated an acute change in status. In the setting of all of the aforementioned situational details, the therapist acted urgently and secured an urgent care appointment for the patient. Consideration of referral to the emergency room did occur, but given his relatively normal vital signs and the setting in which the patient was seeking care (hospital-based outpatient physical therapy clinic at an academic medical center with a level one trauma center), an urgent care appointment was considered to be the most appropriate referral. If this patient demonstrated any other abnormalities that might suggest an acute stroke or if the patient was seeking care in a less well-connected environment, then an ambulance would have been called so he could be taken to the emergency department.

This case supports unrestricted and direct access to physical therapy by the public. Despite the fact that the patient was seeking care for a reason that was undiagnosed by his PCP, the residency trained therapist skillfully identified concerning signs and acted appropriately. In addition to supporting unrestricted, direct access to physical therapy by the public, this case emphasizes the importance of the role that the physical therapist plays within the interprofessional medical team. Finally, this case not only supports previous discoveries pertaining to patient experience, patient-physician relationship, and quality of care but it may suggest that patients receive better care for their musculoskeletal concerns when they receive care from a physical therapist, first.[18,19]

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Cupping in Canine Rehabilitation: Description of a Novel Treatment Technique (Part 1 of 2)

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Amie Lamoreaux Hesbach, PT, DPT, MS, CCRP, CCRT

Cupping is a treatment technique first described in 1550 BCE in Egypt, but similarly was used in ancient Chinese, Korean, Tibetan, and Latin American cultures to "release toxins'' from tissues of the body. It is also known as vacuum cupping and has been performed with animal horns, bamboo, ceramic, glass, metal, and plastic cups, though today more commonly with glass or silicone. Dry cupping, wet cupping (or Hijama, in which incisions are made for bloodletting during the cupping process), oil (or sliding) cupping, fire cupping, moxa cupping, horn cupping (or Raktamokashan by shrung), flash (or empty) cupping, deep tissue cupping (or draining), tonifying, liquid cupping, or facial cupping are various methods or styles of cupping therapy.[1]

The application of the cup to the skin of the patient is proposed to have a mechanical effect on the layers of superficial connective tissues. The cup is placed on the skin and a vacuum is created via a balloon or manual pump on the cup, an electrically-powered (and calibrated) vacuum pump, or heating of the air in the cup.[2] The edge or rim of the cup creates a positive pressure or compression to the skin surface, while the volume within the bell of the cup creates a negative pressure or decompression. The overall effect is that the negative pressure creates a mechanical lift of the layers of skin and superficial connective tissues, with effects extending into deeper fascial and muscular layers, loosening, lifting, and mobilizing them (relative to other tissue layers). This gliding effect, rather than the mechanical deformation of the fascia, has been demonstrated through musculoskeletal ultrasound imaging.[3]

The suction created is also proposed to have an effect on tissue healing and circulation, as the tissue beneath the cup is drawn up into the cup, swells, and results in increased blood and lymphatic flow to the area. Other proposed effects include the following:3

- Facilitation of the tissue healing process,
- Temporary modulation of pain,
- Reduction in inflammation,
- Improved metabolism in skin tissue, with better functioning of sebaceous and sweat glands, improved healing, and improved skin resistance,
- Increased secretion of synovial fluid within joints,
- Increased peristalsis and secretion of digestive fluids within the digestive system, resulting in better digestion and excretion,
- Improved functioning of red and white blood cells, and, thereby, the immunological system,
- Stimulation of sensory receptors and nerves of the skin,
- Improved functioning of the autonomic nervous system,
- Reduction in myofascial tension or tone, and
- Nervous system "sedation" and relaxation.[1]

RockPods are a cupping therapy device consisting of "rubbery suction bell-shaped pods" made of silicone and designed, manufactured, and marketed by RockTape. They are able to apply a compressive-decompressive suctioning similar to traditional cupping tools and are used as part of a comprehensive therapy approach in coordination with manual therapies, instrument assisted soft tissue mobilization, kinesiology taping, and corrective therapeutic exercise[3]

