2017 / volume 29 / number 3

ORTHOPAEDIC PHYSICAL THERAPY PRACTICE

The magazine of the Orthopaedic Section, APTA

FEATURE:

Orthopaedic Section Mentorship Experience

Kathy Cieslak, PT, DScPT, MSEd, OCS, and Becca Gusmer, PT, DPT, share their perspectives as mentor and protégé

APTA
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POSTOPERATIVE MANAGEMENT OF ORTHOPAEDIC SURGERIES

Independent Study Course 27.1

Learning Objectives

1. Describe anatomy of the hip joint and how structure can relate to pathological conditions.
2. Describe indications for surgical intervention and select surgical procedures of the hip.
3. Describe postoperative rehabilitation intervention techniques following hip surgery.
4. Know the common structures and pathomechanics involved in knee injury.
5. Describe the physical therapy guidelines, phases, and goals for a patient who has undergone knee surgery.
6. Understand the etiology of a calcaneal fracture, Lisfranc fracture/dislocation, and an Achilles tendon rupture.
7. Identify the advantages and disadvantages of surgical fixation versus closed treatment for calcaneal fractures.
8. Develop appropriate treatment plans for patients who have sustained a calcaneal fracture, Lisfranc fracture/dislocation, or an Achilles tendon rupture.
9. Synthesize the current evidence comparing conservative care versus early surgery in different subgroups of patients with cervical and lumbar spine pain.
10. Identify the clinical findings that identify patients who are most likely to benefit from cervical or lumbar surgical intervention.
11. Screen and appropriately manage postoperative complications for presented pathologies.
12. Develop an evidence-based rehabilitation program for patients who have undergone different cervical and lumbar surgeries.
13. Integrate biomechanics and pathomechanics of the shoulder to evaluation and treatment.
14. Implement evidence-based nonoperative treatment strategies for shoulder pathology.
15. Describe evidence-based rehabilitation guidelines following shoulder surgery.
16. Understand the anatomy and biomechanics of the elbow complex and how it relates to surgical interventions, tissue healing, and treatment.
17. Understand postoperative guidelines and treatment progression for the elbow complex.
18. Apply appropriate patient-reported outcome measures for select surgical procedures of the hip, knee, ankle/foot, spine, shoulder, and elbow.

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Description

This 6-monograph course covers postoperative management for injuries and pathology of the hip, knee, ankle/foot, cervical/lumbar spine, shoulder, and elbow. Each monograph addresses the anatomy and biomechanics of the structure, a review of select or common injuries, and nonsurgical and surgical management. Emphasis is placed on rehabilitation guidelines, precautions and contraindications to care, and also expected outcomes.

Topics and Authors

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ORTHOPAEDIC PHYSICAL THERAPY PRACTICE

The magazine of the Orthopaedic Section, APTA

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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Editor's Note

Birds of a Feather Flock Together!

Christopher Hughes, PT, PhD, OCS, CSCS

My tasks as *Orthopaedic Physical Therapy Practice* Editor are to not only edit and proof the articles but also to read ALL special interest group (SIG) reports. Every quarter I am fortunate enough to get a preview of all of the SIGs' activities and also all the hard work they put into their SIG. By reading all SIG reports, and not just the ones of personal interest, I have developed a great respect for the SIGs and how diligent and motivated they are in fulfilling their tasks. Participation truly makes a difference! Sharing the load of all the duties makes not only the respective SIG stronger, but also the entire Section.

Joining a SIG is a great opportunity to flock together with other members who have a common interest. There truly is productivity in numbers! The Section has 7 SIGs. They are:

- Occupational Health
- Pain Management
- Performing Arts
- Foot & Ankle
- Imaging
- Orthopaedic Residency/Fellowship
- Animal Rehabilitation

I will spare you all the details but you can find a great description of what a SIG is and also the roles and responsibilities they play within the Section by going to our informative website at:

http://www.orthopt.org/content/special-interest-groups

Over the years the SIGs have had some great leaders and have taken on many tasks and accomplished many productive duties. These include innovative Combined Sections Meeting programming and organizing regional seminars, developing curricular content guidelines for their chosen area, making members aware of legislative events across the country, creating a social network of communication, and also advising the Board of Directors (BOD) on strategic planning.

A SIG is a great place to start to get your foot wet in Section governance. The SIGs have a structure and that structure mimics the Section organization in terms of governance roles for President and Vice President/Education Program Chair and also Section Board of Directors Liaison. Not sure if you have what it takes? Do not worry; there are mentors ready to help. All Board of Director members serve as liaisons to SIGs. You also have access to the great Section office staff to guide you! Each SIG also has a portal on the Section website where you can find great resources, even as a non-member. Also, preview meeting minutes are available to take a "peek" into the world of the SIG. You may find this detail interesting.

I know everyone is busy but SIG involvement can actually save you time. Your common-interest colleagues can help expedite queries and also offer advice from previous experience. Brainstorming ideas and jumping on board an existing project can be stimulating. In addition, your input will be valued by your peers. Being active in a SIG will broaden your perspective on issues and also allow you to add perspective on issues to others as well. But the key is to be ACTIVE! That is the best way you can support your SIG.

As Editor of the Independent Study Courses, I am frequently tapping into the SIGs for potential authors and also topic selections for future courses. Their input and assistance has a rippling effect in other Section activities. Also the expertise of the SIG members has been invaluable to the generation and refinement of the respective topics in publication of the clinical practice guidelines.

Humans have an innate social nature so embrace the instinct by joining a SIG or contributing more to your current SIG! So as you preview this issue be sure and read ALL the SIG reports. One may spark your interest enough to join! Also, one needs to look no further than the mentorship article in this issue (page 158) to understand the impact of being involved with the Section can have on professional growth and development.

I end with a big thank you to all my colleagues who work hard in their respective SIGs and have done an incredible job sharing their time and expertise to make the Orthopaedic Section a wonderful Section to be a part of!

2017 Annual Orthopaedic Section Meeting

We would like to thank the following exhibitors for being a part of the 2017 Annual Orthopaedic Section Meeting

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Thank You

Congratulations 2017 Awardees

The American Physical Therapy Association (APTA) has announced the 2017 Honors and Awards Program recipients. The following members of the Orthopaedics Section have been selected by APTA's Board of Directors to receive the following awards:

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Marian Williams Award for Research in Physical Therapy
Samuel R. Ward, PT, PhD

Helen J. Hislop Award for Outstanding Contributions to Professional Literature
Kathleen Sluka, PT, PhD, FAPTA

Outstanding Physical Therapist Assistant Award
Sean Bagbey, PTA, MHA, ATC

Mary McMillan Scholarship Award for Physical Therapist Students
Ryan Maddrey, SPT
Leah Huber Wright, SPTA

Mary McMillan Scholarship Award for Physical Therapist Assistant Students
Brendon Larsen, SPTA

Minority Scholarship Award for Physical Therapist Students
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Adrianna Martinez Hermosillo, SPT
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Award recipients were recognized during the Honors & Awards Ceremony held at the NEXT 2017 Conference and Exposition in Boston, Massachusetts, this past June.

Rehabilitation After Glenohumeral Microfracture and Type II SLAP Repair Surgery: A Case Report

Judson Williams, PT, DPT, MS, OCS, Cert. SMT, CSCS[1]
Eric Chaconas, PT, PhD, FAAOMPT[2]

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ABSTRACT

Background and Purpose: There are few rehabilitation protocols for patients who have undergone glenohumeral microfracture procedure. The purpose of this paper is to present a patient case after both glenohumeral microfracture and Type II SLAP repair procedures and present a rehabilitation protocol. **Methods:** The patient in this case is a 41-year-old male who had a sudden onset of pain, mechanical catching, and audible popping in his right shoulder, particularly with athletic activities. This patient was seen for 27 treatments and progressed per the presented protocol. **Findings:** The overall improvement when combining the sections of the QuickDASH was 72.96%, the patient also met his individual goals, as well as the progression goals for each phase of the protocol. **Clinical Relevance:** The most important factors in rehabilitation following microfracture procedure of the shoulder are balancing early range of motion (ROM) and controlled loading conditions. The patient in this case had a successful outcome following a protocol that emphasized early ROM and incremental loading.

Key Words: shoulder, articular cartilage, labrum, injury, QuickDASH

INTRODUCTION

Articular cartilage lesions are becoming more recognized in younger, active, and athletic populations.[1] These lesions can result in pain, mechanical dysfunction, and decreased function.[2] Injury to the articular cartilage can occur secondary to trauma, joint instability, iatrogenic injury, and certain metabolic conditions.[3] Inappropriate medical management can result in further joint deterioration and osteoarthritis.[1,4] The lack of long-term success with conservative measures such as non-operative rehabilitation, cortisone injection, and visco-supplementation in the active individual has been documented.[5,6] The failure of conservative treatment can be attributed to the avascularity of the articular cartilage and the lack of undifferentiated pluripotent cells that are necessary for the healing process.[1,4]

There are several surgical procedures to address full-thickness articular cartilage lesions. These include open techniques, such as osteochondral autograft transplantation and autologous chondrocyte transplantation,[5] as well as arthroscopic techniques including lavage and debridement, drilling, abrasion arthroplasty, and microfracture.[7,8] Considerations when choosing the type of surgical intervention are the patient's age, activity level, size, location, and severity of the lesion. Classification of articular cartilage injury is important when selecting an appropriate intervention. The Outerbridge classification system is a commonly used system to classify articular cartilage injury.[3,9] Radiologists and orthopedists use it to grade the degree of articular cartilage injury.[8] This system categorizes articular cartilage injury grades 2 to 4 with 4 being full-thickness lesions (Figure 1). While debridement and chondroplasty are more appropriate for grades 2 and 3, full-thickness injury requires a marrow stimulating procedure such as drilling or microfracture. Marrow stimulating procedures such as abrasion, drilling, or microfracture rely on the body's healing response for chondral resurfacing.[10]

Currently, one of the most popular and conservative surgical interventions for grade 4 full-thickness articular cartilage lesions is the micofracture procedure. The microfracture procedure involves debridement of loose cartilage around the periphery of the lesion to create perpendicular walls of healthy articular cartilage.[11] The next step is to remove the calcified cartilage layer exposing the subchondral bone[11] (Figure 2). After the calcified cartilage layer is removed, the subchondral bone is perforated using an arthroscopic awl (Figure 3). In the knee, the holes should be 3 mm to 4 mm apart and 3 mm to 4 mm deep.[1,11] In the shoulder, it is suggested for the holes to be 2 mm to 3 mm apart and 4 mm deep.[3] The final step is to decrease the arthroscopic pump pressure to assess bleeding from the microfracture perforations.[1,11]

Healing from the microfracture procedure begins with marrow elements such as mesenchymal cells (undifferentiated cells), stem cells, growth factors, platelets, and fibrin. This matrix combines to form a clot within the perpendicular walls of the lesion that were created as a step during the procedure.[10] These initial cells undergo metaplasia or cell differentiation to form granulation tissue.[10,12] The stimulation of undifferentiated cells allows them to become chondroblasts or fibroblasts.[11] These cells begin to form a fibrocartilaginous repair in the area of the microfracture.[12] The fibrocartilaginous matrix undergoes a process of hyalinization and chondrification to form the mature repair over the course of 6 to 12 months.[10] The mature fibrocartilaginous area consists of 70% to 80% Type II collagen and 20% to 30% Type I collagen indicating a hyaline and fibrocartilage mix.[11,12]

There are several advantages of microfracture as an initial surgical treatment for full-thickness articular lesions. First, microfracture is minimally invasive and can be performed arthroscopically. It is technically simple and relatively easy to perform along with other procedures if needed.[10,12] Secondly, it allows for further and more invasive procedures if needed at a later date as the microfracture procedure does not create thermal damage observed with drilling techniques.[12]

It is common for articular cartilage lesions of the shoulder to have concomitant injuries, such as, but not limited to labral pathology and instability.[1,3,8,13] Other surgical procedures are commonly performed at the same time as microfracture due to the high incidence rate of other pathology found in conjunction with articular cartilage lesions. Recurrent instability and rotator cuff pathology have been associated with glenohumeral articular pathology.[13] One study by Paley et al[14] found 5% to 17% incidence of glenohumeral articular cartilage injury at the time of surgery in overhead throwing athletes and patients with rotator cuff pathology. Labrum injuries are commonly found in conjunction

Figure 1. Humeral head grade 4 (full-thickness) articular lesion.

Figure 2. Microfracture site prepared with vertical walls and removed calcified cartilage layer.

with articular cartilage injuries. Both articular cartilage and labrum injuries are common in the unstable shoulder.[8] The labrum adds to the stability of the glenohumeral joint by increasing the depth of the glenoid cavity, acting as a bumper limiting translation, serving as an attachment of the long head of the biceps, and improving the concave-convex relationship of the glenohumeral joint.[15]

One of the most common types of labrum injuries in young, athletic populations are superior labrum anterior to posterior (SLAP) injuries. This term was first coined by Snyder[16] in 1990. The SLAP tears were initially categorized into Types I to IV although there are several different classification systems in use now (Figure 4). SLAP lesions have two proposed mechanisms of injury.[17] Andrew et al[18] described a mechanism of traction injury from bicep contraction, as seen during the follow through in over-head throwing. A peel back mechanism of injury resulting in SLAP lesions was described by Burkhart and Morgan.[19] The "peel back" mechanism theory proposes that the labrum is "peeled back" during the cocking phase of the overhead throwing motion.

Microfracture has been studied and performed on the knee for several years. Recently this procedure has been applied to the talus, the hip, and the glenohumeral joints. While success has been well documented in the knee, there are fewer studies examining the long-term success of this procedure when applied to the glenohumeral joint. There are still fewer studies illustrating the appropriate rehabilitation protocol following glenohumeral microfracture procedure. The purpose of this case report is to present and discuss a rehabilitation protocol for a patient following glenohumeral microfracture procedure and Type II SLAP repair.

CASE DESCRIPTION

The patient in this case is a 41-year-old male kinesiology professor who had a sudden onset of pain, recurrent mechanical catching, audible popping, and pain in his right shoulder, particularly with athletic activities. He had no prior trauma but was very active in sports throughout his adolescent period into his adulthood. He had no previous past medical or surgical history. He was currently active in weight training, volleyball, and cross-fit training. He first noticed these symptoms after doing high repetition pull-ups and barbell bench pressing during a cross-fit session two months prior to surgery. Within a period of one to two days after symptom onset, he was unable to perform overhead activities with his right upper extremity due to pain and mechanical symptoms. He had a magnetic resonance imaging with arthrogram, which was positive for a SLAP tear and full-thickness defects of the glenoid and humeral head articular cartilage. Prior to surgery, he completed a course of physical therapy, activity modification, and anti-inflammatory medication with no improvement in symptoms. Despite conservative measures, he continued to have symptoms limiting his function. Eventually after receiving Type II SLAP repair and microfracture of the central humeral head and glenoid, he was referred to a physical therapist. The size of the humeral head articular cartilage lesion was 1.5 mm x 20 mm, the glenoid lesion measured 6 mm x 8 mm.

EXAMINATION

The patient presented to the clinic two days postsurgery in a shoulder immobilization device. There was noted ecchymosis in the upper anterior brachium with no increased skin temperature. The patient had a visual analogue scale (VAS) pain rating of 4/10 and he described his pain as a dull ache local to the right shoulder (Figure 5). The patient's goal was to resume exercise as well as athletic activities without pain.

Visual analogue scales for rating pain are commonly used by physical therapists as a means for patients to subjectively rate their level of pain. The scale used in this case report was a 10-point scale, which was administered to the patient at frequent intervals through-

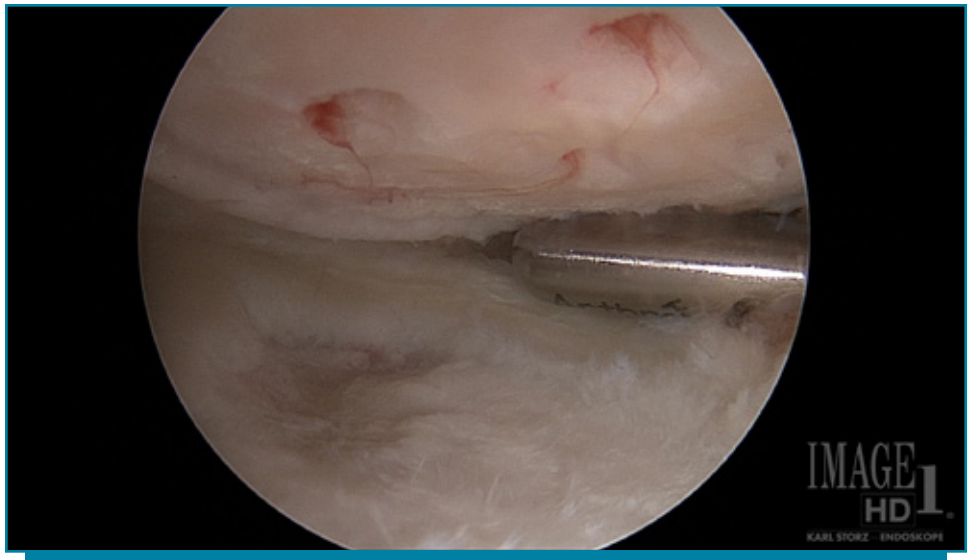


Figure 3. Microfracture procedure completed with bleeding perforations of the subchondral bone. This picture also demonstrates a full-thickness glenoid articular defect.

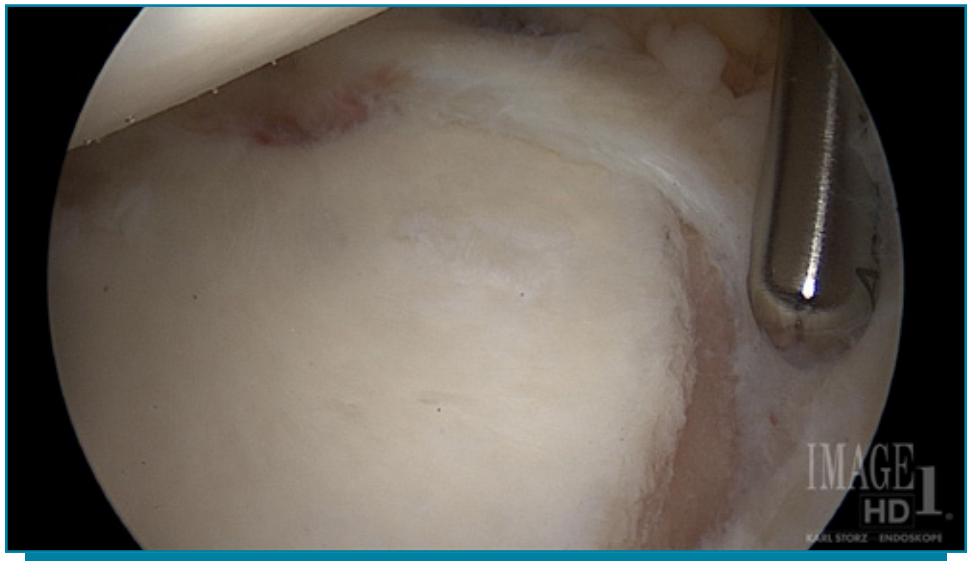


Figure 4. Type II SLAP tear after preparation.

Figure 5. Type II SLAP repair.

out his course of treatment. A study by Bijur et al[20] examined the reliability of VAS pain ratings in the acute setting. Their findings indicate 50% of paired measurements were within 2 mm, 90% were within 9 mm, and 95% were within 16 mm. This study supports the reliability of the use of VAS for patient pain ratings in the acute setting.

Due to the patient's SLAP repair, passive range of motion (ROM) was limited to forward flexion 60°, external rotation (ER) 10°, and internal rotation (IR) to 45°. To avoid excessive compressive and shear forces to the newly forming fibrocartilaginous clot following the microfracture procedure that could be caused with active ROM, only passive ROM was employed. No strength testing or mobility testing of the shoulder was performed at the time of initial evaluation as warranted by precautions due to the SLAP and microfracture procedures.

The Quick Disabilities of Arm, Shoulder and Hand (QuickDASH) was administered as a patient-report outcome measure in this case. The QuickDASH questionnaire was developed from the original 30 question DASH questionnaire that can be used to assess the effect of any upper extremity injury.[21] The original DASH questionnaire has shown reliability, cross-sectional and longitudinal validity in assessing upper extremity musculoskeletal disorders and the more user-friendly QuickDASH has similar test-retest reliability and measurement properties.[21,22] The QuickDASH is an 11-item patient disability/symptom questionnaire completed by the patient. Each question has 5 response options, and scores are calculated from a 0 (no disability) to 100 (maximum disability). The QuickDASH also has two additional 4 question sections consisting of sports and work-related performance questions. The entire series was used in this case and tracked for one year postoperatively. Each item of the QuickDASH is scored 1 to 5 with 1 being "no difficulty" to 5 being "unable" to complete the activity in question. The sum of the higher scores indicate decreased function and severity.[23]

Diagnosis and Prognosis

Primary impairments in this case were decreased joint mobility, decreased muscular strength, and decreased ROM. Inability to actively reach and perform activities of daily living (ADLs) were functional or activity limitations in this case. This patient's participation restrictions or disabilities included an inability to perform weight lifting, cross-fit, and volleyball. The prognosis in this case was dependent on creating the optimal healing

environment for both the microfracture procedure and Type II SLAP repair. The protocol that was developed for this case was based on limited previous research on microfracture of the shoulder despite the extensive research on microfracture of the knee. The morphologic and biomechanical differences of the knee and shoulder were key considerations when developing our protocol. Treatment strategy in this case was to follow the established protocol and examine the outcomes following the protocol. While there have been many studies performed on outcomes after glenohumeral microfracture, virtually none of these described a detailed and successful rehabilitation protocol.[24-26] The patient was seen twice per week during phases 1 through 3 and once per week during phase 4 as the patient was allowed to begin to progress into a gym program during this phase. Specific goals for each phase of our protocol were included to ensure appropriate progression and protection of healing structures (Table 1). The patient's primary goal was to return to previous recreational activities not limited by pain.

Intervention

Phase 1: 0 to 6 weeks (protection-controlled ROM)

The primary goals of this phase of rehabilitation are to prevent the deleterious effects of immobilization and to provide an optimal healing environment for the Type II SLAP repair and microfracture site, using passive ROM to smooth the newly forming fibrocartilaginous matrix site.[7] Specific ROM goals during the first week of rehabilitation were dictated by the Type II SLAP repair. The SLAP repair protocol referenced closely resembles other contemporary Type II SLAP repair protocols in regards to ROM and resistance exercise progression. Some studies advocate continuous passive range of motion (CPM) for microfracture rehabilitation of the knee and in the shoulder when there are no other complicating procedures dictating ROM limitations.[10,24] When considering the ROM limitations exhibited following a SLAP procedure, a CPM device is not practical. In this case, the patient was issued a home exercise program (HEP) using 600 to 800 pendulum rotations divided into 3 different sessions throughout the day.[1,11,25] This continued until the patient removed the sling at 6 weeks postoperatively. During the first 2 weeks, ROM was limited to flexion of 75°, ER to 15°, and IR to 45°. The patient was allowed to progress passive ROM during weeks 3 to 6 to flexion of 145°, ER to 45° at 45° of abduction and IR to 60° at 45° of abduction. To protect the microfracture site from shear or compressive forces, no isometrics or strengthening exercises were performed during weeks 0 to 6. Manual therapy during phase 1 consisted of joint mobilization, soft tissue techniques, and passive ROM. Joint mobilization included grade 1 and 2 glenohumeral joint mobilization, grade 1 and 2 glenohumeral distraction. Soft tissue techniques included myofascial release techniques of the upper quarter and portal scar mobilization techniques. Pain control modalities included electrical stimulation and cryotherapy. The patient's HEP included pendulums, self-supine flexion, cane external rotation at both at 0° and 45° of abduction, and sidelying internal rotation stretching. The patient in this case had normal acromioclavicular, sternoclavicular, and scapulothoracic mobility within the first 2 weeks of therapy. Glenohumeral mobility was not assessed due to healing structure and postsurgical precautions. Range of motion goals were met for this period.

Phase 2: 7 to 11 weeks (controlled ROM to full ROM and initiation of open kinetic chain strengthening)

Primary goals of this phase were careful progression to full active ROM and a very careful progression of loading of the glenohumeral joint. During this phase, the sling was discontinued and ROM was progressed to include active assisted ROM, active ROM, and passive ROM/stretching. Strengthening was initiated with light open chain strengthening using low tension resistance bands and dumbbell exercises. The ROM goal during this period was to achieve full ROM in all planes by 12 weeks. At this time, the strengthening exercises chosen were appropriate for both SLAP repair and microfracture repairs, although the amount of weight was progressed more slowly in an effort to control the loading conditions applied to the microfracture site. During this phase, the primary goal was to continue to provide an optimal healing environment for both the Type II SLAP repair and the microfracture site. Controlled loading of the glenohumeral joint was initiated with light resistance exercise to begin to lightly stress the now maturing fibrocartilaginous matrix to allow for cell differentiation. Studies have shown at 6 weeks, the matrix is still not mature and is still undergoing cellular differentiation from Type I collagen to more of a Type II collagen composition.[10,12] The healing fibrocartilaginous matrix is not mature enough for full weightbearing and heavy strengthening exercise at 6 weeks, but by 12 weeks is more mature and weightbearing strength exercise can be intiated.[12,13] Strengthening during this period began with 1 pound to 2 pound dumbbell exercises and light resistance band exercises. The SLAP repair was protected by avoiding resistance applied through the long head of the bicep and labrum until 8 weeks, which has been promoted in several Type II SLAP repair protocols.[15,18] Strength progression during this phase was progressed from lighter dumbbells and bands at week 7 to heavier dumbbells and resistance bands by week 11 in preparation for closed chain exercises that began at 12 weeks. Secondary to this patient being athletic and previously participating in overhead sports, a selection of short-arc Thrower's Ten exercises were included during this phase. No pressing or closed chain exercises were allowed during this phase to prevent excessive joint compression forces. This phase is a critical healing phase of the microfracture fibrocartilaginous matrix as controlled compression and stress are implemented. The gradual progression from lighter to heavier open chain resistance during this phase mimics a progression from partial weight bearing to weight bearing as described in microfracture protocols in the knee. Controlled loading and compression assist cellular differentiation and promote a more durable repair.[7] The decision to begin open kinetic chain exercise and no closed chain exercise was derived from studies demonstrating greater compressive joint stress with closed chain exercises.[27,28] Light open chain strength exercises were implemented in this phase and cause more shear stress and less compressive force as compared to closed kinetic chain exercises.[27]

Joint mobility testing of the glenohumeral joint at 7 weeks revealed grade 2 hypomobility with a posterior to anterior glide and superior to inferior glide of the glenohumeral joint indicating inferior and anterior capsule restriction. Manual therapy during this phase was advanced regarding the glenohumeral joint to grade 3 and 4 mobilizations as well as grade 2 and 3 distraction to address glenohumeral capsular restriction. The advancement of the grades of mobilization and distraction were appropriate at this time to promote normal mobility and ROM. At 10 weeks postsurgery, the patient had full flexion, IR, and abduction. External rotation at 90° of abduction was still considered minimally limited at 80°. With continued manual therapy and stretching exercises, the patient had full active and passive ROM in all motions as compared to his opposite (left) shoulder by 12 weeks postsurgery. Glenohumeral joint mobility at this time was assessed

Table 1. Postoperative Rehabilitation for Type II SLAP and Glenohumeral Microfracture Protocol

I. Post-op Phase 1: Protection-Controlled Range of Motion (0-6 weeks):

GOALS

1. Protection-sling for 6 weeks
2. Pain management
3. Gentle mobilization within the limits of available motion
4. Prevent negative effects of immobilization
5. Provide ideal environment for healing

EXERCISES

Week 0-2

- Pendulum minimum 600-800 cycles per day (3-4 sessions/day)
- Passive range of motion shoulder
  - Week 1 flexion 60° (week 2, flexion 75°)
  - 60° abduction in the scapular plane
  - External rotation 10°-15° and internal rotation 45° in scapular plane
  - No active external rotation or extension or abduction
- Scapulothoracic, wrist, hand active range of motion exercises, grip exercises
- No isolated biceps contraction
- Manual therapy for grade 1-2 mobilization and distraction of the glenohumeral joint, grade 1-4 mobilization of the scapulothoracic, acromioclavicular, sternoclavicular joints, and soft tissue techniques as needed
- Cryotherapy, modalities as indicated

Week 3-4

- Continue use of sling until 6 weeks
- Continue 600-800 pendulums per day
- Continue gentle range of motion exercises (passive ROM)
  - Flexion to 90°
  - Abduction to 75°-85°
  - External rotation at 45° abduction to 25°-30°
  - Internal rotation at 45° abduction to 55°-60°
  - Resistance band rotator cuff strengthening
  - Scapulothoracic stabilization/strengthening, dumbbell rows multi-angle, scapular protraction, elevation, setting
  - Body blade in scaption
  - Proprioceptive neuromuscular facilitation patterns with light bands
  - Manual techniques
  - Proprioceptive neuromuscular facilitation patterns and rhythmic stabilization strengthening
  - Open kinetic chain perturbation exercises
  - Progression to grade 3-4 joint mobilization and soft tissue mobilization as needed

II. Post-op Phase 2: Controlled ROM to Full ROM and initiation of open kinetic chain strengthening (7-11 weeks):

GOALS

1. Gradually restore full ROM by 10-12 weeks
2. Protect SLAP and microfracture repairs
3. Begin controlled loading of the microfracture repair and begin light open chain strength program

Week 7-9

- Gradually improve ROM to full ROM
  - Flexion to 180°
  - External rotation at 90° abduction: 90°-95°
  - Internal rotation at 90° abduction: 70°-75°
- Begin open chain strengthening program short lever (limit 5 lbs. and light resistance bands) selected short lever Thrower's Ten exercises

Week 10-11

- May progress resistance program (light-medium resistance bands and 15#)
- Progress external rotation ROM
  - External rotation at 90°-100° (goal to be equal to opposite)
  - Continue all stretching and strengthening exercises
  - Consider additional ROM needed for the overhead athlete
  - May begin light bicep resistance exercises

EXERCISES

- Active warm-up
- Sidelying external rotation, prone series
- Resistance band rotator cuff strengthening
- Scapulothoracic stabilization/strengthening, dumbbell rows multi-angle, scapular protraction, elevation, setting
- Body blade in scaption
- PNF patterns with light bands

Manual techniques

- Proprioceptive neuromuscular facilitation patterns and rhythmic stabilization strengthening
- Open kinetic chain perturbation exercises
- Progression to grade 3-4 joint mobilization and soft tissue mobilization as needed

III. Post-op Phase 3: Initiation of closed chain, advanced open chain, and dynamic strengthening (12-19 weeks):

GOALS

1. Maintain full ROM
2. Continue controlled loading conditions
3. Promote muscular strength and joint stability
4. Gradually initiate functional activities

Criteria to enter phase III

- Full nonpainful ROM
- 4/5 to 4+/5 muscular strength (scapular and rotator cuff muscle groups)
- No pain or tenderness with phase II strength exercises

Weeks 12-15

- Continue open chain strengthening exercises
  - Advanced band and dumbbell exercise and advanced Thrower's Ten program
  - PNF manual resistance
  - Initiate light plyometric program
  - Low level aquatic/swimming exercises
  - Continue stretching program as needed
- Closed chain exercises
  - Front and side planks
  - Ball stability exercises
  - Closed chain upper extremity yoga poses

Week 16-19

- Continue plyometric program
- Continue manual strength exercise (PNF, rhythmic stabilization)
- Continue open chain strength program
- Body weight push-ups and pull-ups
- Closed chain perturbation exercises
- Dumbbell and barbell isotonic exercises not to exceed previous 50% of 1 RM (or estimate)

IV. Phase 4: Advanced strengthening phase (20-24 weeks)

GOALS

1. Promote dynamic strength and stability
2. Prepare for return to sport

Criteria to enter phase IV

- Full range of motion
- Painless performance of phase 3 exercise

Week 20-24

- Continue open and closed chain strength program
- Proprioceptive neuromuscular facilitation manual-resistance patterns
- Continue plyometric strengthening
- Initiate throwing program and/or sport specific training

V. Phase 5: Return-to-activity phase (6 months +)

GOALS

1. Gradual return to sport activities
2. Maintain strength, mobility, and stability

Criteria to enter phase V

- Full functional range of motion
- Muscular performance 5/5 strength or isokinetic benchmarks
- No pain or tenderness

Continue stretching and advanced strengthening program

Abbreviations: ROM, range of motion; SLAP, superior labrum anterior to posterior; PNF, proprioceptive neuromuscular facilitation; 1 RM, one rep max

as normal, allowing progression to phase 3 of the protocol.

Phase 3: 12 to 19 weeks (initiation of closed chain, advanced open-chain, and dynamic strengthening)

In this phase, closed kinetic chain strength exercises were introduced. At 12 weeks post-microfracture procedure, the fibrocartilaginous matrix filling the microfracture site has been shown to be relatively mature.[12,13] The decision to begin resistance with open chain exercise and begin closed chain strengthening at 12 weeks was in an effort to control the force or loading conditions of the fibrocartilaginous matrix. Gradually increase the loading conditions to which the microfracture site was exposed to allow cell differentiation and further maturation of the microfracture repair. Strength exercises during this phase included isotonic exercise and closed kinetic chain exercises using the patient's body weight. Isotonic exercises included resistance bands, dumbbells, cable machines, and barbell weights. Initially, closed chain body weight exercises were isometric or static exercises which were then progressed to compound body weight exercises beginning during week 16. All exercises were monitored for careful progression of resistance over the course of this 8 week phase. Plyometric exercises such as the body blade and ball rebounding were also implemented and progressed during this phase. Manual therapy during this phase consisted of rhythmic stabilization at various angles, diagonal proprioceptive neuromuscular facilitation patterns, and closed chain perturbations applied by the physical therapist. At this time, very little soft tissue or joint mobilization was needed as the patient had full, pain-free ROM prior to beginning this phase by week 12.

Phase 4: 20-24 weeks (advanced strengthening)

During this final phase of supervised rehabilitation, the patient was allowed to resume a semi-independent gym program, yet he was educated on avoiding extremes in joint loading, such as heavy pressing activities. The goal for his gym program was to never exceed 75% of his previous 1 rep max on any upper body pressing exercises. The patient was seen for advanced lifting and resisted manual therapy training once per week. Sport specific exercises such as low level volleyball drills and weighted ball plyometric drills were implemented during supervised therapy sessions.

Phase 5: 6 months + (return to activity)

This phase marked the end of supervised training and the beginning of the patient's independent resistance and sports training. The patient had met all of his goals for each phase of the protocol and was also well educated on his future training plan. The patient was cautioned to limit and avoid high-impact and extreme loading activities. A graduated volleyball serving program was also provided to the patient.

OUTCOMES

Outcomes for this case were measured with the following parameters: ROM, strength, pain, and the QuickDASH self-report questionnaire. Factors affecting the outcome following microfracture procedure in the glenohumeral joint are of course proper surgical technique, rehabilitation, patient selection, and whether there are unipolar (involving one joint surface) or bipolar lesions (involving both the glenoid and humeral head). Unipolar lesions have been observed to have a higher success rate when compared to bipolar lesions in the shoulder.[1,12,25,26]

The patient in this case failed conservative measures, underwent microfracture and Type II SLAP repair surgery, completed a 6-month course of postsurgical physical therapy, and was followed postoperatively for one year. One unique aspect of this case is that his supervised physical therapy began two days postoperatively. His final supervised visit was during his 24th week, which according to the protocol, is the appropriate time for him to begin independent, sport-specific training. He was able to meet all of his previously established physical therapy goals. The patient had several phone interviews to answer minor questions he had regarding his independent training and check on his independent progression. His final measurement was in the form of verbal questioning for his pain level and to complete the QuickDASH questionnaire at his one year anniversary date following surgery.

This patient made consistent progress in regards to his ROM and progressed within the ROM guidelines dictated primarily by his Type II SLAP repair. He did experience stiffness, particularly in progressing external rotation from weeks 7 through 11. He was however able to meet his goal of being equal to his contralateral shoulder prior to 12 weeks postsurgery.

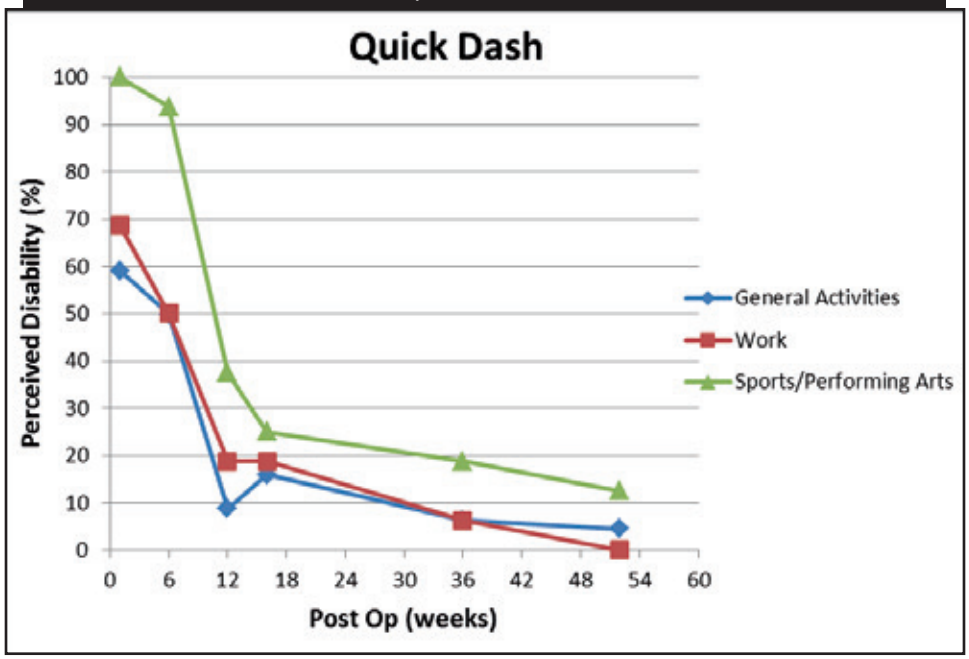
This patient also met his strength goals of 5/5 strength with rotator cuff, scapular, and upper extremity muscle groups. Due to both the SLAP and microfracture procedures, light open chain strength exercises were initiated first and gradually progressed to heavier weight and eventually closed chain exercises. Open chain exercises have been shown to be effective in addressing specific rotator cuff muscle imbalances or weakness. Closed chain strength exercises have been shown to be essential in promoting functional and overall rotator cuff strength.[29] In this case, open chain strength exercises initiated first in an effort to limit compressive joint forces. This is imperative in creating an optimal healing environment after the microfracture procedure.

Pain ratings during the course of this patient's rehabilitation remained relatively low ranging from 4 to 0 on a visual analog scale. The progression of pain scores followed a linear scale and the patient was able to meet his pain-related goal of returning to full, painfree function. This patient did continue to experience what he described as a "dull ache" after weight training or sporting activities such as volleyball. These symptoms usually lasted 24 to 48 hours and were 1-2/10 on the VAS.

The QuickDASH was implemented in this case and demonstrated considerable improvement during the course of treatment. It was developed from the original DASH questionnaire to be a shortened yet still accurate measure of disabilities of the upper extremity.[21] A study by Gummesson et al[22] compared the longitudinal construct validity of the DASH versus the QuickDASH in distinguishing patients after shoulder surgery and found the effect size for the DASH was 0.79 and for QuickDASH was 0.74. The standardized mean response was for the DASH was 0.45 and QuickDASH was 0.46. The ROC analysis indicated no difference in their ability to distinguish between groups. In this same study by Gummesson et al[22] the reliability of the QuickDASH when compared to the original DASH was also found to be similar. In a study by Matheson et al[23] test re-test reliability of the QuickDASH was found to be 0.90 without the work component and 0.94 with the work component included. The minimal clinically important difference (MCID) is the amount of change in the score of a measure that must occur to indicate an important or meaningful difference in the patient's condition. In a study by Minken et al,[30] MCID was determined to be 8 points for the QuickDASH in rating patients with shoulder pain.

In this case report, QuickDASH scores continued to show improvement in all categories up to the one year follow-up. The general activities section showed an improvement of 68.75% from 68.75 to 0, the sports sec-

Table 2. DASH Scores Over a One-year Period



tion showed an improvement of 87.5% from 100 to 12.5, and work section showed an improvement of 59.09% from 62.64 to 4.55 over the course of the year following surgery (Table 2).

DISCUSSION

The purpose of this case report was to present a detailed rehabilitation protocol following glenohumeral microfracture and Type II SLAP repair. Although the microfracture procedure has become the first-line choice for focal full-thickness articular cartilage lesions in the knee, less research has been done on outcomes following microfracture in the shoulder.[12,26] There is an abundance of outcome studies and rehabilitation protocols following a microfracture procedure in the knee. However, there are few studies following outcomes of microfracture in the shoulder. There are still fewer studies following a detailed rehabilitation protocol after microfracture of the shoulder.

The success of fibrocartilaginous repair depends on appropriate rehabilitation, proper surgical technique, and consideration of any other procedures performed. A study performed by Kerr and McCarty[31] on arthroscopic debridement of unipolar and bipolar articular cartilage lesions in the shoulder found significantly improved outcomes in patients with unipolar lesions. A study by Millett et al[26] performed on outcomes following glenohumeral microfracture found patients with smaller lesions and patients who were treated for unipolar lesions of the humerus had better outcomes versus poorer outcome for patients with bipolar lesions. In a study by Frank et al[25] the overall success rate following glenohumeral microfracture was 80%.

Physiologic cartilage characteristics and morphologic differences between the knee and shoulder joint were taken into account when developing this protocol. The shoulder has more degrees of freedom, thinner articular cartilage, and is a nonweight-bearing joint when compared to the knee joint.[1,4,10,26] These differences are imperative to understand when considering rehabilitation after surgery. One of the most considerable differences is the thickness of the articular cartilage of the shoulder versus the knee joint. Average articular cartilage may range from 1 mm to 1.5 mm in the glenohumeral joint compared to 2 mm to 3 mm in the knee.[8,10,32] Another major difference between the knee and the shoulder joint would be the loading conditions that each joint experiences in daily life.[5] Strength and loading conditions were progressed at a slower pace during this study due to these differences. Motion is critical in stimulating synovial fluid, which in turn nourishes the forming fibrocartilaginous clot and surrounding articular cartilage.[10] Controlled mechanical loading and motion are also thought to aid in cell differentiation and collagen synthesis.[6,9,21]

CONCLUSION

This case report presented a protocol and treatment approach used on a patient with both a Type II SLAP tear repair and glenohumeral microfracture procedure. Due to the extensive amount of research and plethora of protocols on rehabilitation of Type II SLAP repairs, much of this case study discussed principles and research guiding the development of the glenohumeral microfracture portion of this case since frequently articular cartilage injuries are linked to trauma, instability, and impact or torsional loading. Rehabilitation of articular injury is often performed while considering other injuries and their respective treatment protocols.[2,8,11] Early motion is required for synovial fluid production and cellular differentiation, both are necessary for a successful outcome following microfracture.[2,8] The most important factors in rehabilitation following a microfracture procedure of the shoulder are early ROM and controlled loading conditions.

In this case report, we elected to initiate a light open chain strength program to minimize compressive force to glenohumeral joint at 7 weeks postsurgery. Closed chain strength exercises were implemented at 12 weeks once the microfracture site had matured enough to tolerate increased compressive force or joint loading. Several studies support a more mature fibrocartilaginous matrix at 12 weeks, which would tolerate compressive loading more easily.[9,12,13] While this patient had an outstanding outcome following this surgery and rehabilitation protocol, there are many factors affecting each individual's outcome. The single subject design of this case report prevents any cause and effect relationship or generalization to other patients. The presented protocol is based on current evidence and can be used as a starting point for further glenohumeral microfracture protocol development.

One area of future consideration would be application of resistance exercise and weight-bearing exercise later during postsurgery recovery. Several studies suggest the vulnerability of the fibrocartilaginous clot between weeks 6 and 12.[12,13] Of great benefit would be a long-term outcome study performed with patients who have undergone unipolar humeral head microfracture procedure with delayed strength training until 12 weeks versus patients who followed a progression of strength from open chain to closed chain such as our described protocol.

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Cervical Stabilization Exercises in People with Neck Pain Following Concussion: A Case Series

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ABSTRACT

Background: Concussion is a medical diagnosis that often results in referral for physical therapy services to address the patient's impairments and functional limitations. There are 3 major classes of post-concussive clinical presentation: physiologic, physical, and vestibular. Complaints related to concussion include headache, neck pain, dizziness, poor balance, and impaired performance in their activities of daily living. **Purpose:** To assess the efficacy of a cervical spine stabilization exercise program (CSEP) in physical therapy for people following a concussion. Cervical spine stabilization exercises promote controlled stability in the neck, which can improve the quality of life for these individuals with suspected ligamentous laxity. **Methods:** A retrospective chart review was conducted on 4 patients who were diagnosed with concussion and had complaints of neck pain. All 4 were found to present with a physical post-concussive presentation. Patient A was an 18-year-old male injured while playing soccer when another athlete's fist struck him in the head, causing his head to whip and strike his shoulder. Patient B was a 23-year-old female with neck-related dizziness who sustained a concussion and neck injury 1 year prior while heading a ball in soccer. Patient C was a 25-year-old female who sustained a concussion and neck-related dizziness following a motor vehicle accident (MVA) in which her head struck the steering wheel when bumped from behind by a car traveling at 5 mph. Patient D was a 16-year-old female volleyball player presenting after 2 injuries. She was hit in the nose by another player's hand, and 10 days later made head contact with another player during volleyball. Two physical therapists were involved with examination and treatment of the patients. Physical therapy interventions included a cervical spine stabilization exercise program. Outcome measures assessed at beginning and end of physical therapy included the Neck Disability Index (NDI), the Visual Analog Scale (VAS) for pain, and the Dizziness Handicap Inventory (DHI). **Results:** The patients included in this study demonstrated between 20% and 100% improvement in the NDI scores, 22.2% and 100% improvement in DHI scores, and 60% and 100% improvement in VAS scores. All 4 patients reported an improvement in functional ability after receiving treatment for 3 to 8 weeks. **Conclusion:** A cervical spine stabilization exercise program is a safe and appropriate treatment strategy for patients experiencing neck pain post-concussion. Further research is recommended to investigate the efficacy of CSEP compared to other conventional physical therapy treatment.

Key Words: vestibular, therapy, trauma

INTRODUCTION

As described in the International Concussion Consensus statement (2012), "concussion is a brain injury and is defined as a complex pathophysiological process affecting the brain, induced by biomechanical forces."[1] The majority of concussions are caused by some form of trauma to the head and cervical spine, including but not limited to motor vehicle accidents (MVA) and sports-related trauma.[2] The cervical spine is the most mobile part of the vertebral column, and is potentially vulnerable to injury.[3] Osteoligamentous structures provide stability to the spine as a whole; however, these structures' ability to provide stability may be challenged with even minimal force sustained, thus increasing joint laxity.[4] The posterior ligamentous structures, which include the supraspinous and infraspinous ligaments, provide check reins to the motions allowed at the cervical spine, including flexion, extension, lateral flexion, and rotation.[4,5] During rotary motions of the cervical spine, the ligaments provide stability; however, a whiplash mechanism of injury may produce injury to these and other tissues.[4]

Whiplash has been defined in the literature as any abnormal, excessive force applied to the cervical spine.[5] The typical range of motion of the cervical spine is 45° of flexion and 45° extension from anatomic neutral. Following a whiplash event, an individual's range of motion may exceed the normal values secondary to hypermobility of the cervical spine. This hypermobility often leads to secondary impairments and various symptoms, the most prominent being neck pain. Due to a common etiology, whiplash and concussion are often experienced concurrently.

Following a concussion, individuals may complain about a variety of symptoms including neck pain, dizziness, vestibular dysfunction, poor concentration, amnesia, irritability, balance deficits, and headaches.[6-9] Symptoms such as neck pain may overlap with other pathologies; therefore, a comprehensive physical therapy systems review is necessary to determine the most likely cause. A systems review examines all of the body's systems vital to function to rule out other etiologies of the patient's complaint. In the majority of patients, symptoms caused by a sports related injury are self-limiting, while symptoms related to non-sports related etiologies resolve within 3 months.[7]

When an individual's symptoms remain present longer than expected, a diagnosis of post-concussion syndrome (PCS) may be appropriate. Post-concussion syndrome is a diagnosis of exclusion when other possible pathologies have been ruled out and residual deficits persist up to one year following a concussion. These residual deficits may include neck pain, headaches, memory and concentration impairments, fatigue, dizziness, insomnia, and irritability. Clinically, an overlap of common patient complaints exists between those diagnosed with PCS and whiplash associated disorder. This overlap is due to a common etiology leading to cervical spine instability that is clinically defined as the spine's inability to function with normal motion under typical physiological loads. Instability may result in irritation to nerves, structural deformation, and/or incapacitating pain.[8,9]

Current treatment guidelines for patients

following a concussion or with a diagnosis of PCS include physical and mental rest, modalities for pain management, active range of motion, stretching, and vestibular rehabilitation exercises. Conventional treatments such as traction and manipulation may exacerbate a patient's complaints of dizziness and neck pain acutely and may extend this phase of healing. This problem can be addressed by incorporating a cervical spine stabilization exercise program (CSEP) because the treatment approach focuses on small range, low intensity, mid-range movements.[10-12] The addition of a CSEP to conventional physical therapy management may increase efficacy when combined with conventional physical therapy. Efficacy of this treatment approach may be assessed with the Neck Disability Index (NDI) to determine the patient's perceived level of function, Visual Analog Scale (VAS) scores to quantify the severity of neck pain, and the Dizziness Handicap Inventory (DHI) to objectify the dizziness impairment.