Indications for use of cupping therapy, cited in the literature, include[3]:

Reduced tissue mobility or glide	Pain
Presence of trigger points	Poor body awareness (cortical mapping)
Motor dysfunction	Inflammation

Historically (via alternative and complementary medicine resources), indications also include hypertension, rheumatoid arthritis, diabetes mellitus, mental disorders, heart disease, hypertension, infections, skin diseases, and respiratory, musculoskeletal, digestive, reproductive, and allergic conditions.[1]

A review on cupping therapy examined 35 randomized controlled trials published 1992-2010, which were of low methodological quality. Common diseases and disorders for which cupping therapy was used included herpes zoster, facial paralysis, cough, dyspnea, acne, lumbar disc herniation, and cervical spondylosis. Wet cupping was the most often used technique, however, retained cupping, moving cupping, and flash cupping were also cited. Meta-analysis demonstrated that cupping therapy when combined with other Traditional Chinese Medicine treatments was better than other treatments alone in treatment of patients with herpes zoster, facial paralysis, acne, and cervical spondylosis.[4]

Absolute contraindications for the use of cupping therapy, cited in the literature include[3,5]:

Areas with superficial nerves	Muscle dystrophy
Open wounds, incisions, abscesses or ulcers	Infection
Skin issues (dry, cracked, fragile skin, eczema or acne)	Age: Under 7 years (for wet cupping), 2 years for dry cupping
Fractures	Excessive swelling
Dislocated joint	Bleeding disorders or on anti-coagulant therapy
Over areas with superficial blood vessels or varicose veins	Gynecological disorders
High blood pressure	Migraines
Over the abdominal region during pregnancy	Patients with a fear of blood or bleeding
Rheumatic diseases (arthritis or fibromyalgia)	Anxiety or depression

Precautions and side effects of cupping therapy, cited in the literature include[3,5]:

Slight discomfort	Lightheadedness
Sweating	Nausea
Fatigue	Headaches
Muscle tension or soreness	Bruising (which should resolve in 1-10 days)
Skin irritation, itching, scarring or burns (if using a heated cup)	Increased risk of infection

The following is a proposed treatment protocol for the use of RockPods Cupping Therapy in canine rehabilitation:[3,5]

1. Perform a thorough examination, including past medical history.
2. Educate owner in expected outcomes and precautions, and obtain consent to treat.
3. Choose treatment site(s), which may be a specific trigger point or an area of reduced or restricted skin or connective tissue mobility. The size and number of RockPods should be selected, specific to the size and conformation of the pet and treatment site.
4. Clean and dry the RockPods and treatment area. Trim the hair or fur coat, if necessary, to obtain suction. (Check for areas of skin irritation/scars, etc)
5. Positioning may be with the tissue relaxed (shortened), stretched (with tissues lengthened), or active (with tissues loaded).
6. Apply the RockPod to the treatment site.
   a. Option 1: Squeeze: Squeeze the RockPod bell from the sides, to create a mild suction or decompression. (You may need to wet the skin and fur or hair with water or ultrasound gel for any of these options). Option 2: Press down lightly on the top of the bell to create negative pressure/suction. Option 3: Inverted cup: Turn the RockPod rim inside-out, place the convex cup onto the treatment site, and turn the rim "right side out" towards the target area by pushing the edge of the rim towards the treatment site. The rapid unfolding of the cup creates lift in the center of the RockPod, and results in a greater level of suction or decompression.
7. You may leave the pods in place for 30-90 sec, or incorporate gliding or stretching with pods. The RockPod may be left on for up to 2-5 minutes in patients that are more tolerant, however, longer treatment times might induce edema or bruising at the treatment site.
8. Remove the RockPod:
   Option 1: Gently squeeze the cup of the RockPod on opposite sides. This is the best technique to remove the Pod in general. Option 2: The RockPod can be grasped by the handle or plunger and gently twisted and pulled. The negative pressure of the cup will also lift the skin due to suction. Please note that this technique is not recommended for use in animals as it may cause discomfort. Option 3: Natural loss of negative pressure within the cup over time will allow the cup to gently release and fall from the patient.
9. Clean the treatment site and clean and dry the RockPods after use.
10. Following treatment, it is advised that the therapist and owner monitor the treatment area for skin irritation, edema, or bruising.
    RockPod treatment techniques: (Suggested treatment time is 30-90 seconds, up to 5 minutes)[3,5]
    - Stationary, static, or placing technique: Apply the Pod for 30-90 seconds or for up to 5 minutes.
    - Static with internal glide technique: Apply the Pod and actively or passively move the body part (above and below the treatment site) through the full, available range of motion.
    - Static with external glide or sliding technique: Apply the Pod(s), and move the Pod horizontally, vertically, and in circular motions .
    - Static with external and internal glide: Apply the Pod(s). Move the Pod while also moving the body part passively or actively.
    - Shearing technique: Similar to the external glide method, use 2 Pods placed on opposite sides of the treatment site and pull the Pods in opposite directions
    - Stretching technique: Apply the Pod. Perform manual stretching techniques and hold for 30-90 seconds. (This is also called a "mobilizing technique.")
    - Flash or pulsation technique: Apply the Pod. Repeatedly and rapidly increase and decrease the suction of the Pod multiple times at a treatment site that has acute pain or sensitization.