METHODS

Participants

This case series was approved by the Human Subjects Research Review Committee at Daemen College in Amherst, NY. A retrospective chart review of 4 patients treated in physical therapy following concussion was collected from October 1, 2015, through November 15, 2015, by physical therapists as part of the physical therapy record of patients treated at Niagara Falls Medical Center, Summit Healthplex Physical Therapy or Catholic Health System, Partners in Rehab Physical Therapy.

Charts were selected if the individual who received therapy had a diagnosis of a concussion with complaints of neck pain and received a CSEP as part of their rehabilitation. The CSEP included deep neck muscle stabilization training exercises performed with the patient in supine, prone, sidelying, standing, or while seated on a dynamic surface (Figures 1-4).

Patient A was an 18-year-old male injured while playing soccer. He went for the ball at the same time as the keeper; the keeper tried to punch the ball away and punched the other athlete in the head, his head whipped and hit his shoulder. He was evaluated 8 days after injury and treated for headaches, dizziness, and neck pain.

Patient B was a 23-year-old female with neck-related dizziness who sustained a concussion and neck pain 1 year prior while heading a ball in soccer.

Patient C was a 25-year-old female who sustained a concussion and neck-related dizziness following an MVA in which her head struck the steering wheel when bumped from behind by a car traveling at 5 mph. She was seen in physical therapy 2 months following the accident.

Patient D was a 16-year-old female volleyball player presenting after 2 injuries. She was hit in the nose by another player's hand, and 10 days later made head contact with another player during volleyball. She was evaluated 1 week after the second injury and treated for neck pain, headaches, and dizziness.

The patients began with the neck stabilization exercises in supine. Then they were progressed based on patient's response to outcome measures listed below and clinical judgment.

Outcome Measures

The NDI is a 10 item self-report questionnaire that is completed by the participant. The VAS is a 0 to 10 pain scale where a participant verbally rates his or her pain as 0 being no pain and 10 being the highest pain; this scale can be verbally administered to the participant. The DHI is a 25-item questionnaire that is self-completed by the participant where a score above 54 is considered a severe handicap in terms of balance and dizziness.[13]

Data Analysis

Retrospective data analysis and descriptive statistics were performed for each patient in this case series. Data analysis was completed using Microsoft Excel software. The outcome measure scores for each patient were assessed at baseline and upon discharge from physical therapy. The percent improvement after therapy for each of the 3 outcome measures was recorded for each patient.

RESULTS

The NDI has shown to be a valid and reliable self-report assessment tool for individuals with mechanical neck pain.[14] The NDI assesses a patient's function in the following areas: pain, self-care, lifting, reading, headaches, concentration, work, driving, sleeping, and recreation. Patient A displayed a 100% improvement in NDI over 3 weeks of receiving the supine and standing deep neck muscle training exercises. Patient B displayed a 94.7% improvement on the NDI after 8 weeks of receiving the supine, prone, sidelying, standing, and therapy ball deep neck flexor training exercises. Patient C displayed a 66.7% improvement in NDI over 3 weeks of receiving supine and therapy ball deep neck flexor training exercises. Lastly, patient D displayed a 20% improvement on NDI over 4 weeks and received the supine deep neck flexor training exercises only.

The DHI has been shown to be reliable self-report tool for quantifying a patient's functional disability related to dizziness.[13] Patient A displayed a 100% improvement on DHI over 3 weeks. Patient B exhibited a 95.2% improvement on DHI over 8 weeks. Patient C exhibited a 22.2% overall improvement in DHI over 3 weeks. Patient D displayed a 58.3% improvement overall on the DHI over 4 weeks.

The VAS improvements of all 4 patients ranged from 67.5% to 100% over the course of 3 to 8 weeks. After receiving therapy, all patients self-reported a decrease incidence and severity of neck pain. All outcomes for the 4 patients are illustrated in Figures 5 through 8.

DISCUSSION

This preliminary study was designed to look at the efficacy of a cervical stabilization protocol to treat neck pain in patients following a concussion. Current research in this area of clinical practice is limited. Other researchers have sought to examine the effectiveness of a CSEP to treat nonspecific neck pain.[8]

Sterling et al[9] used the NDI in 66 volunteers to determine the neuromuscular changes in the cervical spine following a whiplash injury and concluded motor system changes are present within 1 month of trauma to the cervical spine; such neuromuscular changes may be intervened with a cervical stabilization program. Jull et al[10] also reported altered neuromotor strategies are present in individuals experiencing neck pain, regardless of etiology. They determined this was due to increased activity of superficial neck flexors and decreased activity of deep neck flexors. This produced an overall reduction in isometric endurance of the cervical flexors as a whole.

Ylinen et al[11] in a randomized study using 180 female office workers concluded stretching alone is the least effective treatment when treating cervicogenic headache; adding cervical stabilization produced more favorable outcomes in decreasing neck pain.

Jull et al[12] in a randomized study of 200 participants assessed therapeutic exercise, including an isometric strength program, alone and in conjunction with manual therapy. Their study concluded that use of deep neck flexor training may decrease overall neck pain in the long-term for individuals experiencing cervicogenic headaches.

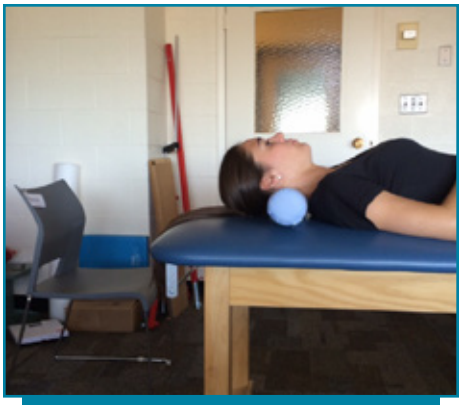

Figure 1. Supine deep neck flexor exercise (DNF).

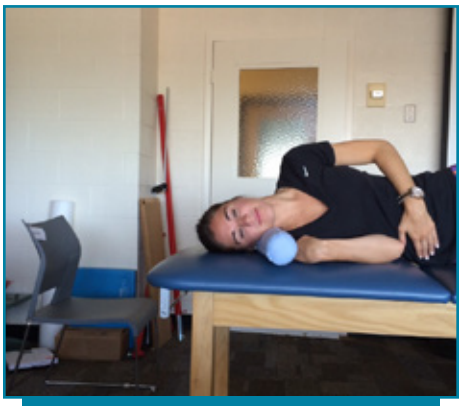

Figure 2. Sidelying (DNF).

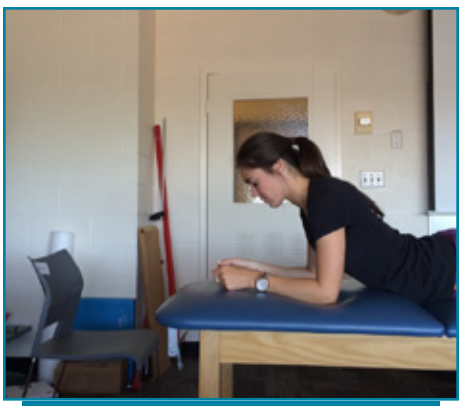

Figure 3. Prone (DNF).

Figure 4. Sitting on therapy ball (DNF).

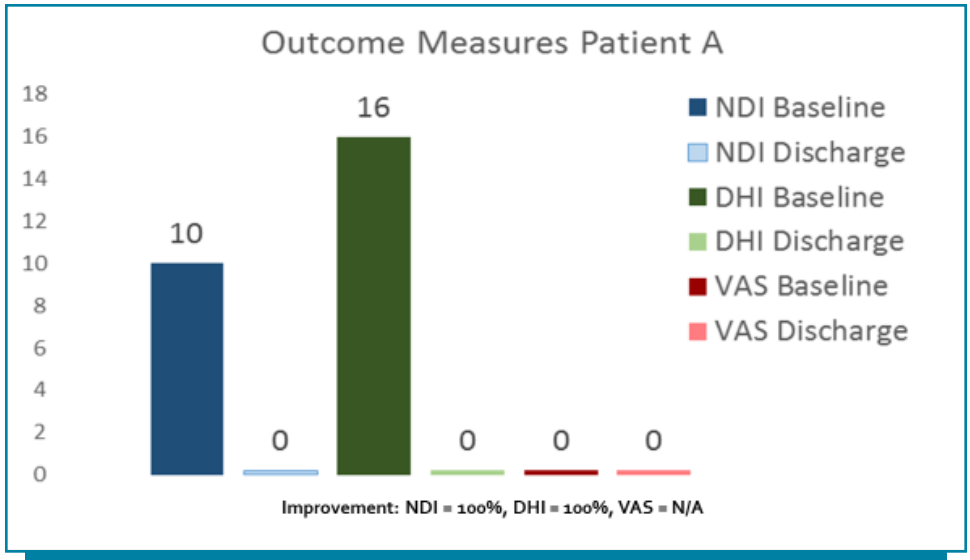

Figure 5. Outcomes patient A.

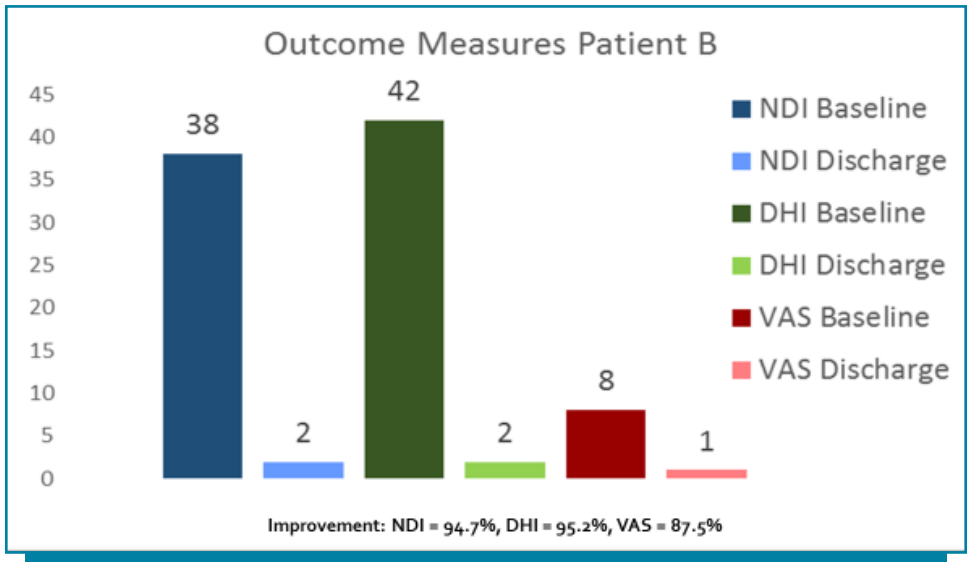

Figure 6. Outcomes patient B.

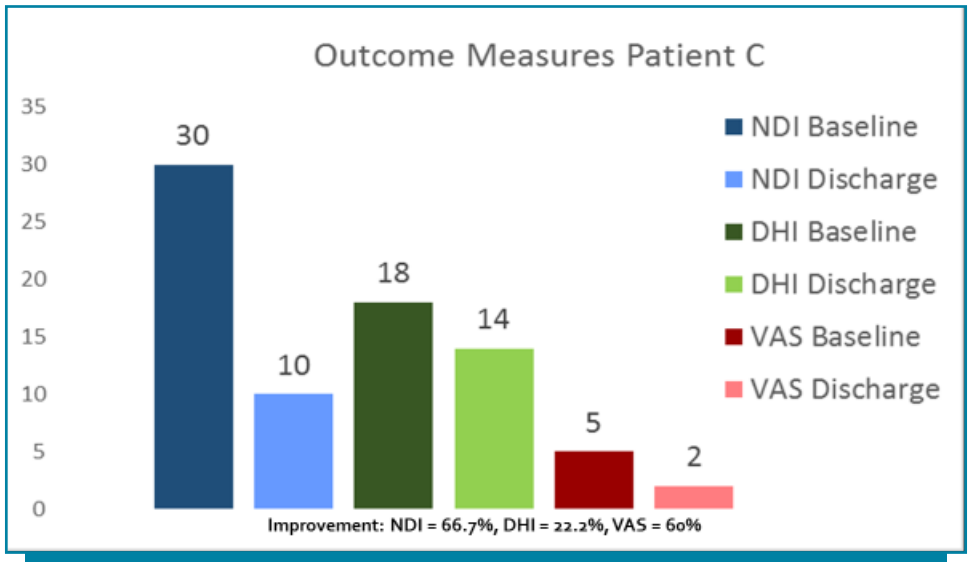

Figure 7. Outcomes patient C.

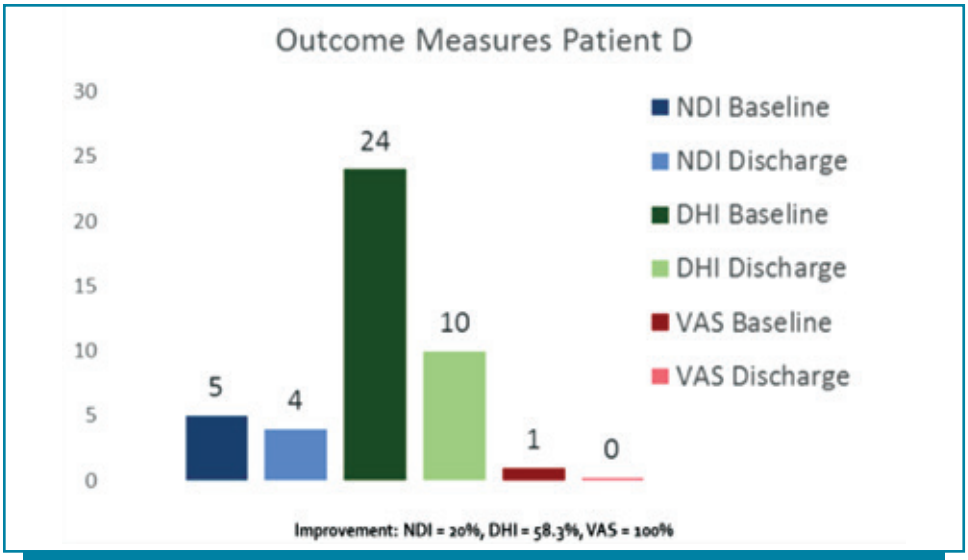

Figure 8. Outcomes patient D.

Thus concurring with the findings of altered muscle recruitment in individuals with neck pain due to traumatic or nontraumatic etiology as reported by Sterling et al.[9]

Dusunceli et al[8] examined the use of a neck stabilization exercise (NSE) program in conjunction with physical therapy agents for nonspecific neck pain. They reported significantly improved NDI scores in patients included in the NSE program.

CONCLUSIONS

A cervical spine stabilization exercise program, as demonstrated in previous research, may be beneficial for individuals experiencing headaches with neck pain and nonspecific neck pain.[9,10,12] Our study was the first to observe the benefits of a CSEP for patients following a sports-related concussion. The retrospective analysis of 4 patients who were treated with a CSEP demonstrated improvements in self-reported pain, physical function, and perceived disability. The interventions were not limited to the CSEP, and for that reason, the outcomes cannot be attributed to the stabilization exercise program by itself. A major limitation to the power of our study is the small sample size. Additionally, research is lacking in evidence examining the efficacy of a CSEP in a variety of patient populations. We recommend further research should investigate the efficacy of CSEP compared to other conventional treatments using a randomized control study design in a larger sample of patients with impairments following a concussion.

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Management of Whiplash-associated Neck Pain Using a Multi-modal Approach: A Case Report

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ABSTRACT

Background and Purpose: There is a paucity of evidence for optimal physical therapy management of whiplash-associated disorder (WAD). The purpose of this case report is to describe the results of a multi-modal approach when managing a patient with neck pain classified as grade III WAD. **Method:** This case report uses the neck pain clinical guidelines and current literature to explore the optimal treatment approach for WAD. **Findings:** For the administered multi-modal intervention after treatment, the patient reported a 28% reduction in disability on the Neck Disability Index and a 50% improvement on the Numeric Pain Rating Scale. **Clinical Relevance/Conclusion:** Optimal physical therapy management strategies for neck pain related to WAD is not well supported. The patient, in this case, returned to activities of daily living and painfree work using a multi-model approach consisting of patient education, manual therapy, dry needling, exercise, and mechanical traction.

Key Words: cervicalgia, intervention, psychological, motor control

INTRODUCTION

Annually approximately 2.5 million people are injured in motor vehicle accidents (MVA) in the United States, with costs totaling $242 billion in 2010.[1] Internationally, about 83% of individuals involved in collisions are likely to exhibit whiplash symptoms.[2] Half of these individuals will experience long-term or chronic symptoms one-year post MVA.[3] Due to ongoing treatments and unwavering levels of pain and disability, whiplash contributes to overall personal, societal, and economic burden, worldwide.[1,4] Whiplash-associated disorder (WAD) is a term given for a myriad of signs and symptoms affecting the cervical spine following an acceleration-deceleration injury, most commonly as a result of an MVA.[5] The most common symptom of WAD is neck pain. However, dizziness, paresthesia, headache, and psychological stress are also frequently reported. In 1995, the Quebec Task Force (QTF) developed a globally recognized WAD classification system based on grades 0-IV, with a corresponding treatment guide. Briefly described, the WAD 0-IV grades are as follows: (0) no pain or clinical signs, (I) neck pain without physical signs, (II) neck pain with limited range of motion[6] (ROM), (III) neck complaint with neurological involvement, and (IV) neck complaint with fracture or dislocation.[7] Whiplash-associated intervention strategies are problematical due to use of this dated classification system with its treatment guide, the complexity of clinical signs and symptoms, and integrating recent evidence such as central sensitization.[8-10]

Recent efforts to improve the QTF classification and treatment guidelines include additions of an acknowledged psychological component to WAD and altered muscle recruitment patterns.[11] Psychological factors are assessed with the Tampa Scale of Kinesiophobia (TSK),[12] while motor control and altered muscle recruitment are measured using the craniocervical flexion test (CCFT).[11,13]

Additionally, treatment may also be contingent upon prognostic factors and responses to questionnaires, such as the TSK, Neck Disability Index[14] (NDI), and Numeric Pain Rating Scale[15] (NPRS). While the NDI and NPRS are both validated for use in patients with acute or chronic neck pain,[15,16] the NDI is also a reliable outcome measure used internationally to assess pain-related disability and functional recovery.[16] Factors indicating a poor prognosis include the following upon initial examination: disability levels greater than 29% on the NDI, pain levels greater than 5.5/10 on the NPRS, symptoms of post-traumatic stress, negative expectations, and cold hyperalgesia.[17]

Despite numerous studies and research, principal management of WAD remains vague. In 2008, the Orthopaedic Section of the American Physical Therapy Association (APTA) released Clinical Practice Guidelines for Neck Pain linked to the International Classification of Functioning, Disability, and Health (ICF); however, there remains a deficit of strong evidence for management of WAD.[18] According to these clinical practice guidelines, the only recommendations based on strong evidence for whiplash-specific treatment are (1) patient education for an early return to normal, nonprovocative activities, and (2) reassurance to the patient that a good prognosis with full recovery is likely.[18,19]

Various interventions have been refuted based on moderate to strong evidence against the use of immobilization, such as soft collars during acute or chronic stages.[20] Thus, this evidence indicates a recommendation to a patient with chronic WAD, a period of prescribed rest is unwise and non-therapeutic.[19,21] Regardless of chronicity, certain modalities such as ultrasound are ineffective as interventions for patients with WAD.[22] Also, other interventions such as exercises, stretches, mechanical traction, and dry needling (DN)[23] have simply not undergone sufficient clinical trials to validate their effectiveness either.

While active treatment plans have indicated superiority to passive interventions,[2] studies regarding the efficacy of exercises for WAD treatment are conflicting. One low-quality randomized controlled trial (RCT) presented exercises that impeded recovery when compared to education alone.[24] There is evidence to suggest simple patient education is equally as effective as exercise for treatment of both acute and chronic WAD.[25] A consistency found throughout the literature relates to early and supervised intervention as more successful as opposed to late or unsupervised, likely due to decreased central sensitization associated with chronicity.[8,26] Treatment effects of exercises for WAD may be inconclusive, although evidence has shown reduced motor control and weak deep neck flexors (DNF) are often present in

people with neck pain.[13] A high-quality RCT by Jull et al[27] published significant improvements in headache frequency and intensity using low load endurance exercises targeting the DNF muscles when compared to alternative approaches. The ICF-based Clinical Practice Guidelines for Neck Pain recommend the use of coordination, strengthening, and endurance exercises to reduce neck pain and headaches.[18]

Mechanical traction lacks conclusive research on WAD-specific intervention; however, it has moderate evidence in conjunction with other interventions at reducing radiating pain associated with cervical radiculopathy.[28] The ICF Clinical Practice Guidelines for Neck Pain[18] list positive findings from the upper limb tension test (ULTT),[29] Spurling's and distraction tests[30] as useful measures to classify neck pain with radiating pain. Raney et el[31] developed a clinical prediction rule to identify those who would benefit from intermittent traction, based on a low-quality RCT. Having at least 3 out of 5 of the following criteria increased the success of cervical traction: patient reported peripheralization with lower cervical spine mobility testing, positive shoulder abduction sign, age 55 or older, positive ULTT of median nerve bias, and relief of symptoms with manual distraction test.[18,31]

Dry needling has been widely used for a variety of neuro-musculoskeletal conditions, particularly targeting a myofascial trigger point (MTrP).[32-35] The classic definition of an MTrP is "a hyperirritable spot, usually in a taut band of skeletal muscle or in the muscle's fascia, that is painful on compression, and can give rise to characteristic referred pain, tenderness, and autonomic phenomena."[36]

Ettlin et al[37] identified a significantly higher number of MTrPs within semispinalis capitis, in people with WAD compared to control groups and clinically identified MTrPs in 85% of examined patients with whiplash. Other cervical muscles prone to MTrPs include trapezius, sternocleidomastoid (SCOM), and scalenes.[36] Functional thoracic outlet syndrome and headaches can associate to these myofascial tension areas.[37] There is no consistent approach to treating WAD; however, evidence exists to suggest DN could be beneficial to alleviate MTrP-derived pain.[32,38] A recent RCT published in 2015 by Sterling et al[23] concluded DN (sham vs. non-sham) and exercise intervention in acute WAD II was more effective than for the chronic condition. Perhaps, DN has favorable effects on central sensitization and nociceptive processes in WAD, including decreased hyperalgesia and increased pressure pain thresholds.[8,23]

Previous literature of whiplash has focused on management of WAD II, without neurological involvement. There is a lack of research on WAD III management, including people who present with sensory deficits, headaches, and positive radicular symptoms in accordance to the ICF-based Clinical Practice Guidelines[18] (positive ULTT, Spurling's and distraction tests). Despite recognition of benefits of dynamic exercises and passive modalities such as DN and traction across numerous studies, research exploring benefits of these interventions in combination are insubstantial for persons with WAD III. Therefore, the purpose of this case report is to describe the results of a multi-modal physical therapy approach on pain, headaches, and disability in a patient with WAD III.

CASE DESCRIPTION AND EXAMINATION

History

The patient was a 61-year-old male insurance agent who presented to physical therapy 6 weeks after a car accident. He described the collision as a broadside impact of an 18-wheel truck to the driver's side. The patient's radiographs taken in the emergency room of the back and neck were negative, ruling out any fractures or subluxations. He was discharged home with pain medication and advised to follow-up with his primary care physician, who later referred him to a neurologist. The neurologist ordered magnetic resonance imaging and physical therapy for evaluation and treatment of neck and back pain. The patient reported upon initial visit his neck pain took precedence, as he had a long history of intermittent low back pain. Due to the patient's symptoms and primary complaint, this case report will focus on neck pain management.

The patient's chief complaint included posterior neck pain and headache, often radiating to his right ear, bilateral upper extremity (UE) paresthesia, and multiple nightly sleep disturbances. The patient reported exacerbation of symptoms with daily activities, including driving, lifting, and prolonged seated or supine postures greater than 10 minutes. He was unable to work full-time or participate in his usual activities such as yard work and walking 2 to 3 times per week for approximately 30 minutes at a time due to pain. The patient's goals were to eliminate headaches, return to painfree work duties and hours, leisure activities, and undisturbed sleep.

Significant patient history included greater than 20 years of occasional back and leg pain with previously failed physical therapy, per the patient. Past and present medical history included hypertension, congestive heart failure (CHF), and Type II diabetes mellitus, all controlled with medications and a measured body mass index of 35 categorized as obese. The patient denied any previous neck symptoms, dizziness, blurred vision, tinnitus, nausea, or changes in bowel/bladder function.

Self-reported Outcome Measures

The patient completed the NDI and NPRS for current, best, and worst pain levels. Data collection included tracking, daily NPRS per visit, 2 NDI assessments at initial evaluation, and a second time at the 8th visit approximately 4 weeks later. Self-reported disability, per NDI, was initially marked as severe, scoring 66% with pain level at initial visit rated 7/10 on the NPRS, where 0 is no pain, and 10 is the worst imaginable pain.

Tests and Measures

The patient was no longer taking the prescribed pain medication when the physical therapy intervention began. Observation of the patient in sitting and standing revealed mild forward head posture, increased cervical lordosis, stiff-neck posturing during transitions, and minimal arm swings during ambulation. Active cervical ROM measured using a universal goniometer in a seated position[6] revealed asymmetrical, decreased, and painful movements, as displayed in Table 1. The passive intervertebral motion of the cervical spine was inconclusive resulting in increased muscle tone and guarding with patient apprehension. Manual cervical stretches demonstrated limited pectoralis minor muscle length, but primarily the patient reported muscular tightness. Gross manual muscle testing of the UE strength showed key findings of 4+/5, grossly for all muscles of the shoulder, elbow, and wrist; however, resisted shoulder motions provoked pain in the shoulders. Deep neck flexors assessed using the CCFT with biofeedback, as described by Jull et al.[13] revealed decreased strength and endurance of the DNF, due to an inability to hold a 2mm Hg increase from the starting test position of 20mm Hg for 10 seconds. The patient had palpable tenderness with superficial and moderate pressures, increased muscle tone, and soft tissue restrictions, consistent with active and latent MTrPs to bilateral upper trapezius, levator scapulae, SCOM, and sub-occipital musculature. Neu-

Table 1. Pre- vs. Postintervention Range of Motion and Outcome Measures

Range of Motion (°) (Outcome Measure)	Pretreatment (Week 1)	Posttreatment (Week 4)
Flexion	20	30
Extension	25	45
Right Rotation	50	60
Left Rotation	45	60
Right Side Bend	20	25
Left Side Bend	15	25
NDI (%)	66	38
NPRS	7/10	2/10

Abbreviations: NDI, Neck Disability Index; NPRS, Numeric Pain Rating Scale

rovascular testing revealed bilateral positive neural tension, measured by ULTT.[29] Tests for traction and Spurling's compression[30] were positive bilaterally and UE reflexes for the biceps, brachioradialis, and triceps were normal bilaterally. Sensory function assessed using light touch over C5-T1 dermatomes showed minimally diminished over bilateral UEs, most consistently in the C5 and C6 dermatomes. Additional cervical tests were performed to rule out any upper cervical instability. Cranio-vertebral stress tests for alar-odontoid and transverse ligaments revealed no symptomatic laxity. The patient denied any symptoms related to upper cervical instability, including dizziness, dysarthria, dysphagia, diplopia, disorientation, nausea, or facial numbness.

PATIENT EVALUATION

Primary and Secondary Impairments

Primary impairments included decreased joint mobility, decreased motor function and muscle performance, and radiating pain into bilateral upper extremities. Secondary impairments include myofascial restrictions, hypertonic musculature, limited pectoralis minor muscle length impaired posture, and pain in the head and neck.

The above impairments contributed to limitations in activities of daily living, including the inability to hold static postures during driving, reading, and sleep, and performing dynamic mobility during activities of dressing, bathing, cooking, and cleaning. The patient was unable to participate in full-time work duties as an insurance agent, which involved deskwork and driving and could not engage in his leisure activities of walking and yard work.

PHYSICAL THERAPY DIAGNOSIS

Physical therapy diagnoses as described by the International Classification of Diseases, 10th revision, included the following: (1) strain of muscle, fascia, and tendon at neck level, subsequent encounter; (2) abnormal posture; (3) cervicalgia; (4) headache; and (5) cervical disc disorder with radiculopathy. Thus, a WAD III classification is consistent with these diagnoses and this patient's signs/symptoms.

PLAN OF CARE

Goals, Intervention Plan, and Treatment Strategies

Goals and interventions targeted restoring the patient's active ROM and dynamic stability so he could return to full-time work duties requiring sustained seated positions and safe driving. Treatment consisted of patient education, therapeutic modalities, manual therapy, therapeutic exercises, mechanical traction, functional DN, and a home exercise program (HEP). The initial treatment on the first visit after the evaluation focused on patient education and pain reduction. Modalities addressed pain and discomfort initially using a moist hot pack and an inferential current stimulation with a trapezoidal sweep pattern to bilateral upper back and neck regions at the intensity level of patient-reported sensation at a low frequency of 250 Hz. Treatment strategies to eliminate myofascial trigger points, relieve neck pain, and headaches helped to restore ROM. Stretches and active ROM exercises facilitated encouraging movement and maintained any gains of muscle and joint mobility. Additional DNF strengthening was implemented based on concepts of muscle inhibition postinjury.[5]

Prognosis

The prognosis was fair to meet the patient and established physical therapy goals. Barriers to rehabilitation included multiple comorbidities, including obesity, diabetes, CHF, and chronic low back pain. The patient exhibited persistent pain and demonstrated signs and symptoms of central sensitization, including hyperalgesia. Also, he questioned physical therapy based on his history of unsuccessful previous interventions for low back pain.

Treatment Sessions

Treatment consisted of one-hour sessions, twice weekly for 4 weeks. This would allow sufficient time to re-evaluate outcome measures and determine the necessity for skilled physical therapy or referral.

IMPLEMENTATION OF INTERVENTIONS AND REASSESSMENT

Weeks 1 to 2

The patient education underscored the benefits of a return to normal daily activities emphasizing posture corrections for driving and sleeping and reassurance that pain after a whiplash injury is expected. However, a positive prognosis is possible with appropriate intervention. The patient received deep manual pressure soft tissue mobilization to cervical spine musculature, including upper trapezius, semispinalis, splenii, suboccipitals, SCOM, and levator scapulae to improve mobility and decrease pain. The patient performed alternating cervical active ROM exercises with stretches of the upper trapezius, levator scapulae, SCOM, and pectoralis minor muscles. The DNF training began in supine performing chin tucks with biofeedback to encourage proper DNF recruitment, necessary to aid in stabilization. The patient performed these exercises daily as part of the HEP. Pneumatic mechanical traction was started at the second visit, and continued through the duration of treatment, except for week 3. Initial traction started at 15 pounds of pressure and progressed each visit to 10% of the patient's body weight (about 24 lbs). By visit 7, traction parameters were used at an intermittent cycle of 3 minutes on, 30 seconds off for 4 cycles, totaling 14 minutes. The patient reported improved paresthesia during and following traction, although disturbed sleep related to paresthesias persisted.

Weeks 3 to 4

Dry needling was initiated at week 3 (visits 5 and 6), targeting various MTrPs

mostly in the upper trapezius and levator scapulae. On average 6 needles were used each session, creating a local twitch response. Active ROM exercises followed with an emphasis on maintaining a neutral spine. After marked improvement of symptoms following the 5th visit, DN occurred for a second time on visit 6. The patient returned week 4 reporting 100% improvement in headache and ear pain. Exercises progressed based on the patient's ability to perform 10 repetitions of supine DNF exercises at 24mm Hg for 10-second hold. Once this level of control was achieved, DNF exercises were then continued in anti-gravity positions to incorporate functional postures of sitting and standing.

OUTCOMES

At the end of the 4th week, a re-evaluation occurred with a repeat of self-reported outcome measures taken. The therapist recommended continuation of therapy to further address the radiculopathy symptoms. Unfortunately, the patient was unable to return and thus was discharged due to undisclosed personal matters.

Ten weeks following the MVA and onset of symptoms and one month after commencing physical therapy, the patient returned to full work activities with only minimal neck pain and reported the absence of headaches. Bilateral hand paresthesias improved minimally; therefore, the patient reported continued disturbed sleep one to two times per night. Cervical mobility increased, as measured with goniometry and noted in Table 1. Functional mobility goals for daily activities, such as driving and cleaning, were 100% met. Other goals regarding sleep and recreational activities were only 50% met due to continued UE paresthesias and low back pain. Myofascial restrictions and active trigger points significantly lessened as evidenced by decreased palpable tenderness in previous regions with deep pressures. While residual deficits persisted, the patient's strength and endurance of DNF improved as measured by the ability to maintain 26mm Hg in both supine and standing for 10 repetitions times 10-second hold.

The patient's NDI and NPRS posttreatment scores were 38% and his current pain level was 2/10. These outcome measures represent significant decreases in disability and pain, interpreted as a 28% reduction on the NDI and a 50% reduction (5 points) on the NPRS. The minimal clinically important difference (MCID) is 19% to 20% for the NDI and 2 points on the NPRS.[14] Based on the MCID and functional outcomes, these results are statistically and clinically significant.

DISCUSSION

This case report described a multimodal physical therapy program consisting of patient education, manual therapy, DN, traction, and exercises for rehabilitation of a 61-year-old male presenting with WAD III signs and symptoms including headache, sensory deficits, and decreased ROM. Dry needling has shown efficacy for various neck pain related to MTrPs[33-35]; however, DN's effectiveness in management of WAD remains uncertain.[2,5,21] Traction and exercises can successfully treat symptoms related to radiculopathy[18,28,31]; however, no studies to date propose evidence for use with WAD III.[21]

The patient in this case report demonstrated significant improvement clinically, particularly following the sessions of DN. Our results add to existing studies that indicate favorable outcomes with DN and exercises. These studies, however, primarily pertained to people with WAD II only, listing people with WAD III under exclusion criteria.[23] Sterling et al[23] also suggested that DN (non-sham vs. sham) and exercises had no effect in reducing disability at weeks 6 and 12 instead at 6 and 12 months DN and exercise was more effective.[23,35] Potentially, DN affects central sensitization comparable to that seen in people with chronic pain, but this is unconfirmed. The patient in this case report described obliteration of his headache and decreased UE paresthesias after only 2 DN sessions in 7 weeks postinjury. Most likely DN facilitated relief of active MTrPs as recommended in the feasibility study by Tough et al.[38] A systematic review and meta-analysis[35] gives some evidence that after DN, often local and temporary discomfort occurs while the favorable effects are more effective in short (immediate to 3 days) to medium (9 to 28 days) terms as compared to long term (2 -6 months). Contact after discharge or in the long-term DN timeframe did not occur with this patient. Therefore, these effects are unknown.

Inconsistent with current literature, this patient's neck and head pain significantly decreased following patient education, manual therapy, DN, traction, and exercise. In addition possible other unforseen contributing factors resulted in this patient's favorable outcomes. While there is moderate evidence for traction in the management of mechanical neck pain,[18] there is no literature to date regarding traction for WAD III. Also, a recent study[25] suggested no greater effect of exercises compared with advice (ie, patient education) alone in chronic WAD, but this RCT did not include exercises in combination with other modalities. A factor such as patient belief and satisfaction may be more predictive and important for success of the intervention as recognized by Graham et al.[28] In this case intervention program, traction was included routinely primarily per patient request and administrated in a darkened room with ambient music. This environmental effect potentially helped alleviate pain by assisting muscle relaxation, stimulation of mechanoreceptors, and thus inhibit muscle guarding.[28] The time factor of symptom resolution is worthwhile to examine. Studies show most people with whiplash will recover on their own after 3 months (ie, 12 weeks). In many cases, people with WAD III will require treatment and support beyond 12 weeks.[3] The patient in this case report spoke of complete cessation of headaches after 2 weeks of physical therapy. This result challenges his symptom relief was due to either time or medication alone.

Limitations of this case report include the presence of multiple comorbidities and the lack of psychometric properties for further objective data. This patient not only had multi-factorial health problems but also had a concomitant exacerbation of chronic low back pain. Our current understanding of pain suggests a link between chronic pain and a tendency for central hypersensitivity.[10] It is possible this patient's long exposure to low back pain predisposed him to central sensitization, which was not accounted for in this report. Furthermore, psychometric properties[12,16] used to evaluate central hypersensitivities, such as the TSK, Pain Catastrophizing Scale, cold pain thresholds, or the Posttraumatic Stress Diagnostic Scale were not used. Additionally, there is a lack of objective data collected regarding decreased sensation and palpable MTrPs. The intrarater reliability of a physical therapist's ability to localize MTrPs is conflicting within the literature. However, it is agreed upon that reliability increases with experience.[32] The therapist, in this case, had only 2 years' experience with DN, which may have affected reliability of the data collection process.

Little is known about the etiology of WAD, partly due to its complex nature; however, muscle guarding and MTrPs are found extensively in people post whiplash.[37] This case report cannot show a cause-and-effect relationship between interventions and patient outcomes. The treatment prin-

ciples presented address MTrPs and to apply these to patients with WAD III is interesting and previously unexplored. The inability of most studies to demonstrate the evidence of efficacy for interventions for patients with WAD may occur because investigators were not addressing the potential source of the patient's signs and symptoms. For this reason, the future of WAD management rests on physical therapists delivering patient-centered care while using their knowledge of pain science, emphasizing patient education and the prevention of central hypersensitivities related to WAD, regardless of grades classified by the QTF. Further research is essential to determine the effectiveness of DN in the role of multi-modal treatment. Interventions applied in this case report highlight significant improvement for this patient with WAD III; however, this case does not present definitive answers about what should occur with similar WAD cases in the future.

CONCLUSION

The treatment strategies in this case, were based on components of current neck pain clinical guidelines in addition to recent literature exploring optimal treatment for WAD. At discharge, ROM was restored, and headaches were eliminated, allowing the patient to return to activities of daily living and work restriction-free. Currently, there is lack of consistent evidence for optimal physical therapy management of WAD. Further research is required to determine the role of DN and its effectiveness within a multimodal treatment.

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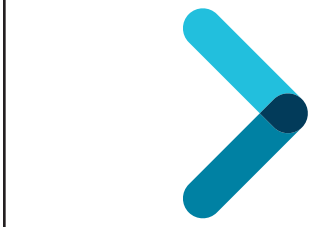

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Intensive Rehabilitation of an Individual with Marfan Syndrome After Multiple Total Hip Arthroplasty Revisions in an Outpatient Setting: A Case Report

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ABSTRACT

Background and Purpose: Marfan syndrome (MFS) is a rare disorder affecting 1 in 5000 individuals that impacts connective tissue and is associated with a higher prevalence of osteoarthritis. Total joint arthroplasty has been used to treat joint damage resulting from osteoarthritis in individuals with MFS. To date there has been no description of rehabilitation of individuals with MFS. The purpose of this report is to describe the rehabilitation of a patient with MFS, following multiple total hip arthroplasty revisions and multi-systemic comorbidities. **Methods:** The patient is a 58-year-old male presenting for rehabilitation at an outpatient physical therapy clinic. During the initial stage, his rehabilitation focused on transfer training and hip stability to prevent dislocation. In the following rehabilitation phase, the focus shifted to strengthening the hip musculature in the upright position, gait training with Lofstrand crutches, and step-up progression. During the final phase, the treatment was aimed at increasing ambulation tolerance and endurance with 1 Lofstrand crutch, reciprocating steps, and maximal functional independence. **Results:** The outcomes were assessed using the Lower Extremity Functional Scale, Short-Form Health Survey 36, and the Western Ontario McMaster Osteoarthritis Index at intake, 6 weeks, 16 weeks, and 3 months after discharge. The outcome measures indicated improvement in the patient's functional ability and quality of life. **Conclusion:** This case report highlights intensive rehabilitation of an individual with MFS after multiple total hip arthroplasty revisions and significant medical co-morbidities.

Key Words: joint replacement, return to function, physical therapy

BACKGROUND

Total hip arthroplasty (THA) is the 12th most commonly performed orthopaedic surgery in the United States.[1] Rehabilitation following THA has traditionally focused on treating strength deficits of the hip, decreased hip range of motion (ROM), decreased balance, and decreased activity tolerance.[1,2] Total hip arthroplasty has been used to treat osteoarthritis (OA) of the hip, which is a very common condition. In contrast, Marfan syndrome (MFS) is a rare multi-system disorder affecting 1 in 5,000 individuals. This condition affects the connective tissue and is associated with a higher prevalence of OA. Individuals with MFS may present for rehabilitation after a total joint arthroplasty with a number of unique issues such as extensive surgical history, cardiovascular, and blood clotting complications.[3] Rehabilitation following THA for the individual with MFS has not been previously described. Because of the unique challenges faced by these individuals in rehabilitation, physical therapists must consider novel approaches that have demonstrated effectiveness in patient populations with multiple impairments such as proprioceptive neuromuscular facilitation (PNF).

Herman Kabat, a physician, and Margaret Knott, a physical therapist, developed PNF in the 1940s as a method to treat patients with neurological conditions. These techniques consist of manually applied resistance in diagonal patterns, which are intended to mimic natural movement with the goal of restoring optimal function.[4] Proprioceptive neuromuscular facilitation techniques have been successfully used in the rehabilitation of individuals with neurologic conditions such as hemiparesis, gait impairments, and spinal instability.[5-9] The use of PNF techniques has not been described with patients following total joint arthroplasty. Clinically it is not uncommon for patients following multiple THA revisions to complain of symptoms of joint instability such as "giving way," "buckling," and "clicking" at the hip. The author's hypothesis was these techniques could be an effective adjunct to a comprehensive treatment program in a patient with lower extremity weakness and instability following multiple THA revisions. The techniques would also be particularly effective for patients with MFS.

CASE DESCRIPTION

Patient Characteristics and History

The patient described in this case report was a 58-year-old male who was originally diagnosed with right hip OA and MFS. The patient was referred to a specialty orthopedic hospital-based outpatient clinic following his eighth THA revision. The patient's consent was obtained for publishing anonymous information about his treatment in a professional journal. This patient reported a history of 9 hip surgeries beginning in 1981 with a primary arthroplasty being performed as an intervention for right hip OA. In the last 30 years, the patient had 2 infections requiring intervention and antibiotic spacer placement. The other revisions were due to implant failure and dislocations following falls. Most recently he spent 2 years nonweight bearing in a wheelchair with an antibiotic spacer, which was placed in 2009. On March 28, 2011, the prosthetic joint was reimplanted and following an uncomplicated postoperative course, the patient was discharged to an inpatient subacute rehabilitation facility on the 4th postoperative day. Ten days later, the patient was readmitted to the specialty orthopedic hospital due to wound dehiscence for 6 days. Following discharge, he was readmitted to the subacute rehabilitation facility for 1 week and then for home-based physical therapy for an additional 12 weeks. He was referred to an outpatient facility for physical therapy in July 2011, 3 months after discharge from the subacute rehabilitation facility. At the time of the outpatient evaluation, the patient was able to ambulate 40' with a rolling walker weight bearing as tolerated. His chief complaints were decreased function, specifically limited ambulation distance, inability to reciprocate steps, and difficulties with transfers. His past surgical history was significant for left ankle fusion in 1985 and a revision in 1993, right rotator cuff repair in 2008, aortic valve replacement in 1983 and 2002, and thoracic aorta replacement also in 2002.

Radiologic Findings

For radiographs taken 3 months postoperatively, the report showed that the patient's pelvis demonstrated protrusio acetabuli bilaterally. According to Van de Velde,[10] this alignment is characteristic of MFS and is considered a risk factor for OA. Also evident in the films was ectopic bone formation between the right greater trochanter and the border of the acetabulum. The patient's surgeon used a constrained liner, as it has been reported to decrease the risk of dislocation.[11] Cerclage wires were noted at the right proximal femur with evidence of a healing nondisplaced fracture.

Physical Examination

The examination revealed impairments in the musculoskeletal, neuromuscular, cardiovascular, and integumentary systems. The patient demonstrated asymmetrical gait with decreased weight bearing on the right lower extremity (RLE) and increased use of upper extremities for support. He ambulated with decreased right hip flexion during the swing phase with a substituting hip hike for the RLE. In addition, the patient lacked push off bilaterally. He had decreased stance time on the RLE with increased adduction of the right hip. Specific results of the patient's manual muscle testing and ROM are illustrated in Table 1. Noteworthy is that the patient's right hip flexors tested 2/5 and hip abductors 3/5. His sensation was impaired to sharp/dull in the S1 dermatome. The patient reported this deficit had begun after the primary THA in 1981. During this time, he also developed decreased dorsiflexion strength in the right tibialis anterior and extensor hallucis longus, necessitating the use of solid ankle foot orthosis for ambulation. The patient presented with decreased activity tolerance as evidenced by dyspnea with transfers in and out of bed or chair and ambulation limited to 40'. He also demonstrated grade 2 pitting edema bilaterally in the lower legs. There was a 20 cm long, healed postsurgical incision along the posterolateral right hip. A marked atrophy of the hip abductors was also observed.

Diagnosis and Prognosis

According to the *Guide to Physical Therapist Practice*, the patient would be classified in Pattern 4H: Impaired Joint Mobility, Motor Function, Muscle Performance, and Range of Motion Associated with Joint Arthroplasty.[2] The patient demonstrated impairments of aerobic capacity and endurance; anthropometric characteristics; gait, locomotion, and balance; joint integrity and mobility; muscle performance; and posture. He was functionally limited in home, work, community, and leisure actions, tasks, and activities, and required assistive and orthotic devices. His prognosis was judged as fair secondary to the multiple comorbidities and extent of his current functional limitations. Additionally, the patient's body mass index was 37 at 6'6" and 320 lbs. This co-morbidity placed him at a 6 times greater risk of THA failure.[12]

INTERVENTION

The patient attended physical therapy 3 times a week for 20 weeks. The treatment plan was divided into 3 phases. The first phase focused on continued patient education, increasing hip stability, improving balance, transfers, and the strength of the affected hip musculature. During this phase, the emphasis was on preventing falls and maintaining posterolateral THA precautions. The progressive resistance exercises (PRE) in Phase 1 consisted of seated knee extension, bridging, and hip abduction/external rotation in hook lying. In addition, during this phase, PNF techniques including reversal of isometrics and rhythmic initiation were incorporated to increase hip stability.[4] In the bridge position, reversal of isometrics was used to facilitate the hip rotators and to improve the endurance of the hip extensors (Figure 1).[4] In the hook lying position, heel slides were started with rhythmic initiation to improve hip flexion to improve gait and in preparation for driving an automobile.[4] The patient's stability in standing was addressed with reversal of isometrics.[4] While standing in step stance with a rolling walker (RW), the patient placed the affected lower extremity in front while the therapist manually applied resistance at the patient's pelvis and proximal femur to improve stability of the right hip (Figure 2). The RLE was sequentially moved backwards with resistance applied at each position. At first the direction of the resistance was alternated in a predictable pattern, eventually progressing to random.

In the second phase, the patient required minimal assistance for transferring into the bed and could independently perform sit-to-stand using one Lofstrand crutch (LC) and supine to sit. In addition, his ambulation distance with RW improved to 500'. The patient was then progressed to ambulation using two LCs to improve his mobility and to initiate stair elevation. During this phase, the emphasis shifted to greater emphasis on improving strength and function in the upright position. Hip flexion was initiated in sitting with a modified foot prop to simulate a driving pedal, as due to impaired dorsiflexion, patient required hip flexion to operate the pedals in his van. The patient also performed seated hip flexion and simultaneous contralateral upper extremity flexion-abduction-external rotation against manual resistance applied by the therapist to facilitate the ipsilateral psoas (Figure 3). He performed this exercise at home with a resistance band (Figure 4). This exercise was based on previously published work, which demonstrated increased activity in the contralateral limb with resistance ipsilaterally.[9,13-15] Manual resistance was added to ipsilateral knee extensors to elicit a contralateral force irradiation (Figure 3). The patient began performing PREs in standing, such as hip abduction and extension on the multi-hip machine. Furthermore, the patient initiated an interval ambulation program on the treadmill to improve his exercise tolerance and endurance. In this phase, he started forward step ups with the affected limb on a 2-inch step with upper extremity support.

Table 1. Results of Range of Motion Examination and Manual Muscle Testing at the Initial Evaluation

	ROM in Degrees		Manual Muscle Testing (5 max)	
	Right	Left	Right	Left
Hip Flexion	70	80	2/5	5/5
Hip Abduction	20	45	3/5	5/5
Hip Extension	NT	10	3/5	5/5
Hip External Rotation	NT	NT	3/5	5/5
Knee Flexion	130	130	4/5	5/5
Knee Extension	0	0	4-/5	5/5
Ankle DF	-5	-5	2/5	NT (Fused)
Ankle PF	15	5	4/5	NT (Fused)

Abbreviations: ROM, range of motion; R, right; L, left; MMT, Manual Muscle Test; NT, not tested; DF, dorsiflexion; PF, plantar flexion

Figure 1. Reversal of isometrics in the "bridge" position.

Figure 2. Hip stabilization training in step stance.

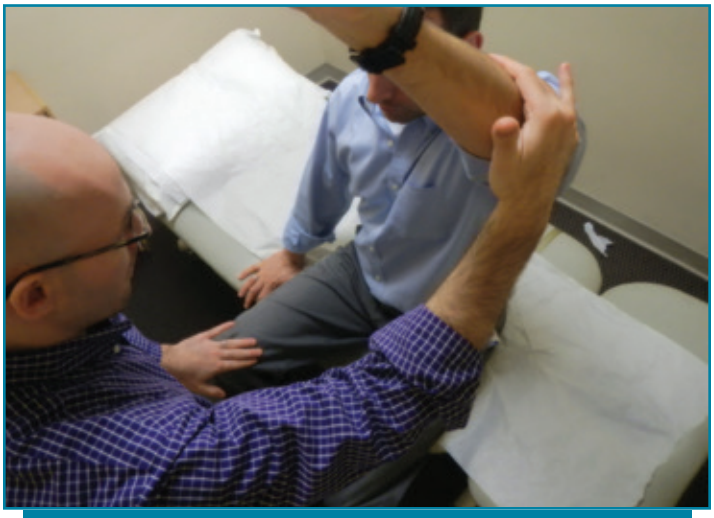

Figure 3. Manually resisted contralateral hip and shoulder flexion.