*Please note that these movement techniques are not treating the fascia but the interfaces and loose connective tissue between the fascial layers.

Remember:

- If excessive pain or sensitivity is present, remove and discontinue use of the RockPods immediately.
- Treatment time should never exceed 5 minutes per point. Shorter treatment times are recommended for animals to avoid edema and bruising and, especially, on the first treatment session.
- Cupping treatment can exacerbate acute injuries.
- Remember that "less is more."[3]

Though cupping therapy is not yet a widely used modality in canine rehabilitation, it has potential benefit to increase local circulation through this previously-described compression-decompression effect. Other tools and techniques, for example, the application of kinesiology tape or the application of hair clips to the hair or fur coat overlying a treatment area,6 can potentially provide a similar effect with varying levels of stimulus intensity and duration of treatment effect, however, no clinical studies comparing these techniques have been done.

Cupping therapy has been reported to be utilized in large animal rehabilitation, complementary and alternative medicine, and massage therapy practice, however, only one study applying cupping to animals was found in a PubMed search. In this study, the effects of wet cupping therapy (or Hijama) were investigated as it was applied to the backs of 7 healthy Arabian horses. Two 4-ounce cups were placed on points on the back (behind the scapula) and on the rump of each horse and cupping therapy was performed using

a mechanical pump. Outcomes included measurement of arterial and venous blood parameters and serum cortisol concentration before cupping, 3 days and 2, 4, and 8 weeks after cupping. The treatment resulted in no significant difference in most hematological and biochemical parameters after cupping, but in a significant decrease in the concentration of serum cortisol at 3 and 14 days after cupping. As in this report, incisions were made for bloodletting during the cupping process, it is unknown as to whether the cupping or the bloodletting led to the reported results.[7]

It is apparent that further investigation is necessary in the use of cupping techniques in canine (and equine) physical therapy and rehabilitation. It is the authors' advice to perform cupping therapy with caution and only following additional training and when practicing within their scope of practice. The Animal SIG looks forward to further research in this area.

(Please note that this technique is proposed by the authors and has not been authorized or approved by RockTape or RockPods.)

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4. Apply the current body of evidence underlying the physical therapy management for injury to the muscle-tendon unit.
5. Know how to apply concepts to improve the tolerance of muscle-tendon tissue to load, and implement such concepts to injury prevention strategies.
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7. Describe the pathophysiological processes that occur in the event of an injury to ligament or capsule.
8. Identify the phases of healing following a ligamentous injury.
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11. Appreciate the scientific basis of why cartilage regeneration is limited.
12. Describe the most common mechanisms for articular cartilage damage.
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14. Describe the medical interventions currently used in the repair of articular cartilage.
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