During the third phase, the treatment focused on maximizing the patient's independence. The patient wanted to return to work as a visiting nurse, which would require him to drive, ambulate up to 3 blocks, and climb at least 1 flight of stairs. He gradually progressed to stepping down from a 7-inch step with 1 LC. He was able to ambulate 950 feet with 1 crutch, with 3 rest breaks. The patient brought his van to the clinic to practice safe transfers in and out of the vehicle and attempted to operate it. Unfortunately due to patient's height, the resultant hip flexion angle in the driver's seat placed the psoas in passive insufficiency and at a mechanical disadvantage. Thus, he was unable to operate the pedals. A recommendation was made to install hand-operated controls in the vehicle as an alternative.

OUTCOMES

Three standardized outcome instruments were used to measure the patient's progress. The Lower Extremity Functional Scale (LEFS) is a self-administered questionnaire, with established test-retest reliability and construct validity.[16] In addition, the patient completed the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), which has been described as the most sensitive condition-specific instrument for OA intervention.[17] The Timed Up and Go (TUG) test was initially conducted with the RW and was measured at 15 seconds. The TUG has been noted to have sensitivity and specificity of 87% for identification of individuals at risk for falls.[18] The patient completed the LEFS 4 times: at intake, 8 weeks, 16 weeks after start, and 3 months after discharge. On this test, the patient demonstrated a 45-point improvement between the intake and 3 months after discharge. According to test developers, 9 points is the minimally clinically important difference (MCID).[16] On the WOMAC, the patient demonstrated a 7-point improvement from baseline at 16 weeks after start of treatment and 3 months after discharge (Table 2). On this instrument, Angst et al[17] reported 1.33 points as the MCID. Patient's TUG time showed improvement from 15 seconds with RW at intake to 11 seconds with 1 LC at discharge. Finally, the patient demonstrated a number of other functional improvements from the initial evaluation to discharge (Table 2).

DISCUSSION

Following a course of intensive rehabilitation, the patient with a history of multiple total hip revisions, medical comorbidities, and functional limitations, demonstrated improvement in strength and mobility, ambulation distance, and tolerance and the ability to reciprocate steps. The patient showed improvement on all the outcome tools from the initial evaluation to 3 months after discharge. Due to the physical limitations and medical history unique to this patient, a number of treatment techniques were modified. For example, sidelying techniques were avoided due to a history of multiple dislocations. Stair training was performed on the multi-hip machine platform because the patient wore size 17 shoes, which did not fit on the practice steps. However, despite the challenges, it appears that the PNF techniques, may have contributed to the achievement of functional goals. Wang[5] reported positive results using PNF techniques to improve gait in patients with hemiplegia. Although this patient did not have hemiplegia, the unilateral dysfunction of his affected lower extremity significantly affected his gait. Improved hip strength and stability assisted with gait and transfers. While PNF has been described with populations with neurologic impairments,[5,15,19] less information is available in orthopedic settings. The author believes rhythmic initiation, reversal of isometrics, contralateral force irradiation, and rhythmic stabilization benefited the recovery of this patient. These techniques were applied in functional positions and may have helped to elicit a more efficient neuromuscular response. Furthermore, the emphasis on functional training customized to the patient's needs and abilities expedited the achievement of patient's goals.

There were a number of limitations noted in this case report. It is difficult to establish the causal effect of any components of this treat-

Figure 4. Band resisted contralateral hip and shoulder flexion.

ment on outcomes without a randomized controlled study. Also, the results in this case are difficult to generalize to other patients, because of the unique medical condition and history. Despite these limitations, this case illustrates that the use of PNF techniques, and a comprehensive approach may be effective in improving functional outcomes in individuals with significant orthopaedic limitations with multiple comorbidities.

CONCLUSION

A comprehensive multi-modal approach was described in the rehabilitation of an individual with multiple THA revisions and comorbidities. The results suggest that PNF techniques, strengthening, and functional training can be effective in treating patients with MFS and significant multisystem impairments.

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Table 2. Treatment Outcome Measures

	Intake	8 Weeks	16 Weeks	3 months after d/c
LEFS	24/80	50/80	56/80	69/80
WOMAC	Not Assessed		72/96	79/96
TUG	15 sec with RW	14 sec with RW	11 sec with RW	Not Assessed
Transfers sit<->supine	Min/Mod A	Min A	Independent	Independent
Ambulation Distance	40' RW	500' RW	3 city blocks with LC	3 city blocks with LC

Abbreviations: LEFS, Lower Extremity Functional Scale; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index; TUG, Timed Up and Go Test; RW, rolling walker; LC-Lofstrand crutch; Min, minimum; Mod, moderate; A, assist

The Orthopaedic Section Mentorship Experience: Perspectives from a Mentor and Protégé

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INTRODUCTION

The Orthopaedic Section Mentorship Program (OSMP) consists of a 6-month formal mentorship to foster the professional development of third year physical therapy students by pairing them with mentors who demonstrate expertise. This initiative aims to increase professional association involvement and to assist new professionals with networking opportunities by pairing protégés and mentors related to specific interests and demographic locations to facilitate optimal success.

Components of the program include speaking over the phone or in-person monthly and communicating as desired by email, Skype, or other methods. Participants receive emails with discussion topics for facilitating ongoing communication and encouraging the sharing of experiences. The program concludes with a final meeting through a conference call with all the protégés and mentors. The mentorship program began in 2012 and over the years has paired over 40 protégé/mentor participants. In 2015-2016, fifteen protégés were paired to mentors for the 6-month formal mentorship.

HOW ONE BECAME INVOLVED IN THE OSMP

Kathy's Perspective

Over the course of my career I have been involved in various mentorship programs, both as the mentee and mentor, for the purpose of professional development. The structure of the OSMP is what appealed to me. The 6-month time commitment was very doable on my part. The transition from being a physical therapy student to beginning a career is both exciting and challenging. Having the opportunity to work with a physical therapy student to provide guidance during this milestone made me reflect on my early career and how beneficial it would have been for me to work with a mentor. I enthusiastically responded to the call from the Membership Committee seeking volunteers to participate in the OSMP. All that was required on my part was to submit my CV and provide a bit of background information.

I received notification in early January that I was paired with Becca Gusmer, a student in the University of MN Physical Therapy program in Minneapolis, MN. As I read the introductory email from Becca, I was extremely excited to hear she is also a Green Bay Packers fan and looked forward to our meeting at CSM.

Becca's Perspective

As a student physical therapist, I desired to develop knowledge and expertise to provide optimal care to patients. When I became aware of the OSMP through the Orthopaedic Section website, I was immediately drawn to the opportunity to receive mentorship with an Orthopaedic Section member.

The application process involved ensuring I met the criteria for becoming a mentee which included being in my final year of an accredited physical therapy program, being an Orthopaedic Section member, and planning to attend the APTA Combined Section Meeting (CSM). Applying required completing an application requesting demographic information, a short essay with goals, and a resume. The application included a section where potential candidates selected specific areas he or she had an interest in receiving mentorship that included research in orthopaedics, academics/teaching, manual therapy, professional organizations, involvement/leadership, private practice, and an "other" category.

As part of the 6-month mentorship program, my goals were to further develop clinical expertise, integrate research in clinical practice, and foster professional development. I aspired to discuss and analyze complex patient cases and receive guidance for fostering clinical skills to assist the pursuit of completing an orthopedic residency and obtaining an OCS. In regard to research, I hoped to develop my ability to apply literature to clinical practice through the guidance of a mentor. Additionally, I sought to advance professionalism and leadership skills by presenting 3 times over the 6-month program and participating as a volunteer and/or attending a professional organization/leadership event at least once per month. My final ambition was to advance my personal mentorship skills as my hope is to become a mentor in the future.

Upon receiving an acceptance email, participants were provided with contact information with their paired mentors. My first correspondence with Kathy was through email before the official in-person kick off meeting at CSM 2016 in Anaheim, CA. We immediately connected over our passion for orthopaedics and shared love for the Green Bay Packers. The excitement for the program was apparent.

EXPERIENCE DURING THE OSMP

Kathy's Perspective

From the beginning, I was impressed with Becca's thoughtful approach to her transition from student, to beginning her physical therapy career. Her energy and enthusiasm were evident during our first meeting at CSM. We discussed her goals for the program and her plans for the future. We also made time to discuss our mutual support for the Green Bay Packers. The OSMP is organized to promote discussions between the protégés and mentors that focus on how to choose and pursue a pathway which is in alignment with the proteges' goals. The topics are aimed to cover the milestones students and new graduates experiences. Each month, we received a list of 3 to 4 questions to discuss related to a specific topic.

In March, we discussed our experiences at CSM. I shared many of my positive experiences at CSM over the years and encouraged her to make it a priority to attend and participate throughout her career. I recommended she begin with submission of a poster to gain experience and progress to other venues such as platform and concurrent presentations as she progresses in her career.

Our April topic was related to career path development. I reflected on my own career path and encouraged Becca to be open to new opportunities and take advantage of

possibilities as they become available. Becca wanted to participate in an orthopaedic residency program. We discussed how to choose a program that is a best "fit" for her. She was interested in participating in teaching and research opportunities. I recommended she choose a program that includes these experiences in the program.

In May we discussed challenging clinical cases. We talked about the clinical decision making process and how best to incorporate evidence in the continuum of patient care, in conjunction with considering the individual patient's needs. One major advantage of a residency program is the mentorship experience, which affords the opportunity to discuss complex cases and strategies for problem-solving and clinical decision-making.

The June topic focused on preparation for the National Physical Therapy Exam (NPTE). We discussed study tips, test taking strategies, and the timeline. Becca was organized and developed a comprehensive study plan. I shared my experience taking the NPTE exam back in the day before technology was available. We relied on a paper and pencil format and had to wait weeks before we received the results. The current process is much more efficient and allows students to know the results in a much timelier manner.

At our final meeting in July, we discussed transitioning from a student to a practicing clinician. Becca was scheduled to begin her orthopaedic residency program at the Mayo Clinic in a few weeks. Residencies offer a structured process for new graduates to develop skills and knowledge and offer mentorship that is not often available to a new graduate in a staff clinician position. I shared in her excitement, and looked forward to our continued work together due to my role in the residency program.

Becca's Perspective

The kick off meeting at CSM was the first time all the participants met. The selected protégés and mentors were from locations across the country with a vast range of specializations. Networking with the various individuals provided a sense of unity within the profession as the group mix was new physical therapists and renowned experts within the field. The meeting fostered relationships where the OSMP mentees connected with each other throughout the rest of the conference.

The relationships with the other protégés and mentors persisted throughout the program primarily through a Facebook group. The Facebook group afforded posts and discussions regarding current news within the profession such as when Wisconsin Physical Therapists received imaging rights, research highlights, and case discussions. The informal discussions augmented the formal mentorship.

Components of the program involved communicating monthly. The structure provided flexibility regarding the dates and times for correspondence. Further, each monthly meeting had a discussion topic and associated questions for the protégé and mentor. These topic questions encouraged the sharing of experiences. For example, topics included CSM experiences, professional development, clinical conundrums, and NPTE examination preparation.

The most valuable components of the monthly discussions for me included the conversation topics and knowing I had a physical therapist as a resource to assist with any questions that arose. For instance, during the month with the professional development topic theme, a question the mentors answered was, "What do you wish a mentor/clinical instructor/profession would have told you?" Kathy's response included the advice to obtain a broad range of experiences, take advantage of "stretch" opportunities, and to seek mentorship/expertise throughout the journey. Her response resonated with me and I continue to embrace her recommendations.

The informal and additional guidance outside of the core components of the program were exceptional in tailoring the mentorship to areas I sought to grow in and the expertise Kathy provided. For example, I sought to learn more about the business aspects of the profession during my clinical rotations. Kathy assisted in providing a list of business questions for me to ask the physical therapy manager. In my desire to advance my clinical skills, I asked Kathy recommendations for spinal manipulation skills to practice with a specialized manual therapist at one of my clinical rotations. Additionally, Kathy would assist in providing edits for my in-service presentations during my clinical rotations. A highlight during the mentorship was meeting at the MNPTA annual conference where we were able to have our monthly mentorship session in person. During my final months as a student physical therapist and my transition into working as a physical therapist, Kathy was an instrumental and significant resource.

In regards to my specific goals, the mentorship provided advancement of clinical expertise by being able to attain guidance for sharpening and advancing clinical skills. Discussions offered advice for how to more effectively communicate with an interdisciplinary team, direction for my 5-year plan, strategies for developing clinical knowledge in preparation for the NPTE and advice for transitioning to a role as an orthopaedic resident. In regard to research, the mentorship was influential in assisting translating research into evidence-based clinical practice through how Kathy provided edits to research based in-service presentations and discussions for evidence-based interventions in complex patient situations. Additionally, professionalism and leadership were advanced through learning about Kathy's involvement in the APTA on the state and national level, her current role as a Director for the MNPTA Board, and her role as the Practice Committee Chair for the Orthopaedic Section. She facilitated knowledge of special interest groups, the House of Delegates, and Federal Advocacy. This mentorship was instrumental in fostering development in all these areas.

The program concluded with a final meeting through a conference call with all the protégés and mentors 6 months after the formal mentorship period. Conversing together with the participants allowed sharing positive aspects of the program and areas the program could be improved. Reflecting on the incredible impact the mentorship had through guiding me during my final months of graduate school, obtaining my physical therapy license, and assisting my transition into an orthopaedic residency was invaluable.

REFLECTIONS ON THE OVERALL PROGRAM EXPERIENCE

Kathy's Perspective

As the program drew to a close, Becca and I were fortunate to be in the same town and able to continue our relationship. Over the past several months, I have been able to witness her progress in the residency program and provide support as she searches for a job. Her commitment and dedication to professional development is admirable. I am extremely thankful for the opportunity to participate in the OSMP and look forward to following Becca as she continues her physical therapy career path. Working with someone as dedicated as Becca, gives me great confidence in the future of our profession. It also allowed me to reflect on my own career and the value of establishing goals regardless of what stage you are at in your career.

Becca's Perspective

Since the OSMP has formally concluded, Kathy and I have continued our mentorship.

I am currently in my final months as an Orthopaedic Physical Therapy Resident at Mayo Clinic. The foundation and mentorship provided by Kathy continues to be fruitful. I can confidently say this program has been integral in fostering professional skills and building connections for years to come.

As a student, involvement in the Orthopaedic Section, APTA was exceptional through the myriad of opportunities to be involved in the profession to foster clinical skills, develop professional relationships, and pursue passions. The OSMP has undoubtedly enhanced my ability to serve patients and continually foster professional growth on many levels. I have been honored to be a part of the program and am incredibly thankful for the OSMP, Kathy, and the mentors. I am looking forward to carrying forward this experience to assist others. I highly recommend this program to all aspiring student physical therapists and mentors who wish to pay it forward.

CONCLUSION

The OSMP inherently provided a framework to grow professionally for the protégés and mentors which in turn advance the level of care offered to patients. The continued success of the OSMP depends on member involvement. We highly encourage involvement in the program. Learn more at www.orthopt.org.

The 2017 American Physical Therapy Federal Advocacy Forum Update

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The 2017 APTA Federal Advocacy Forum (FAF) took place on March 26-28, 2017, in Washington, DC. The Orthopaedic Section was proud to sponsor two physical therapy students to attend the event with more than 270 physical therapists (PTs), physical therapist assistants (PTAs), students, and supporters.

The 2017 FAF participants focused on 3 key legislative issues: Ending the Medicare therapy cap, inclusion of physical therapists (PTs) in the list of providers qualified for student loan forgiveness as part of the National Health Services Corps, and legislation that would make it easier for PTs to practice when traveling with sports teams. Other topics discussed with members of Congress included the opioid epidemic, PTs role in concussion management, and the importance of essential health benefits for patients.

REFLECTIONS ON ATTENDING APTA FAF 2017

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It is easy for us as clinicians to shy away from staying up-to-date on different aspects of our profession (eg, research, industry trends, changes in policy, etc.) because we are already pulled left and right in our day-to-day practice. However now more than ever, it is important for us to be able to wear different hats, particularly as the health care environment continues to change. Having the opportunity to attend the 2017 FAF as a student representative of the Orthopaedic Section has brought to light the importance of being an informed advocate. It is imperative for each one of us to be informed advocates of our profession as conversations about health care policy continue throughout this year and beyond.

A large part of the FAF programming was centered on getting us prepared for our meeting with congressional representatives on the Hill. This meant we needed to be educated on the issues the APTA has prioritized for this year. The major issues discussed included repealing the Medicare Therapy Cap (H.R. 807/S. 253), increasing patient access to physical therapy through inclusion of PTs into the National Health Service Corps Loan Repayment Program (H.R. 1639/S. 619), among others. I would like to encourage all of you to read up on all these issues on the APTA Action App. The repeal of the Medicare Cap is particularly important since the extension for the cap expires at the end of this year. We need as much congressional support as possible in order to make sure our patients that need the most care receive it!

While the highlight of the FAF was the congressional visits on the last day, the best session was the one where we learned how to effectively advocate. We were given pro tips on how to best get our message across to our representatives. Some tips included forging a relationship with the Congress member's health legislative assistant (LA), the representative's go-to person for all health-related legislation, and on sharing personal/patient stories to stress the importance of certain issues.

The biggest takeaway from my 3 days in DC was that we can each advocate for our profession from our own districts. Contrary to what you may think, advocacy does not require that we spend excessive time or resources! The APTA has made it easy for each of us to be an informed advocate. The easiest way to start is to visit the APTA website or to download the APTA Action App. Both of these resources will allow you to read up on the issues and will give you suggestions on what to do next. You can start by writing a letter to your representative or starting up conversations with your patients. As the popular saying in DC goes, "If you're not at the table, you're on the menu." We can each do our part to make sure we have a seat at the table. It is important for our profession and the well-being of our patients.

Ryan Gray, SPT
Doctor of Physical Therapy Program
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At first glance, the Federal Advocacy Forum does not seem like the most exciting conference that the APTA organizes. It does not present the latest research and clinical practices, or have a huge exhibition hall to showcase cutting edge technology and give away freebies. But, despite these apparent drawbacks, the FAF is the most important conference you can attend as a member of the APTA.

The first event on Sunday featured a panel discussion on various policy issues; but the overarching theme was payment reform. This issue arose many times over the course of the 3-day conference, and for good reason. Every attendee of that first panel discussion had stories to share about their experiences with payment problems. One clinician talked about the decrease in reimbursement from insurance companies, and the increase in co-pay amounts for patients, compared to 20 or 30 years ago. Another clinician spoke about Medicaid reimbursement, and the financial challenges that come with accepting Medicaid patients. Others brought up patient cases that were impacted by the Medicare cap. Later that evening, during the welcome reception, I spoke with a clinic owner who told me the profit margin for private practice is "razor thin" right now, and his employees have to take a pay cut compared to working in other settings, just so he can keep his doors open. It was becoming clear every FAF attendee had a reason to be there.

The second day brought more education on payment reform, and the introduction of other policy issues affecting physical therapy practice. I attended a seminar that discussed the value-based payment system, in conjunction with the newly launched physical therapy outcomes registry. The seminar highlighted the benefits of moving into a value-based system, but also included a discussion of the many roadblocks involved with implementing it. The greatest of these was the

need for data from the PT registry to back up the value of our services, and for PTs who are willing to contribute to the registry in order to create that data. This brought up the importance of active member involvement in the improvement of our profession; a theme that drew me to the conference.

Later that afternoon we were prepped on the legislation for which we would be advocating on Capitol Hill. The first bill was the Medicare cap repeal. Talking points for this bill included the cost effectiveness of repealing the cap, because of increased function of long-term patients, and decreased re-hospitalization and early nursing home admission. The second bill was the Physical Therapist Workforce and Patient Access Act, which would include PTs in the National Health Service Corps Loan Repayment Program. The talking points of this bill included the projected growth of demand for PT, and the need for PT in underserved areas. Other legislation included adding PTs to development and execution of concussion protocol, and sports medicine licensure clarification for PTs who travel across state lines with sports teams. We also advocated for including PTs in combating the opioid epidemic. All the attendees were now ready to become advocates.

The third and final day of the conference consisted of visits to Capitol Hill. This was the time for us to actively advocate to those who can change the policies that impact us. We were now speaking with legislators who can, through their action—or inaction—change the way we practice. As exciting as this was, our trip to Capitol Hill, once again, demonstrated the importance of active involvement in advocacy. For all the FAF attendees who visited legislators' offices, we were still not the largest group of advocates on the Hill that day. Entering the Rayburn Congressional Offices Building, I immediately noticed hundreds of lobbyists and advocates there for other causes. I could not help but compare that with our contingency from California, the largest PT state chapter, which consisted of only 6 people. For instance, later in the day, while we were waiting outside Senator Kamala Harris's office, there was a group of about 20 dentists finishing up their meeting with her staff, advocating for their profession. Again, compare that with our 6. The 270 FAF attendees, split among 50 states, amounted to only 5 or 6 people per state. Even though that is a great turnout, we still need to increase the number of advocates we have in order to strengthen our collective voice. If every PT who attended CSM also attended the FAF, instead of 270 advocates, we would have over 11,000. Imagine the impact that would have on lawmakers in Washington.

Not every APTA member has to attend the Forum to make an impact on the advocacy front (although I am still a proponent of it!). Every member can donate to the PT-PAC. Every member can download the APTA Action App to learn about current legislation, stay updated on federal policy alerts, and send letters to their representatives. Every PT can visit their State Legislation Day, and advocate for PT legislation in their own state, or even just in their community. And most importantly, we can all advocate to our patients, other health care professionals, and the general public by the way we practice and interact with all parties involved in our profession.

We will not improve our profession unless the members of our profession get involved in improving it. We all enjoy learning about the latest and greatest in clinical practices, and networking with colleagues in our profession, and those things are absolutely important. However, if we do not take the steps necessary to define and advance our profession, then others, who do not have our best interests in mind, will define it for us. Conferences like the FAF provide us with those opportunities. The importance of the FAF cannot be overstated, and having experienced it for myself, I know that my advocacy days are just beginning.

Interested in attending the Federal Advocacy Forum in 2018? Watch for information about application details on the Section website in January 2018.

Orthopaedic Section Awards

Now is the Time to Nominate!

ORTHOPAEDIC SECTION

Now is the time to be thinking about and submitting nominations for the Orthopaedic Section Awards. There are many therapists in our profession who have contributed so much, and who deserve to be recognized. Please take some time to think about these individuals and nominate them for the Orthopaedic Section's highest awards. Let's celebrate the success of these hard-working people!

James A. Gould Excellence in Teaching Orthopaedic Physical Therapy Award

Outstanding PT & PTA Student Award

Paris Distinguished Service Award

Richard W. Bowling - Richard E. Erhard Orthopaedic Clinical Practice Award

Plan to nominate an individual for one of these highly-regarded awards! http://www.orthopt.org/content/membership/awards

Wooden Book Reviews

Rita Shapiro, PT, MA, DPT
Book Review Editor

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

Physical Therapy Clinical Handbook for PTAs, 3rd Edition, Jones & Bartlett Learning, 2018, $85.95
ISBN: 9781284105568, 590 pages, Soft Cover

Author: Cikulin-Kulinski, Kathy, PT, DPT, OCS

Description: This is an update of a comprehensive, evidence-based, and standards of practice-based clinical reference manual for physical therapist assistants (PTAs), PTA students, educators, and clinical instructors. **Purpose:** It is intended as a primary go-to reference for PTAs to use in daily clinical environments in order to strengthen and maintain their clinical competence. It serves as a current model for the role of the PTA in the PT/PTA team. The purpose is to supply clinicians with safety guidelines and normative values for components of the movement system and a comprehensive list of pathologies commonly encountered in all physical therapy settings. It provides PTAs with useful clinical pearls for guiding treatment approaches, documentation and reimbursement with intentions of being aligned with APTA's evidence-based standards of practice. **Audience:** This book targets PTAs at all levels of proficiency as well as PTA students, educators, and instructors. While it is intended for PTAs, any PT who has PTAs as part of their treatment team would benefit from referencing it as well. **Features:** This book is organized into easy to find "thumb-to" tabs. It provides an overview of the PTA's clinical role from the PT/PTA team perspective, highlights safety considerations during interventions with detailed coverage of patient communication, cultural competence, infection control guidelines, family violence, systemic norms, and signs and symptoms for pathology. The first chapter provides easy-to-access standards of clinical behavior and safety valuable to any clinician. The second chapter is dedicated to documentation, and includes pearls for patient education based on patient type as well as terminology for ICF (International Classification of Functioning, Disability, and Health) components and electronic medical documentation. The subsequent chapters feature physical therapy interventions categorized by setting or system, each with references for anatomy and function as well as corresponding disorders, disease processes, impairments, and activity limitations. Each chapter offers an adequate amount of data collection guidance appropriate to components of the movement system, including standardized special tests, scales, and rating systems. The chapters on intervention also offer corresponding patient education, documentation, and reimbursement pearls where appropriate and reference APTA's policy and recommendations. The book has newly updated PowerPoint slides that are available online to classroom instructors, clinical instructors, and directors of clinical education. **Assessment:** This clinical handbook provides abundant, easy-to-access information for PTs and PTAs using the team approach to treatment interventions. The author's acknowledgment and referencing of APTA's Guide to PT practice 3.0 for clinical practice standards and ICF impairment terminology for evidence-based intervention selection is a necessity in a rapidly changing healthcare environment and a quick advancing profession.

Jason Reid Oliver, PTA, BGS
McLeod-Trahan-Sheffield Physical Therapy Services

Neuro-Developmental Treatment: A Guide to NDT Clinical Practice, Thieme Medical Publishers, Inc., 2016, $89.99
ISBN: 9783132019119, 553 pages, Hard Cover

Editor: Bierman, Judith C., PT, DPT, C/NDT; Franjoine, Mary Rose, PT, DPT, MS, PCS, C/NDT; Hazzard, Cathy M., BSc, MBA, PT, C/NDT; Howle, Janet M., PT, MACT, C/NDT; Stamer, Marcia, PT, MH, C/NDT

Description: This comprehensive book details the principles and guidelines for treating patients of all ages using Neuro-Developmental Treatment (NDT). Highlights include numerous case studies, 287 illustrations, and material directed at physical therapists, occupational therapists, and speech-language pathologists. **Purpose:** The purpose is to assist clinicians, ranging from students to highly experienced therapists, in understanding NDT principles and practice. The authors' goals are realized with the book and additional video-based cases, figures, and tables available online. **Audience:** Occupational therapists, physical therapists, and speech-language pathologists will find this to be a complete handbook on NDT. It is appropriate for students learning about NDT and clinicians who work in neurological rehabilitation to advance their knowledge and improve techniques. **Features:** The Bobaths, a physician and physical therapist team, created NDT in the 1940s. They encouraged change with time, populations, culture, and technology to shape their techniques. This recognition for progression with need and evidence evolved decades before evidence-based practice became standardized. The book describes how the Bobaths established essence and approach as well as advances with current research. The book details posture, movement analysis, evaluation ideas, and application to treatment with helpful photos and pediatric and adult case reports. Chapters review cerebral palsy and stroke characteristics with associated functional disorders, and consider neural plasticity after central nervous system injuries. **Assessment:** This book provides students and clinicians with high quality information supported by illustrations and a useful combination of treatment principles and real-life examples. This book contrasts with other recent books (*Bobath Concept: Theory and Clinical Practice in Neurological Rehabilitation*, Raine et al. [Wiley-Blackwell, 2009] and *The Bobath Concept in Adult Neurology*, Bassoe Gjelsvik and Syre [Thieme, 2016]), by offering extensive case studies, treatment information across the lifespan, and simply more material with approximately double the pages.

Karin J. Edwards, MSPT
Providence Health & Services

The Big Back Book: Tips and Tricks for Therapists, Thieme Medical Publishers, Inc., 2017, $79.99
ISBN: 9783132048218, 463 pages, Soft Cover

Author: Johnson, Jane, MSc

Description: This is a handy, easily-referenced compilation of tips and tricks for assessment and treatment of the spine. Section topics are divided into cervical, thoracic, and lumbar regions. This nearly pocket-sized book is a useful primer of hands-on techniques. The emphasis on soft tissue manual therapy and the author's background as a massage and physical therapist is clearly evident. **Purpose:** The author's purpose is to share thoughts and experiences gathered through many years of active practice and present feedback and answer questions that arose during seminars and courses she has conducted on assessment and treatment of the spine. These are worthy objectives and they are successfully accomplished. The author does not attempt to make a strong case for evidence-based practice, but instead provides a set of readily-applicable assessment and treatment techniques which have, in her experience, demonstrated effectiveness. **Audience:** This author does not target a specific audience with this book, though discerning readers might conclude that an advanced or fellowship-prepared clinician might be looking for more in the way of evidence-based practice. A practitioner interested in myofascial and soft-tissue techniques without demanding a theoretical amount of information will find this book particularly helpful. The author's extensive experience as a certified massage therapist prior to becoming a physiotherapist makes her a credible authority in discussing the benefits of these techniques. **Features:** The book is simply divided into three sections covering the cervical, thoracic, and lumbar spine, with three chapters in each section on assessment, treatment, and aftercare. Each area is conveniently demarcated by three different color-coded blocks along the margin, making quick reference easier for readers. The book also uses a very simple yet effective style of line drawing for the ample illustrations. This makes learning the manual techniques very easy to comprehend. Tables with blank spaces are used to encourage readers to record their own notes about the use of particular techniques on different patients to allow for practice and reflection on their own experiences. Practitioners hoping to find a significant amount of information on manipulative or high-velocity, low-amplitude thrust treatments of the spine may find this book lacking in that regard. The primary focus of this book is on soft tissue mobilization with some joint mobilization. **Assessment:** This should be considered a useful quick reference for practitioners hoping to improve their manual skills for non-thrust/manipulative treatments for the three spinal regions. It is not intended as a comprehensive textbook on spinal anatomy or biomechanics, but rather an easy-to-use reference to encourage the practice of manual techniques rooted in massage therapy and soft tissue mobilization approaches. Readers seeking in-depth information on spinal anatomy or pathology, manipulation, and biomechanics no doubt have many other choices. This author limits her efforts to an area with which she has had many years of treatment and teaching experience.

Sean P. Easley, PT, DPT, OCS
U.S. Navy

Clinical Orthopaedic Rehabilitation: A Team Approach, 4th Edition, Elsevier, 2018, $99.99
ISBN: 9780323393706, 618 pages, Hard Cover

Editor: Giangarra, Charles E., MD; Manske, Robert C., PT, DPT, MEd, SCS, ATC, CSCS

Description: This book covers a wide variety of topics in orthopedic and sports medicine rehabilitation in detail. A free ebook that also includes videos of specific exercises and manual treatment techniques accompanies the print version. **Purpose:** The purpose is to "widen the breadth of content and orthopedic and sports information to mimic that of the everyday practicing surgeon, physician, physical therapist, and athletic trainer who work in orthopedics." Both the print version and the ebook version are beneficial to practicing healthcare providers. **Audience:** The intended audience is surgeons, physicians, physical therapists, and athletic trainers, as well as students. Chapters are written by multiple authors, all of whom are qualified in their respective fields. Some of the authors, such as Todd Ellenbecker and George Davies, are well known in the field of sports medicine. **Features:** The book is divided into eight topics: hand and wrist injuries, elbow injuries, shoulder injuries, foot and ankle injuries, knee injuries, hip injuries, spinal disorders, and special topics (running injuries and tendinopathy) and covers topics such as core stabilization. Many of the chapters discuss the diagnosis, treatment, and prevention of specific injuries. Strong components of the book are the chapters regarding gender issues and rehabilitation for specific athletic populations, such as the throwing athlete and functional performance measures. **Assessment:** This is an invaluable resource for all clinicians working with an orthopedic population. It covers surgical procedures, the evaluation process, treatment ideas/protocols, and current resources for further inquiry. The authors cite new and updated evidence-based treatment ideas and rehabilitation protocols as the rationale for this updated edition. The book is very much in step with these ongoing changes in orthopedic rehabilitation.

Christopher D. Blessing, MS, MPT, OCS, CSCS
University Medical Center of Princeton at Plainsboro PRO Phy

CURRENT LEADERSHIP

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Education

In case you missed the April webinar, it is available on the OHSIG webpage on the Orthopaedic Section website. Drew Bossen and Scott Ege clarified OSHA reportable injury and identified advocacy that it needed to promote a healthy work force. Listen to this hour-long session at your leisure.

http://www.orthopt.org/content/special-interest-groups/occupational-health/news-podcasts-from-your-ohsig

In the News: Post-offer Screens

When providing post-offer/pre-placement screens, awareness of state and federal regulatory actions impact physical therapist practice. Here is a bill from Montana's 2017 legislative session. It was vetoed by Montana's governor, however, a veto override vote mail poll is in progress (5-17-2017). Following the bill is an excerpt from the EEOC to give guidance related to post-offer screens. Consider how this information might be considered when completing functional job descriptions and offering post-offer screens.

AN ACT PROVIDING THAT A FALSE STATEMENT IN AN EMPLOYER-PROVIDED QUESTIONNAIRE UNDER CERTAIN CIRCUMSTANCES IS A BASIS FOR BARRING WORKERS' COMPENSATION BENEFITS; AND PROVIDING AN EFFECTIVE DATE.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF MONTANA:

Section 1. False statement on employment questionnaire--definition. (1) A false statement made by an employee in an employer-provided written questionnaire calling for the disclosure of an employee's medical condition that is relevant to the essential functions of the job following a conditional offer of employment bars all wage-loss or medical benefits under this chapter if all of the following conditions are met:

(a) the employee knowingly or willfully, by omission or commission, makes a false representation regarding the employee's physical condition that is relevant to the essential functions of the job;

(b) the employer relies on the false representation and that reliance is a contributing factor in the hiring of the employee; and

(c) there is a causal connection between the falsely represented condition and the injury or occupational disease for which wage-loss or medical benefits are claimed.

Section 2. The employee has the right to petition the workers' compensation court after satisfying the mediation requirements of this chapter if the employee disagrees with a decision to terminate benefits or bar benefits as provided under subsection (1).

- 1 - Authorized Print Version - SB 116 ENROLLED BILL
https://legiscan.com/MT/text/SB116/2017

EEOC Guidance

Disability discrimination occurs when an employer or other entity covered by the Americans with Disabilities Act, as amended, or the Rehabilitation Act, as amended, treats a qualified individual with a disability who is an employee or applicant unfavorably because she has a disability. Learn more about the Act at *ADA at 25*.

Disability discrimination also occurs when a covered employer or other entity treats an applicant or employee less favorably because she has a history of a disability (such as cancer that is controlled or in remission) or because she is believed to have a physical or mental impairment that is not transitory (lasting or expected to last 6 months or less) and minor (even if she does not have such an impairment).

The law requires an employer to provide reasonable accommodation to an employee or job applicant with a disability, unless doing so would cause significant difficulty or expense for the employer ("undue hardship").

The law also protects people from discrimination based on their relationship with a person with a disability (even if they do not themselves have a disability). For example, it is illegal to discriminate against an employee because her husband has a disability.

Note: Federal employees and applicants are covered by the Rehabilitation Act of 1973, instead of the Americans with Disabilities Act. The protections are mostly the same.

Definition of Disability

Not everyone with a medical condition is protected by the law. In order to be protected, a person must be qualified for the job and have a disability as defined by the law.

A person can show that he or she has a disability in 1 of 3 ways:

- A person may be disabled if he or she has a physical or mental condition that substantially limits a major life activity (such as walking, talking, seeing, hearing, or learning).
- A person may be disabled if he or she has a history of a disability (such as cancer that is in remission).
- A person may be disabled if he is believed to have a physical or mental impairment that is not transitory (lasting or expected to last six months or less) and minor (even if he does not have such an impairment).

Disability & Medical Exams During Employment Application & Interview Stage

The law places strict limits on employers when it comes to asking job applicants to answer medical questions, take a medical exam, or identify a disability.

For example, an employer may not ask a job applicant to answer medical questions or take a medical exam before extending a job offer. An employer also may not ask job applicants if they have a disability (or about the nature of an obvious disability). An employer may ask job applicants whether they can perform the job and how they would perform the job, with or without a reasonable accommodation.

Disability & Medical Exams After A Job Offer For Employment

After a job is offered to an applicant, the law allows an employer to condition the job offer on the applicant answering certain medical questions or successfully passing a medical exam, but only if all new employees in the same type of job have to answer the questions or take the exam.

Disability & Medical Exams For Persons Who Have Started Working As Employees

Once a person is hired and has started work, an employer generally can only ask medical questions or require a medical exam if the employer needs medical documentation to support an employee's request for an accommodation or if the employer believes that an employee is not able to perform a job successfully or safely because of a medical condition.

The law also requires that employers keep all medical records and information confidential and in separate medical files.

https://www.eeoc.gov/laws/types/disability.cfm

President's Letter

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

STAY CONNECTED!

Clinical Sites: We are currently updating the list of clinical rotation sites on our website. Please email Rosie Canizares if you take students and would like your information included on this list. **Membership:** We are also trying to keep are members connected. Please email Liz Chesarek if you are a new member, or want to become more involved as a current member. We would like to know your interests, and maintain information to pass on such as if you can provide backstage physical therapy (PT), if you treat a specific performing arts population, etc. Membership is free to all Orthopaedic Section members. **Dancer Screening:** For getting connected to others involved in dancer screening, please contact Mandy Blackmon. **Social Media:** To belong to our Facebook page, contact Dawn (Muci) Doran, and please tweet about performing arts with us @PT4PERFORMERS

STAY AHEAD!

Fellowship: The practice analysis re-validation project team is working on final revisions for the upcoming publication of the Description of Fellowship Practice (DFP) for Performing Arts Physical Therapy. The Description of Advanced Specialized Practice (DASP) in Performing Arts Physical Therapy was approved by the ABPTRFE in January 2016. The DFP is currently being reviewed by ABPTRFE. This is the final phase for laying the groundwork for providing current practice guidelines in the subspecialty area as well as curriculum requirements for Performing Arts PT fellowships. **Citation Blasts:** If you have a topic of interest and would like to contribute to the monthly e-blast, contact Laura Reising. ***OPTP* Submission:** If you have a brief, clinically-focused case report on a performing arts PT patient, or a clinical commentary, please contact me to submit your writing. I would like to thank the authors for sharing their work on Pilates as an intervention and the use of outcome measures for injury tracking.

Outcome Measures for Dance Injury: A Pilot Study Exploring Functional Movement Screen and a Novel Screening Tool

Mary Lou Galantino, PT, MS, PhD, MSCE, Stockton University; University of Witwatersrand, Johannesburg, South Africa

Jae Hoon Lim, MFA, Power Pilates NYC Certified, The University of Texas at Austin

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Kahra Woolverton, SPT, Stockton University

INTRODUCTION

Dancers are graceful athletes and their sport demands highly athletic traits. These attributes include strength, stamina, agility and extreme range of motion, speed, coordination, motor control, and balance. Landing from a Grande Jeté places a peak vertical ground reaction force of at least three times body weight onto the landing foot/leg of a dancer.[1] A Torch Lift requires a male dancer to lift a female dancer over-head with one arm while she sits on his palm, and women must exhibit elegance while dancing on their tip-toes for ballet pointe work. Long hours of practice (in-class training, rehearsal, and performance) and psychological and physical promptness for performance are also integral daily commitments made by dancers. Regarding these extreme physical pursuits, dancers are often compared to professional athletes; however, they are inherently different from traditional football or basketball players.[2] Injuries are located particularly in the lower limbs and are predominantly strain and sprain-type of injuries. There is a need for injury definition consensus and high-quality prospective studies examining the multifactorial relationship between risk factors and injury in pre-professional dance.[3] When it comes to dance injuries and treatments, a constant state of mobility makes it difficult for the physical therapist (PT) to devise treatment strategies unique to eclectic dance styles.[4]

Research has shown dancers often feel misunderstood when communicating with health care professionals, who are perceived to be unaware of dance vocabulary, the physical demands of dance, and dance-specific psychological training. As a result, dancers often self-diagnose and self-treat their injuries.[5,6] The prevalence of injury is high in professional dancers with a significant percentage not reporting their injuries for a variety of reasons. The number of years dancing and rank are associated with injury in professional ballet dancers.[7]

This communication misunderstanding predominantly comes from lack of education in both parties, which includes PT's lack of dance knowledge and vocabulary and dancers' lack of knowledge in human anatomy and kinesiology. The value of improving knowledge is recognized through survey responses from PTs and dancers. Both groups consider an understanding of human anatomy and kinesiology to be an essential element of dance injury prevention and treatment.[5,6] Dancers who incorporate dance science education as part of holistic dance training are inclined to properly communicate with physical therapy about their injuries. Also, PTs who have had dance training, frequently attend dance performances or sports medicine conferences, and read dance medicine literature are inclined to have more comprehensive understanding of dance patients.[5,6]

Specialized dance styles, duration of training, relative rest period, nutrition, occupational stress, and lack of specialized health care access for dancers can also promote injuries and delay treatment.[8,9] Studies show that the majority of dance injuries derive from cumulative tissue micro trauma as opposed to acute, traumatic accidents. The origin of these injuries are multi-faceted—faulty joint positions, musculoskeletal imbalance from training, with level 2 evidence that previous injury and poor psychological coping skills increases reinjury risk.[7] Therefore, in dance rehabilita-

tion, the PT must be able to conceive holistic treatment approaches integrating proper biomechanics of interdependent joints that are engaged in dance training.[10]

Too often, dancers are told to refrain from dancing by physicians without specific knowledge in dance. Although complete rest can be a sound approach for patients with a sedentary occupation, it is not a suitable method for dancers who are training or performing full time. It can generate fear of inadequate improvement in technique, being out of shape, and loss of finances. Thus, dancers may not comply and return to training/work prematurely and delay the recovery.[5] Studies show dancers engage in daily practice routines that are longer than most professional athletes whose daily practice duration is relatively short, which allows longer recuperation time.[5]

Another hindrance of dance injury treatment is the dancer's perception of musculoskeletal pain and the high pain tolerance. Pain is typically seen as an accompanying aspect of dance training thus dancers are prone to "dance through pain" that could lead to detrimental aftermath.[8] This study looks to explore the need for rehabilitative methods that incorporate sport specific/dance vocabulary for optimal recovery may assist dancers' transition from rehabilitation to performance and ultimately prevent reinjury.

This research introduced an interprofessional approach to student learning and focused on 5 areas: evaluation/screening, interventions, supplementary interventions, communication, and continuing education. The goals included exploration of specific outcome measures for the dancer and determined the feasibility of a Pilates-based intervention from both dancer and physical therapy perspectives.

METHODS

Sample

Participants included dance major students (from ballet and modern classes) and PT graduate students of Stockton University in New Jersey. All students signed an approved Institutional Review Board consent. Dancers with an acute injury who did not have clearance for intervention were excluded from this study.

Data Collection

Demographics included age, body mass index (BMI), number of previous injuries, and hours danced. Hours danced per week included classes, rehearsal, and performances. Self-report measures included the Self-Estimated Functional Inability Scale (SEFIS).[11] This scale was modified specifically for dancers to determine the extent and location of pain at the present moment. It has been validated in the literature[11,12] and used in a study exploring the relationship between increased exercise training during a ballet season, oxygen uptake, and injury. Results showed decreased pain after performance and increased ability to cope psychologically.[12]

The Functional Movement Screen (FMS) allows athletes to be screened to predict future injury regularly with good intrarater and interrater reliability.[13] However, with the prevalence of injury in the dance population, there is a need for a specific dance movement screening tool. Allen and colleagues[14] used the FMS and prior injury history to study the changes in injury risk of 52 to 58 professional dancers over 2 to 3 years with implementation of individualized conditioning programs. These programs individualized to the unique and dynamic needs of a dancer were successful in reducing dance injury rates and help lay groundwork for our study.[14]

Dancers were also evaluated at baseline using the *Dance Specific Screen* (DSS) (Appendix A). This was designed to assess various facets of dance and was developed by one of the authors (SB), in concert with an expert panel of orthopaedic specialists. It uses the 7 basic movements in the Cecchetti style of ballet technique, plié, étendré, relevé, glissé, sauté, élancé and tourné. The DSS was created around 3 of the basic steps: plié, relevé and sauté using observation of the last 2 movements with double and single leg variations to assess for unilateral differences.[15] A 4- point scale was used with a higher score indicating less risk. Similar to the FMS, the dancer scored a zero if there was pain with the movement being assessed. Dancers were screened at the beginning and the end of the fall semester, and again in the spring semester after their final performance to ascertain the effectiveness of Pilates-based intervention.

Data were collected at baseline, the end of the fall semester, and at the end of the spring semester from both student dancers and student PTs perspectives. The initial physical therapy screening, FMS and DSS, were collected over 2 days, early in the fall semester. The FMS screenings were performed by licensed PTs that participated in the required 4 hour training session and had personal experience administering the tool. The DSS was administered by the PT students who were randomly assigned to dance student participants. Prior to the screen, the PT students participated in a 2-hour training session on the 3 chosen movements with use of lecture, examples, demonstration and discussion, prior to screening.

Four session interventions were administered by a dance professor who is an expert in Pilates (JHL). All students were present and participated. These included variations in difficulty and complexity depending on the participants' strength, flexibility, skill/dance level, and injury. Physical therapy and dance faculty supervised student sessions. Throughout the process, researchers encouraged continuous, open conversations between dancers and PT students in order to establish comprehensive and efficacious communication. A follow-up evaluation was performed in the spring for all 3 measures.

Intervention Protocol

The intervention designed by an experienced Pilates instructor and professional dancer of 17 years (JHL) focused on 6 key areas based on principles of Pilates method—centering, control, concentration, flow/efficiency of movement, breath, and precision.[16] The base intervention follows the Pilates conditioning principle: focusing on the core strength and stabilization prior to working the peripheral parts of the body (Table 1). The individually designed base protocols attended to each dancer's needs and weaknesses through natural human movement progression; lying-kneeling-sitting-standing, in order to gradually increase level of challenges. Five to 10 repetitions per exercise were recommended to maximize muscle recruitment and limited rest period between exercise to increase stamina and flow of movement sequences.

The design of the protocol was intended to provide dancers with movement sequences that are designed to assist them to organically transition to dance training, rehearsal, and performance. The goal was to develop innovative mind-body tools that promote deeper understanding of dance and physical therapy that will benefit both disciplines. Dance and PT student interactions were required weekly for a total of 12 weeks. Each individually designed protocol was to be practiced daily up to 5 days per week for 15 to 20 minutes. Students communicated through e-mail and in person to foster communication and address concerns over time.

Table 1. Pilates-based Intervention Protocols

Base Protocol Sequence Examples (Different exercises in varying orders were implemented to create sequences that accommodate injuries/ weaknesses of each participant/dancer)

Position	Supine	Prone	Lateral/Sidelying	Sitting	Standing
Exercises	Hundred, Roll Up, Single Leg Circle, Single Leg Stretch, Double Leg Stretch, Scissors, Lower Lift, Criss Cross, Corkscrew, Shoulder Bridge, Teaser	Swan, Single Leg Kick, Double Leg Kick, Swimming, Serratus Push up, Pilates Push Up	Side Kick, Side Plank	Spine Stretch Forward, Saw, Rolling Like a Ball, Seal, Mermaid, Sitting Hug, Table-Tendon Stretch, Side Hug-Rolls, Snake Hug-Twisted Pigeon, Teaser Variation	Knee Raise, Chest Expansion, Single Leg Circle (F, B, S) One Leg Attitude, Sauté
Repetitions	5-8 repetitions/exercise	5-8 repetitions/exercise	5-8 repetitions/exercise	5-8 repetitions/exercise	3-5 repetitions/exercise
Duration	3 minutes	2 minutes	2 minutes	5 minutes	5-7 minutes

RESULTS

Ten dancers were paired with 10 doctoral physical therapy students. Previous areas of dance injury included: 2 low back, 2 hip (1 with surgery), 3 foot, 2 Achilles tendonitis, 2 ankle sprains, 3 knees (with 1 surgical repair), 1 elbow, and 1 shoulder. Range of dancers' age was 18 to 24 with an average of 20.6 years. On average, students danced 11.2 hours per week and BMI ranged from 18 to 27 with average 22.67. Of the 10 dancers, 50% received physical therapy in the past. General adherence to the program was between 60% and 75%. Table 2 presents descriptive statistics and shows trends of improvement in the DSS and SEFIS during the fall semester. The FMS and the subscales had little change over the 12 week intervention. No significant differences were found in the 2 follow-up assessments.

DISCUSSION

Injuries in professional athletes have been widely known and studied with dancers, who are a unique subset of athletes. Prevalence of injuries to the lower extremities and back is well documented within the dance population with overuse and overload being most common mechanism of injury.[17-19] The percent of injured dancers has been reported to be as high as 75%[17] and 95% in professional dance companies.[19] An incidence of injury rate of 0.8 per 1,000 dance hours in both female and male dancers has also been reported.[20] Injuries in dance result in absence from class, rehearsal, and performance. Thus, the need to incorporate prevention interventions early in one's career may foster greater awareness and appropriate treatment approaches.

Outcome Measures

This pilot study was able to create an interprofessional learning environment between dance and PT students, as observed throughout weekly student interactions. The 6 week supervised intervention took place the fall with students and follow-up assessments taken during the spring semester. The DSS and SEFIS[11] showed improved trends in a positive direction. Further psychometric testing is required not only to assess the relevance of choosing 3 out of the 7 basic movements in the Cecchetti method of ballet versus utilization of all 7 or another variation but to begin to assess the relationship of scores and their bearing on power, speed, and balance.

Using the FMS as standard, this study begins to explore the use of a lower extremity injury risk screening tool specific for dancers. It also continues to identify predictive factors to injury in dancers and develop movement patterns to address weaknesses found. However, little change was noted in the results of the FMS and, we were not powered to ascertain significance. Functional movement screen may not be discriminative enough to address the unique needs of the modern dancer. The dancer's source of movement varies, while the FMS comes from a stable base and testing the dancer in a unilateral stance and movement from a unidirectional position may not capture the full scope of the multidirectional needs of the dancer. Hartigan and colleagues found no correlation in a level 3 study between FMS score and power, speed, or balance.[21] Furthermore, this pilot study supports our effort to foster discrete testing for the dancer to ascertain subtle changes that are not reflected in the FMS. For example, O'Connor et al found 10% of 874 healthy sample of Marine officers to be at risk for future injury with less than or equal to 14 points.[22] Thus, FMS cut off points for certain populations, including dancers, requires further exploration as there may be ceiling/floor effects of this outcome measure.

Self-efficacy improvement trends noted in the SEFIS provide promising evidence for structured interventions for dancers with significant weekly hours dedicated to the dance major in an undergraduate degree. Evidence suggests that psychosocial and psychological issues affect injury frequency and duration along with chronic pain and decreased physical performance.[23] The need to adequately screen for, treat and ultimately prevent co-existing issues in the dance population is crucial.

Impact of Pilates

Particular challenges in crafting interventions for the dance population is that dancers are in a constant state of mobility.[21] An integral part of dance education is founded on constant movement and "covering ground/traveling" through dance, which imbues the dancers to expand their kinesthetic, geographical, and sociopolitical properties. Our Pilates-based intervention focused on the mobility of kinesthetic properties. Learning various styles of dance technique and choreography requires physical flexibility and cognitive versatility.[24] In order to adhere to constantly diversifying current dance styles of today, dancers must train in multitudes of techniques and routines.

Table 2. Results of Outcome Measures

Variable	Pre Mean	Post Mean	Final Follow-up
Dance Specific Screen	13.9 SD (2.42)	15.6 SD (2.57)*	16.40 SD (2.11)*
Functional Movement Screen	15.40 SD (1.07)	15.70 SD (1.83)	14.75 SD (1.28)
Self-Estimated Functional Inability because of Pain	6.40 SD (6.72)	3.70 SD (4.24)*	4.60 SD (3.48)
Deep Squat	1.50 SD (0.85)	1.70 SD (0.67)	2.00 SD (.53)
Hurdle Step	2.30 SD (0.48)	2.20 SD (0.63)	2.38 SD (.52)
Inline Lunge	2.80 SD (.42)	2.90 SD (0.326)	2.50 SD (1.06)
Shoulder Mobility	2.60 SD (0.70)	2.60 SD (0.70)	3.00 SD (.00)
Active Straight Leg Raise	2.70 SD (0.48)	2.90 SD (0.326)	2.87 SD (.35)
Trunk Stability Pushup	1.50 SD (0.85)	1.60 SD (1.17)	2.13 SD (1.13)
Rotary Stability	2.00 SD (0.000)	1.80 SD (0.632)	2.00 SD (.000)
*Trending in positive direction			

Flexibility is a significant aspect of dance training as greater mobility provides dancers with better full body integration as well as less chance of joint injury. Lumbo-pelvic flexibility, especially, is important in performing Grande Plié, Passé, and greater range of motion in Grande Battement. In a study involving healthy adults, noticeable improvements in pelvic stability and flexibility in both 4-week and 8-week Pilates training.[25] Our study supports these improvements in 2 of the 3 measures to quantify function and body self-perception through the use of individually designed Pilates-based programs for dancers.

Creating movement sequences that assimilate elements from conventional physical therapy, Pilates and dance were the primary goals of this unique intervention. Also, this interdisciplinary movement investigation emphasized promoting mind-body education that will advocate a life-long practice of proper spinal alignment and balanced strength of the body and mind for both dancers and PT students. Pilates method, combined with other conventional PT exercises, can offer improvement in skeletal structure and bone mass/strength as deep core muscles profoundly affect the skeletal system.[26] Nurturing this well-rounded fitness/rehabilitation method is especially imperative for the longevity of a dancer's career, during which time they are required to execute diverse styles of dance over extended time periods. Being proactive in taking care of one's mind and body is the key to injury-free and fulfilling career.[2]

Communication

Research shows medical practitioners rarely communicate with each other concerning a common dance patient.[5] They also fail to communicate, in most cases, with the dancers' teachers, choreographers, and directors. Furthermore, dancers do not fully understand the nature of their injuries when they seek medical advice, and do not press medical practitioners for additional information.[5] Our study found similar challenges regarding communication, specifically the use of terminology in student interaction. A common vocabulary is required for both groups. Initiating this important dialogue early in the dance and PT student experiences provides insight into the need for ongoing, clear, and precise communication by both groups.

CONCLUSION

This study promoted interprofessional education for dancers and PT students to improve evaluation and rehabilitation interventions for dance-related injuries. The DSS and SEFIS showed improved trends in a positive direction. Little change was noted in the results of the FMS. Further research is warranted to test the psychometric properties of the DSS for future use in dance rehabilitation studies. The small sample size requires a future, larger adequately powered study. The educational component of this research showed positive interaction for dance and PT students. This was most notably in comprehending specific vocabulary in dance and physical therapy, for the management of dance injuries.

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Appendix A. Dance Specific Screening Portion: Designed to Assess Four Facets of Dance. (SB)

Dancer:_____ Age:_____ How many hours/week of dance? _____

Years of dance training: _____ Past injuries: _____

Previous treatment:_____

Requirements: Person performing the screen must have basic knowledge in four basic movements in dance, plié, releve, saute and temps leve as well as the coupe or cou-de-pied position.
Equipment needed: counter or table around waist height
Time to complete: 10 minutes
Scoring: Four-point ordinate scale: 0 indicating lowest level of performance and 3 indicating highest level of performance. Total score = 18
General instructions: Instruct patient as written. When scoring, please record the lowest category applicable. Progressively more points are deducted if subject's performance declines or if he subject touches an external source for balance or utilize it for assistance in performing the activity.

1. **Plie _____**
Instruct client to perform one demi plié in first position, then repeat. Observe from front and side.
   a. (3) normal: plié is performed with heels remaining on the ground with knees over toes and pelvis in neutral.
   b. (2) mild deviation: plié is performed with one deficit from normal, may need fingertip touch for balance.
   c. (1) moderate deviation: plié is performed with two deficits from normal, may need countertop grasp for balance.
   d. (0) severe deviation: client unable to perform activity or loss of balance.

2. **Single leg releve performed on Right LE ___**
Instruct client to perform ten releve with the LEFT foot cou-de-pied back. Walk around client to observe.
   a. (3) normal: heel raise is symmetrical throughout all ten releve, no extraneous hip rotation is noted to perform turn out, no inversion of foot noted, knee remains straight and hips in neutral with equal turn out.
   b. (2) mild deviation: heel raise performed with two deficits from normal, may need fingertip touch for balance.
   c. (1) moderate deviation: heel raise performed with three deficits from normal, may need countertop grasp for balance.
   d. (0) severe deviation: client unable to perform activity or loss of balance.

3. **Singe leg releve performed on Left LE ___**
Instruct client to perform ten releve with the RIGHT foot cou-de-pied back. Walk around client to observe.
   a. (3) normal: heel raise is symmetrical throughout all ten releve, no extraneous hip rotation is noted to perform turn out, no inversion of foot noted, knee remains straight and hips in neutral with equal turn out.
   b. (2) mild deviation: heel raise performed with two deficits from normal, may need fingertip touch for balance.
   c. (1) moderate deviation: heel raise performed with three deficits from normal, may need countertop grasp for balance.
   d. (0) severe deviation: client unable to perform activity or loss of balance.

4. **Saute in first _____**
Instruct client to perform five sautés in first position.
   a. (3) normal: client does not utilize counter for external means of elevation, height of jumps are equal, toes clear the ground and are stretched, heels remain on the ground when in landing position, no pelvic drop, no dynamic valgus at knee, no excessive pronation at foot.
   b. (2) mild deviation: jumps performed with two deficits from normal, may need fingertip touch for balance.
   c. (1) moderate deviation: jumps performed with three deficits from normal, may need countertop grasp for balance.
   d. (0) severe deficits: unable to clear floor or perform activity with greater than three deviations noted or loss of balance.

5. **Temps leve in coupe derriere Jumps performed on Right LE____**
Instruct client to perform five temps leve jumps with LEFT foot in cou-de-pied position back, they may hold onto a counter only for balance
   a. (3) normal: client does not utilize counter for external means of elevation, height of jumps are equal, toes clear the ground and are stretched, heel remains on the ground when in landing position, raised leg maintains original position throughout, no pelvic drop, no dynamic valgus at the knee, no excessive pronation at foot.
   b. (2) mild deviation: jumps are performed with two deficit from normal, may need fingertip touch for balance.
   c. (1) moderate deviation: jumps are performed with three deficits from normal, may need countertop grasp for balance.
   d. (0) severe deficits: unable to clear ground or perform activity or greater than three deficits noted or loss of balance.

6. **Temps leve in coupe derriere Jumps performed on Left LE____**
Instruct client to perform five temps leve jumps with RIGHT foot in cou-de-pied position back, they may hold onto a counter only for balance
   a. (3) normal: client does not utilize counter for external means of elevation, height of jumps are equal, toes clear the ground and are stretched, heel remains on the ground when in landing position, raised leg maintains original position throughout, no pelvic drop, no dynamic valgus at the knee, no excessive pronation at foot.
   b. (2) mild deviation: jumps are performed with two deficit from normal, may need fingertip touch for balance.
   c. (1) moderate deviation: jumps are performed with three deficits from normal, may need countertop grasp for balance.
   d. (0) severe deficits: unable to clear ground or perform activity or greater than three deficits noted or loss of balance.

Name: _____

Date: _____

Location: _____

Rater: _____

TOTAL SCORE: _____/ 18

FASIG on the Move

Do you have an interest in foot and ankle pain, pathology, or function? Now is a great time to consider joining the Foot and Ankle SIG. Why now? Why not, it is free! And here are a few more reasons: (1) We have a growing group of really active physical therapists across the country who share a common interest in foot and ankle care. (2) We love supporting our members, including students. (3) The FASIG is on Facebook and the growing interaction and networking has been fun and informative. (4) #FASIGfun, #FASIGfriday. (5) Everyone treats patients who have feet. (6) And lastly, did we mention, it is free. Maybe you know someone who has an interest as well, so pass along the idea to connect with the Foot and Ankle SIG now. We are excited about a few ongoing initiatives.

Student Mentorship

We have started a student mentorship program. If you are a student or work with students and would like to get connected with the FASIG, check us out on Facebook (https://www.facebook.com/groups/FASIG) and we will get you connected with a mentor. It is that easy.

Facebook

We are increasing our efforts on Facebook and hoping to connect with more people. There are some great videos, articles, and general questions/answer exchanges that are sure to provide a little something for everyone.

Marketing

The Orthopaedic Section has launched a new brand this past year and the FASIG is excited to join-in with a new logo that will help to identify the FASIG. Keep an eye out for the new FASIG logo launching soon.

Vision

Finally, for those in academics the month of May typically occupies us, in part, with additional graduation activities. It is during this time of year that I write this submission for *OP* although it won't be read until we are fully into July and the summer is upon us. Graduation is an exciting time as we see students who have studied and trained with us begin their professional careers. This year I listened to speakers and graduates comment on the theme of "interdisciplinary care." The commencement speakers spoke of the future of health care and how integrated care teams will be used to guide and oversee care for the patients of tomorrow. Graduates reflected on hours spent preparing for a clinical environment where their communication skills and team focus will be tested. I find it striking that as I write this submission for the Foot and Ankle SIG that in many ways this is not new to us. Yes, it could be argued it is not new for many areas of practice, but I do think, as we consider foot and ankle care, it is easy to see we rely on, and pull from, a diverse set of professionals. It is quite apparent to identify clinical care that includes physical therapists working closely with orthotists to design or fabricate custom shoe inserts. Or perhaps it is an orthopedic surgeon who just completed an ankle replacement surgery. Many therapists working with patients with foot pain have close relationships with local shoe sale resources because we too often find our patients in the wrong shoes or in need of new ones. Our patients managing foot ulceration link us to primary care physicians, dieticians, and more custom shoe or casting specialists. Or patients who are runners with foot pain help to unite our clinical care with that of sports performance specialists and coaches. And, the little feet we see connect us to children's school system, physical education teachers, and parents.

As we see another graduation season come and go, and are reminded this is the start of a new era of health care, I am optimistic that perhaps many physical therapists out there managing foot and ankle pain, pathology, and function are perhaps already well prepared for the start of an increasingly connected focus of care. We should embrace this interconnected mode of care and the opportunity it affords. While caring for our patients we can also strengthen our connections and networking opportunities as we work with so many professionals across our medical and local communities.

Get Involved!

Our patients need your great ideas and energy. Check out the Facebook page, comment and share! The FASIG is stronger with your energy and your ideas.

President's Message

Carolyn McManus MSPT, MA

I want to share with you the PMSIG Board's latest accomplishments and preview our upcoming activities. By now you should have received the first of our planned monthly research and clinical pearl emails. I want to especially thank Research Chair, Dana Dailey, PT, PhD, for her vision, expertise, and time given to this activity. Our intention is for these emails to provide you with both information and inspiration to help you bring the highest quality care to your patients with pain. We value your knowledge, skills, and experience and hope you will consider submitting your research ideas to Dana at Dana-dailey@uiowa.edu and clinical pearls to me at carolyn@carolynmcmanus.com.

Be sure to check out the updated home page and additions to our website. We now have a research page that lists the research abstracts sent in the emails mentioned above, provides information on finding a clinical trial, and offers links to other research-related resources. We have a Clinical Pearls page that maintains a record of our clinical pearl topics. Lastly, we added an Archived PMSIG Newsletter page where you can find previous PMSIG newsletters.

Core PMSIG members of the Clinical Practice Guideline (CPG) development group, including Dave Morrisette, PT, PhD, OCS, Joel Bialosky, PT, PhD, OCS, Derrick Sueki, DPT, PhD, OCS, and Craig Wassinger, PT, PhD, received critical appraisal training at the Annual Orthopaedic Section Meeting in April. This group continues to move forward to develop CPGs for chronic musculoskeletal pain conditions with the helpful guidance of Brenda Johnson from the Orthopaedic Section office.

The next time you attend an APTA conference, be sure to stop by the Orthopaedic Section booth and pick up our new PMSIG flier to share with your colleagues. Whether you inspire someone to join with or without the flier, they will receive a new member welcome email from the PMSIG Board. I am happy to report our membership has increased from 483 at CSM 2017 to 586, so keep spreading the word about our dynamic and engaged SIG!

I want to especially thank our Board Liaison, D. Scott Davis, PT, EdD, OCS, and Executive Associate, Tara Fredrickson for their support and behind-the-scene efforts to help bring our ideas and projects to fruition.

As a professional group, our skills are crucial to help address the needs of people in pain and the current opioid crisis. We have so much to offer our community! Although the PMSIG Board and volunteer members have taken some positive initial steps, there is much work still to be done to support our membership to truly maximize our potential to help people in pain. The PMSIG Board's next major task is to develop a strategic plan to include our vision and mission statements and specific goals for the future. We welcome your ideas and active participation in this effort. If you are interested in contributing to this project, please contact me.

I would now like to introduce you to Katie McBee, DPT, OCS, MS. Katie is the Regional Director of WorkStrategies for Select Medical based in Louisville, KY. Her passion is learning and sharing new information on pain science and best practices for the treatment of pain for physical therapists. Katie spends a portion of her professional time developing new strategies to prevent and manage pain effectively and efficiently in outpatient practice under current payor models. I want to thank her for contributing the following article on the role of therapists' beliefs and expectations in the treatment of pain.

How does "Explaining Pain" Work?

Katie McBee, DPT, OCS, MS

Explain Pain,[1] Therapeutic Neuroscience Education,[2] and other ways of educating our patients about pain are growing in popularity in our profession as a go to component of evidence-based treatment planning for pain conditions. Whatever you call it, the research is building that patient understanding of the basic science behind a pain experience can improve the outcomes for patients in pain.[3-5] However, studies mainly measure patient factors as outcomes. This leads to the conclusion that if we successfully change our patient's beliefs and understandings of pain, we will decrease the threat value of different movements and activities and improve their pain experience. But how do physical therapists' understanding and beliefs play a role?

Before even attempting to answer that question, let's review insights found in the literature examining caregiver beliefs, expectations, and the effects on patient outcomes.

- Physicians can modify expectations from positive to negative in a patient. They can do this by directly expressing their views on the effectiveness of a treatment, or indirectly through unintended means that reflect their perceptions of the treatment's effectiveness to the patient.[6]
- Some health care providers have fear avoidant beliefs and these beliefs may influence treatment practice.[7]
- Placebos work better when delivered by warm empathetic health care providers.[8]
- Kinesiophobia beliefs of physical therapists negatively impact the lifting ability of healthy adults.[9]
- There is a connection between the degree of patient expectations and the strength of the placebo effects.[10]
- Expectations can be changed through verbal information, development of a therapeutic alliance, appearance of treatment modalities, and previous experiences.[11]
- Enthusiastically delivered education provides greater pain relief even if the treatment is the same.[12]
- In some situations, the patient's expectations can have a larger influence on the treatment outcomes than the administered drug for pain relief.[13]
- Expectations can impact the outcomes from physical therapy for musculoskeletal pain.[14,15]

These observations suggest a potential key role for physical therapist beliefs in treatment outcomes. When treating patients with symptoms inconsistent with a traditional biomedical explanation, a better understanding of pain mechanisms and psychologically informed care may promote positive expectations from treating physical therapists. Positive expectations from the therapist can

be translated to patients through direct and indirect communication and may impact not only patients' positive expectations to the treatment but also strengthen the therapeutic alliance. Both factors have been shown to have a positive impact on outcomes in pain conditions.

Practicing in a country in the midst of an opioid epidemic with 91 Americans dying every day[16] from opioid overdose, it is important that all health care providers, including physical therapists, start analyzing their treatment practices in regards to pain. Pain is a perception arising from complex processing of sensory, cognitive, and emotional information by the brain. Understanding of biopsychosocial pain model and basic pain science can impact the way physical therapists approach patients in pain. Pain is not always just a symptom but can be a disease and there are factors to look for early in care to assist in predicting the transition from acute to chronic pain. Having tools to screen for chronic pain risk and interventions with psychologically informed treatment strategies such as pain education, motivational interviewing, graded exposure, graded activity, basic cognitive behavioral therapy exercises, stress reduction techniques, graded motor imagery, mindfulness, and movement with awareness such as yoga and pacing provide options for treating the whole person not just the body part of complaint. Knowledge and additional tools can change the way we look at and treat complex patients and change our self-efficacy in managing these cases and improving our expectations for the patient's outcome. These changes, as mentioned earlier, can lead to improved expectations from our patients and an improved patient-clinician therapeutic alliance. Cumulatively these changes in therapy traditional treatment paradigms can lead to improved pain relief and outcomes for the pain patient.

Results of a study by Synnott et al[17]suggest physical therapists may stigmatize and feel unprepared to treat patients with low back pain and psychosocial factors. In this study, some therapists had undergone training on pain science and psychologically informed practice but had not found them easy to implement. It is possible therapists who struggle to integrate new knowledge and techniques are likely to have negative expectations towards outcomes for patients they believe need these interventions even if they see them as incorporating best evidence treatments, which in turn may fail to result in a maximal therapeutic benefit. Further investigation may be indicated to determine more effective education and mentorship processes to improve clinician's comfort with managing this patient population to assist in achieving optimal patient outcomes.

Although therapists' beliefs and expectations about pain and patients in pain are not the only factors driving therapeutic effects with complex pain patients, they are definitely important factors that should not be ignored. We may not know everything about curing complex or persistent pain states at this time, but we do know positive expectations from a clinician can have a positive impact on patient outcomes.

Understanding the many factors that contribute to a patient's pain experience and the underlying science of pain are central to effective pain treatment. Valid tools to screen for chronic pain risk and help establish evidence-based treatment strategies addressing multiple factors contributing to a patient's pain are essential. Using these tools therapists can have confidence in developing a treatment plan to fit the unique needs of the patient and improve outcomes.

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Research Relating to Imaging in Physical Therapy

The Imaging SIG Research Committee is currently involved in several large scale initiatives. The committee, led by George Beneck, PhD, PT, OCS, KEMG, is undertaking projects looking at data in states where physical therapists have been and will soon be ordering imaging as well as evaluating the attitudes and beliefs of physical therapists pertaining to imaging. Among those contributing to this are Connie Kittleson, Rob Worth, Dennis Kaster, Aaron Keil, Murray Maitland, Teonette Valasco, Sean Rundell, Scott Rezac, John Garbecht, Donald Goss, Rob Manske, Kip Schick, and Michael Crowell.

There are also a couple of opportunities to participate in survey research concerning imaging recently announced by the Orthopaedic Section. If you are interested in participating, please check your email for those announcements. Your contributions may be valuable in advancing imaging in physical therapy practice.

AIUM/APTA Webinar

The APTA, with specific contributions from the Orthopaedic Section and the Imaging Special Interest Group, is cultivating a relationship with the American Institute of Ultrasound in Medicine (aium.org). Plans are for this to evolve into a mutually beneficial partnership which may be of particular interest for those physical therapists involved with point-of-care ultrasound. On Thursday, August 3, 7-8 PM EDT, AIUM/APTA Webinar: Value of Ultrasound Imaging in Peripheral Nerve Pathology will occur. The presenter will be Mohini Rawat, DPT, ECS, OCS, RMSK. The involvement of physical therapists in this educational effort with AIUM is a new step for both organizations. For more information, please visit aium.org.

Webinar on Diagnostic Imaging

On April 20, Aaron Keil presented a webinar through APTA on "Implementation of Hospital-Based Direct Access Highlighting Direct Ordering of Diagnostic Imaging." Aaron led the effort to allow physical therapists to order imaging at Georgetown University Hospital (Washington, DC) and documented this effort in the publication: Keil A, Brown S. US hospital-based direct access with radiology referral: an administrative case report. *Physiother Theory Pract*. 2015;31(8):594-600. In the webinar and in their published work, Aaron described navigating administrative barriers, securing physical therapy board approval for ordering of imaging studies, partnering with radiologists, and tracking of reimbursement and imaging data. The webinar also included several case reports in which the use of diagnostic imaging directly influenced clinical decision making. Aaron is currently a clinical associate professor at the University of Illinois at Chicago. As of this writing, the webinar is still available at the APTA Learning Center under the listing of course LMS-814.

Scholarship Soon To Be Available

The Imaging SIG will soon be offering a scholarship toward assisting in paying the cost of attendance to CSM for a student or clinician with accepted work related to imaging. A committee, headed by Murray Maitland with assistance by Becky Rodda, Byron Smith, Lena Volland, and Meg Sions, is formulating an application, selection criteria, and working through other processes to establish this scholarship. Although still a work in progress, the committee is well underway and is likely to launch the availability of the scholarship later this year.

Nominations and Election for Vice President Later This Year

The current SIG Vice President, Jim Elliott, will be finishing his term at the conclusion of CSM 2018. The election to fill this position will occur in November of this year. Thus, the Nominating Committee, led by Nancy Talbott (talbotnr@uc.edu) will begin seeking interested parties and nominations for Vice President during the summer. Paul Beattie and Megan Poll are the other Nominating Committee members. If you are interested in serving or would like to nominate someone, please contact one of the committee members.

Recruit a Colleague to Join

The Imaging SIG is now approximately 300 members and growing, but that is still relatively small compared to some of the other SIGs. With all that has been happening with imaging and what appears on the horizon, this SIG will be a factor in shaping future practice. Please recruit a colleague in the Orthopaedic Section to join the Imaging SIG. They only need to contact Tara Fredrickson (tfred@orthoPT.org) at the Orthopaedic Section and ask to be included on the Imaging SIG membership roster. To become a member of any Orthopaedic Section SIGs, you must first be an Orthopaedic Section member.

Differential Diagnosis Strategies for a Patient Presenting with Anterior Groin and Knee Pain due to Avascular Necrosis

Brittany Ryan, SPT
Benjamin Barnes, MPT, OCS, FAAOMPT

BACKGROUND

Due to recent changes in health care referral and delivery model with direct access, physical therapists now more than ever need to be able to identify pathology of non-musculoskeletal origin. The physical therapy examination must include screening tests to identify more symptomology more related to pathologies such as cancer, fracture, infection, or necrosis. Some of these conditions may not be life threatening, however, early detection allows for an appropriate course of treatment. The hip can commonly refer pain to areas in the lumbar spine as well as down the lower extremity into the foot. The upper segments of the lumbar spine can also refer to areas that mimic hip pain. Being able to differentially diagnose if the origin of pain is from the lumbar spine or the hip is very important. Avascular necrosis of the hip is a more serious diagnosis that can refer pain up the lumbar spine and down into the knee. It is characterized by an interruption of the blood supply to the femoral head. The presentation will usually include, but not

limited to, dull anterior hip and groin pain with loss of hip ROM typically occurring in a capsular pattern of flexion, internal rotation, and abduction. It is important for a thorough history and examination of a patient presenting with anterior groin and knee pain to rule in or out the diagnosis of intraarticular hip pathology such as avascular necrosis so that further testing, such as imaging, can be performed.

CASE DESCRIPTION

The patient was a 37-year-old male who had complaints of pain from the right buttock down into the right lateral ankle. He was referred to the authors by his primary doctor for physical therapy and a lumbar MRI was ordered. The patient had been discharged from a successful course of physical therapy approximately 6 weeks prior for similar symptoms at the same therapy clinic with a different therapist. He presented with 25% of normal lumbar flexion active range of motion along with moderate pain on the right side. It was noted the patient had poor hip flexion with forward bending. A positive straight leg raise occurred in supine with only 30° of hip flexion. A positive straight leg raise was observed in seated position as well. Restriction lumbar passive intervertebral movement was also noted to be present. His posture was of inordinate flexion positioning with restricted extension and increased pain with greater flexion. Prone positioning was reportedly more comfortable. Treatment began addressing the lumbar directional preference with prone press ups, standing extension, and passive hip flexion with the focus of maintaining an extension bias at the lumbar spine. The patient responded well to the extension biased treatment with an overall decrease in low back pain and radicular symptoms. It was noted during the second visit the patient had difficulty performing both hand heel rock and hip hinge exercises due to significant hip restrictions. Initial examination of the hip was limited due to pain. After 4 visits, the low back pain and right radicular symptoms had reduced significantly, however, he continued to complain of right anterior groin pain that referred to the knee. Since the low back pain had improved, a more thorough hip examination was able to be completed. During reassessment of the hip, the patient presented with a capsular pattern at the hip with limited flexion, internal rotation, and abduction. A firm capsular end feel was noted with reproduction of knee pain on hip adduction with internal rotation. These significant findings, coupled with knee pain reproduced with femoral compression, prompted concern of hip intraarticular involvement. The findings were discussed with the physician and imaging of the hip was recommended. Results of the lumbar MRI, which were not received until after the hip imaging, further confirmed the suspicions of the physical therapists. Results were minor facet arthrosis of L4-5 and a right paracentral disc protrusion without direct neural impingement. These less significant findings allowed us to speculate the pain the patient was experiencing in the lumbar spine was more than likely referred pain from the hip.

OUTCOMES

As seen in Figure 1, an anterior-posterior view of pelvis was obtained. The radiologist interpretation of the x-rays was subchondral sclerosis and mild flattening of the right femoral head. The findings were suggestive of evolving avascular necrosis of the right femoral head with early collapse. After the results of the x-ray were obtained, an MRI of the right hip was ordered to confirm the results. Both Figure 2 and Figure 3 showed large geographic areas

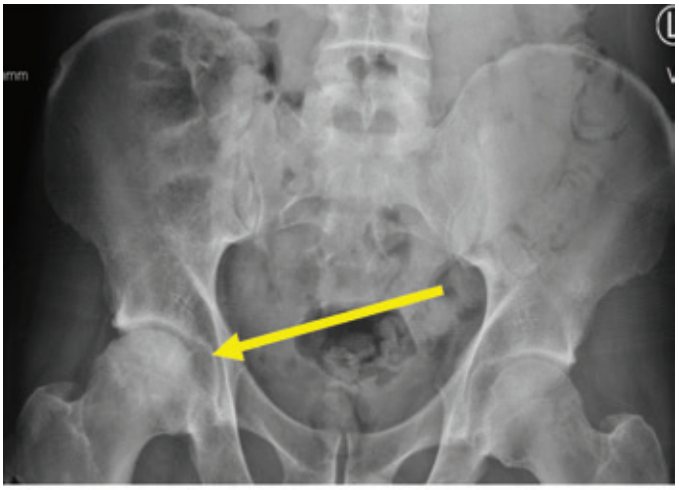


Figure 1. X-ray with anterior-posterior view of the pelvis showing subchondral sclerosis and mild flattening of the right femoral head.

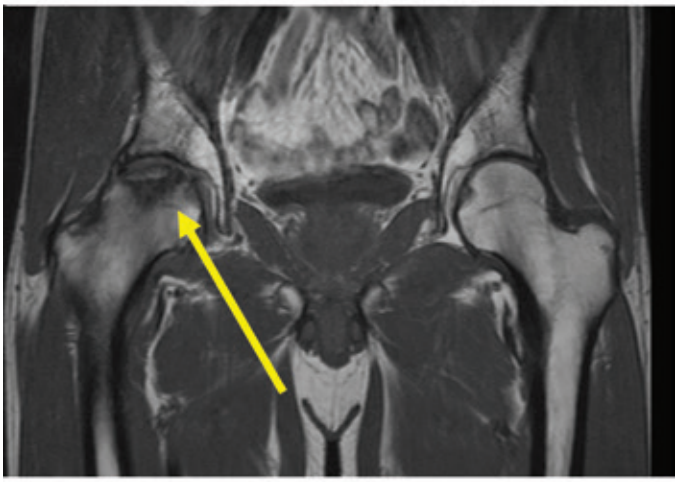


Figure 2. T1-weighted image in coronal view of pelvis showing early articular collapse and flattening of weight-bearing portion of right femoral head.

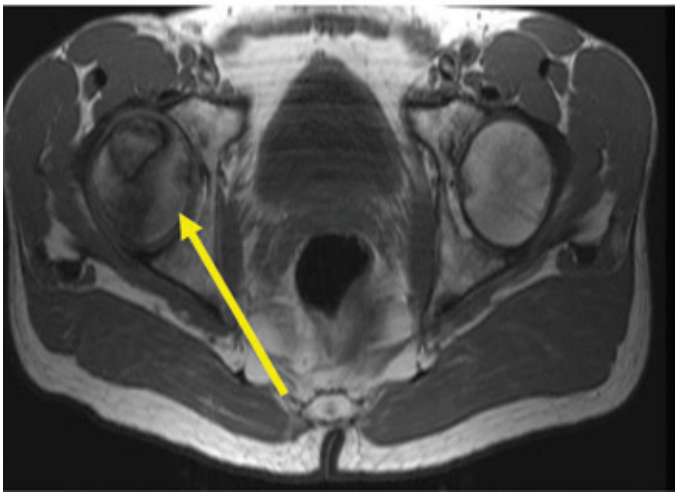


Figure 3. T1-weighted image in transverse view of pelvis showing large geographic areas of abnormal signal involving the subarticular bone of right femoral head with serpiginous sclerotic margins surrounding central areas of fatty marrow.

of abnormal signal involving the subarticular bone of right femoral head with serpiginous sclerotic margins surrounding central areas of fatty marrow. There was early articular collapse and flattening of the weight-bearing portion of the right femoral head. This is consistent with advanced osteonecrosis with early articular collapse and extensive reactive marrow edema in the head and neck.

DISCUSSION

When a patient initially comes to therapy for one complaint of pain and improves with a specific treatment plan, but over time pain returns, it is easy to assume that the subsequent episode originates from the previous condition. If treatment resolved symptoms before, why would it not help the patient again? One challenging aspect of this case was the significant improvement the patient made while treating the lumbar spine. It is easy to dismiss the less debilitating hip complaints as something that will gradually improve. Continual review of differential diagnoses and knowing when imaging is indicated are both essential skills necessary for a physical therapist. Yellow flags during interventions will be more apparent and allow a therapist to determine when a patient's pain may be due to some other pathology with secondary symptoms. This case study had several yellow flags such as history of alcoholism, age, sex, and recognition that the secondary low back pain was due to restricted hip mobility. With the findings over the course over 4 visits the physical therapists were able to convey their concerns for intraarticular pathology of the hip and justified the need to order for follow-up imaging for further investigation to allow management decisions, including consultation with an orthopaedic surgeon.

RECOMMENDED READINGS

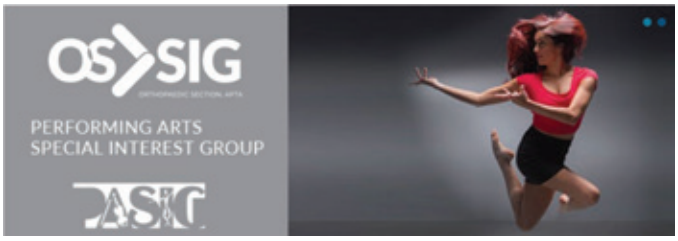
1. Malloy P. *Examination and Differential Diagnosis of Hip Injury.* In: Malloy P. Independent Study Course 24.2 Injuries to the Hip. LaCrosse, WI, Orthopaedic Section, APTA, Inc; 2014.
2. Sahrmann S. *Diagnosis and Treatment of Movement Impairment Syndromes*. St. Louis, MO: Mosby; 2002.
3. Greenwood MJ, Erhard RE, Jones DL. Differential diagnosis of the hip vs. lumbar spine: five case reports. *J Orthop Sports Phys Ther*. 1998;27(4):308-315.
4. van Kleef M, Vanelderen P, Cohen SP, Lataster A, van Zundert JV, Mekhail N. 12. Pain originating from the lumbar facet joints. *Pain Pract*. 2010;10(5):459-469.

ORTHOPAEDIC RESIDENCY/FELLOWSHIP

DEAR ORFSIG MEMBERS,

2017 is quickly passing and we are now one step closer to becoming a budgeted Orthopaedic Section Special Interest Group (SIG) in 2018. Now that we are transitioning to a SIG, there are several key items that we need to begin preparing for. These include:

1. **Elections: Part of the requirement** of a SIGs to elect officers. Positions include President, Vice President, and 3 individuals for the Nominating Committee. Our slate of candidates will be included on the upcoming 2018 Orthopaedic Section and SIG election ballot. Watch for a "Call for Candidates" to come in the July issue of OPTP, as well as via the Orthopaedic Section's electronic "OsteoBlast."
2. **Strategic Plan, Goals, and Objectives:** It is time to revise our originally developed objectives and goals and put in place our path to carrying out these goals over the next several years. We held a WebEx Meeting to review our previous set objectives and goals and re-evaluated how we want to move forward.
3. **Budget Proposal:** Our newly formed SIG will be included as a separate program in the 2018 Orthopaedic Section budget. Yes, we will soon have money. We will need to prioritize spending in line with our strategic plan and goals. More to come on this.
4. Submissions for an image to serve as the face of the ORFSIG are under review. The winning submission will receive a 3- or 6-monograph (print copy) Independent Study Course of his or her choosing.
5. Take a look at these website banner examples from the Performing Arts and Occupational Health SIGs:



Our new logo will be placed within the new SIG-specific banners, and will appear on a side-bar banner (ie, PASIG banner) or a horizontal banner (OHSIG banner), depending on the size of the SIG's logo.

6. **Website Development, Resources and information:** We are looking for individuals who would be interested in developing content for our SIG website, which will be housed within the Orthopaedic Section's web site. Please email matthaberl@hotmail.com if you are interested.
7. **Facebook Groups:** After the Combined Sections Meeting (CSM) several noted interests in continuing online communication however not all had access to Facebook Groups. At this time we will still continue with this mode of communication until other means are available. We will also use the Orthopaedic Section's OsteoBlast and *OPTP* quarterly updates to share information. If you are not currently a Facebook member, please request access via the attached link or contact Kris Porter at kporter@thejacksonclinics.com
   - ✓ https://www.facebook.com/groups/741598362644243/
8. ***OPTP* Quarterly Submissions:** We are looking for submissions to highlight residency and fellowship education in the Orthopaedic Physical Therapy Practice magazine. This can activity can be part of a resident/fellow scholarly project or any outcomes based research. As a SIG we are allowed up to 4 printed pages in each issue of Orthopaedic Physical Therapy Practice every quarter.
   - ✓ To find out more regarding the requirements for submitting your articles, contact Sharon Klinski at sklinski@orthopt.org.
9. **American Board of Physical Therapy Residency and Fellowship Education (ABPTRFE) Update:** The 6-week Call for Comment period on the proposed Quality Standards concluded on March 31, 2017. You can access the weekly review of the survey comments on THE HUB on the APTA website under Residency/Fellowship Education. EducCred will be presenting their findings to ABPTRFE in late May with additional updates thereafter. Please keep an eye open for the ABPTRFE quarterly Newsletter.
10. Combined Section Programming Submissions: Thank you to all of those who submitted programming on behalf of the ORFSIG. We were able to submit a preconference course. Please plan to attend.
    - ✓ Preconference Course:
      - "TRUST in YOUR THRUST! Implementing High Velocity Techniques into your Practice." Dr. Aaron Hartstein, Dr. Marwan Kublawi, Dr. Abe Shamma, and Ed Schiavone

As you can see, we have several important and exciting initiatives in process. I look forward to the continued support of our members and want to thank all of those who serve with the intent on making the ORFSIG better.

Sincerely,
Matt Haberl
Chair, ORFSIG

President's Message

Kirk Peck PT, PhD, CSCS, CCRT, CERP

ARSIG Vice President

In case you missed a prior announcement from the Orthopaedic Section, it is finally official following a special election for the Vice President position in the ARSIG—Stevan Allen was voted to serve a second term as VP. Congratulations Stevan, your volunteer contributions to the organization have proven to be invaluable!!

Strategizing Future Goals

In September 2017, the ARSIG will engage in a strategic planning process to reassess and revise as needed its current mission, purpose, and goals to reflect present day animal practice by the profession. The plan is for several key members of the SIG to convene in Denver, Colorado, and determine the best course of action for the organization to achieve future initiatives. Several topics will certainly be part of discussions including the role of the SIG in recruiting new members, providing quality educational opportunities, conducting and sharing research, and assisting those who need help in navigating the political process to change state laws. The future of animal practice looks promising, but the real ingredient to success is active engagement at all levels by SIG members.

ARSIG Practice Analysis Survey Update

At the time of writing this article, the total number of completed surveys hit a record mark of 78. This is 23 more than noted in the last *OPTP* report. After closing the survey at the end of May, the goal will be to analyze data and start crafting the initial draft of a description of practice for animal rehabilitation. This is very exciting news since a detailed description of practice for animal rehabilitation has never been developed since the inception of the SIG.

California Veterinary Medical Board

Following an enormous victory in California with a Task Force vote in favor of practicing physical therapists, the original motion (see below) was quickly voted down during the following Veterinary Medical Board meeting. Despite the negative vote from Board members, the motion will continue to move through legislation in some format, hopefully this year for debate. As with the majority of state legislative processes, the issue in CA is no different in that it may take months or even years to finally agree upon acceptable language by all interested parties. Original Motion: *"California licensed PTs with advanced training in animal rehab can work under the supervision level determined by the veterinarian on a veterinary premise or an Animal Rehabilitation Facility (which may be on a non-vet premise)."*

State Laws & Regulations—They Absolutely Do Matter

Five out of 50 or 10%…that's right, at the present time there are only five state jurisdictions that have officially codified statutory laws that recognize physical therapists as practitioners who can treat animals: Nevada, Colorado, New Hampshire, Utah, and Nebraska. If that sounds alarming to you, well, it should. This is why the ARSIG has continued to stay on message of encouraging physical therapists (PTs) to actively engage in changing jurisdictional laws.

So why have only 5 states passed legislation supporting animal practice by licensed physical therapists? The answer is simple… because PTs in those 5 states historically took the time and energy required to enact appropriate laws. Yes, it takes a LOT of time, energy, and often money (even personal money) to change state laws, but I cannot overemphasize just how important this issue is for the future of animal practice. Now that a greater number of PTs have engaged in treating animals, the practice has gained national attention by the veterinary profession, and other health care professionals as well. Therefore, it is imperative that state laws catch up to desired PT practice patterns, but it will not happen without personal diligence and passion.

For too many years now PTs working in states that are void of codified language have simply been practicing *under the radar* so to speak. However, in recent months, a few PTs have been questioned about their ability to practice on animals in states where laws are nonexistent. Without legal practice language, interpretation of whether or not a PT is allowed to treat animals becomes murky at best, leaving professional licensing boards and state departments of health in precarious situations to render unfavorable decisions. For example, some PTs have recently received "cease and desist" orders from state officials indicating laws do not currently exist for PTs to practice on animals. This leaves PTs in situations that can result in what is currently being witnessed in the state of California; eg, a political mess that has lasted for more than 12 years and still counting.

So what is the ideal fix for those states that lack codified laws for PTs to legally practice on animals? Well first off, don't get angry because laws are not already present in your state. Keep in mind that when statutes were initially passed for PTs to practice on humans, there was never any intent to include animals in scope of practice…and for good reason…very few PTs were even treating animals 20 to 25 years ago in the United States.

Only recently have more PTs been getting certified to practice on animals, but state laws don't "automatically" change just because a few have added a new species to their practice. So please keep history in perspective, the fix to state laws is now in the hands of those who get certified and actually want to practice what they just learned through additional education. The first step is to check your state practice acts for both PT and Veterinary medicine to see what is allowed by way of treating animals. If no laws exist for PTs, contact your State PT Association or Chapter Legislative Committee and inquire as to how laws in your jurisdiction are legislated. There is no better time to begin the process than immediately after reading this article. Seriously, I am not kidding! This issue really is that important.

Scholars

To ALL members of the ARSIG—*Please share your knowledge for the collective good!!* We are looking for any and all submissions related to the practice of animal rehabilitation or sports performance. Review articles, abstracts, case studies, novel treatment

techniques, interesting clinical anecdotes, etc. Do not be afraid to submit, all it requires is activation of your median nerve to push on the send button to transmit an email with a novel attachment.

Contributory Acknowledgment

In this edition of *OPTP* Charles Evans MPT, CCRP, and Mark Troxel, DVM, DACVIM, have submitted an excellent article on Degenerative Myelopathy. If dogs are a part of your practice, then please read the accompanying article in this edition of *OPTP* for information you may find clinically useful.

Contact: Kirk Peck, President ARSIG
Office (402) 280-5633
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Degenerative Myelopathy

Mark Troxel, DVM, DACVIM (Neurology) and Charles Evans, MPT, CCRP
Massachusetts Veterinary Referral Hospital, Port City Veterinary Referral Hospital

WHAT IS DEGENERATIVE MYELOPATHY?

With diseases like Degenerative Myelopathy, which have no cure, one of the most important coping mechanisms for owners can be information. There are many decisions that will have to be made at each stage involving not only the pet's quality of life but the owner/caregiver's as well. Canine degenerative myelopathy (DM) is a progressive disease of the spinal cord and ultimately the brain stem and cranial nerves which, at its end stages, results in complete paralysis and death. The closest human equivalent is Amyotrophic Lateral Sclerosis, or ALS (Lou Gehrig's disease). The same gene mutation (SOD-1) is implicated in both diseases.

Degenerative myelopathy was first described as a specific neurological disease in 1973. The cause of the disease is not known although recent research has found a possible genetic link. The mutated gene has been found in 100 breeds including Cardigan and Pembroke Welsh Corgis, Chesapeake Bay Retrievers, Irish Setters, Boxers, Collies, German Shepard Dogs, and Rhodesian Ridgebacks. In a recent study, 2% of German Shepard Dogs were identified as having the disease. Only 0.19% of dogs, in general, have the condition. The disease typically appears between 5 and 14 years of age depending on the breed of dog. Both sexes appear to be equally affected.

Degenerative myelopathy begins in the spinal cord in the thoracic, or chest, region. The white matter of the spinal cord, degenerates. One theory for the cause of DM is the immune system itself attacks the nervous system causing the degeneration. The degeneration consists of demyelination of the nerves and actual loss of nerve fibers. According to Dr. Joan R. Coates, one of the leading experts in this condition, DM is not an inflammatory disease. She states DM is similar to oxidative stress that characteristically has a release of free radicals resulting in cell degeneration.

SYMPTOMS/WARNING SIGNS

Degenerative myelopathy has a slow, insidious onset with a slow progression of weakness. It is not uncommon for the signs to progress slowly, plateau, and then start to progress again. These symptoms often begin in one rear leg and then eventually involve both rear legs as the disease progresses; alternatively, it could affect both rear legs at the same time. This condition is NOT painful. As a result, with appropriate physical therapy and nursing care, patients with DM can still have a good quality of life for a significant length of time.

TREATMENT

- Exercise will help to prolong muscle mass and mobility.
- Aquatic therapy of either walking or swimming can even be more useful than walking. To date, professional canine rehabilitation (physical therapy) is the only treatment that has been shown to improve quality of life and longevity.
- Owner education on preventing decubitus ulcers, urinary tract infections, foot damage, and on assistive devices (harnesses/carts) to assist in the dog's mobility.

TESTING AND DIAGNOSTIC PROCEDURES

- Because there are a number of disorders that mimic the symptoms of degenerative myelopathy, testing and diagnosis of the disease is primarily a process of ruling out other possible causes for the symptoms. The only definitive way to diagnose DM is to examine the dog's spinal cord under a microscope using histopathology (the microscopic examination of tissues) after the animal has died.
- A comprehensive neurological examination is essential to determining what neurological impairment a dog may have. A history of the speed of onset, the presence or absence of pain, and the extent of dysfunction is essential. A further "hands on" examination by a skilled veterinarian can determine the localization of the dysfunction. X-rays/radiographs of the thoracolumbar region can reveal any tumor involving the spinal cord that may be producing the symptoms. A spinal tap and analysis of cerebrospinal fluid can reveal evidence of inflammation in the spinal cord. Advanced imaging such as magnetic resonance imaging (MRI), computed tomography (CT), and nerve conduction studies can be done alone or in combination to further pinpoint or rule out disorders.
- There is a DNA saliva test to screen for the mutated gene found in dogs with degenerative myelopathy. The test determines whether there is a mutated copy of the SOD1 gene present in the sample. This test can be run prior to any presenting symptoms but it is only recommended in the breeds that most frequently present with the disease. The results will fall into 1 of 3 categories: (1) Normal/Normal (N/N or "clear") which indicates the dog does not have the mutation and is extremely unlikely to develop the disease (2) Normal/Abnormal (N/A or "carrier") which means the dog has one copy of the mutated gene and one of the normal gene, or (3) Abnormal/Abnormal (A/A or "at risk") which means the dog has 2 copies of the abnormal gene and is at risk for DM.

Early signs (Duration: 1 to 3 months)

Degenerative myelopathy initially affects the rear limbs. At first, you may notice rear limb weakness, scuffing of the nails, muscle loss, decreased coordination, loss of balance, difficulty transferring from lying down or sitting, to standing, and/or an inability to climb stairs, jump into the car, or onto furniture. These symptoms are also typical of other conditions, such as arthritis, hip dysplasia, and other spinal diseases (eg, disk protrusion/herniation). If you are seeing these signs, you should contact your veterinarian and have your dog examined. In this phase, treatment consists primarily of owner education in proper nursing care and use of assistive devices, as well as physical therapy.

Augie in his sling, a long time physical therapy client at Massachusetts Veterinary Referral Hospital with degenerative myelopathy.

Intermediate Phase (Duration: 3 to 4 months)

- The next stage of symptoms are knuckling or walking on the tops of their feet (loss of conscious proprioception), limp tail, crossing of the hind limbs under the body (scissoring), or a rear leg drag. Check the two middle toes of the feet to see if there is unusual toe nail wear. The middle two toes are the main weight bearing digits of the foot. As the symptoms progress, you will begin to see worsening signs of weakness and dragging the hind limbs on the ground or floor. Urinary and/or fecal incontinence occur very late in the course of the disease. You may also note a hoarseness or loss of volume to the bark. At this phase, treatment consists of assisting the owners with fitting and use of assistive devices, such as harnesses and carts, educating owners on bladder care and turning schedule to prevent pressure sores, and aquatic therapy to maintain motor control for the gait cycle.

End Stage (Duration: 4 to 6 months)

In the very late stages of the disease progression is more rapid and you will see forelimb involvement with muscle mass loss to the shoulders and forelimbs. As the disease progresses, the dog will develop weakness in all 4 legs. Eventually, the dog will be unable to stand or walk. There may be residual head movement at this stage and they will not be able to remain sternal (on their chest) without assistance. The disease will then progress to the brain stem and eventually to the cranial nerves which may affect breathing. The nervous system's spinal cord and brain stem are the only structures affected by DM. However, weakness from DM can have secondary effects such as decubitus ulcers (pressure sores), systemic infections, and urinary tract infections due to urine retention. There can be kidney, lung, and heart failure. Death from DM results from multisystem failure. Treatment at this stage focuses on assistive devices to assist the owner in moving their pet around safely (ie, quadriplegic carts, rolling beds, etc), and in nursing care/education to prevent bladder/skin infections and pressure sores. Most owners at this point will consider euthanasia, so discussing quality of life issues and providing support to the owners is also important.

Index to Advertisers

ORTHOPAEDIC SECTION

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