ORTHOPAEDIC

# Physical Therapy Practice

THE MAGAZINE OF THE
ORTHOPAEDIC SECTION, APTA

VOL. 21, NO. 1 2009

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|---|---|---|---|
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Where did you hear about the course? ☐ Brochure ☐ Orthopaedic Section Web site ☐ E-mail ☐ Other _____

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# ORTHOPAEDIC

## Physical Therapy Practice

VOL. 21, NO. 1 2009


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## regularfeatures



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## publicationstaff




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# editor'smessage

Christopher Hughes, PT, PhD, OCS

## When All Else Fails… We succeed!

I am sure many of you have had at least one of these experiences. You have been treating a patient for 4 weeks and they are not getting better. In fact they seem to be regressing even though you have tried to intervene as best as possible. As a consequence you refer the patient back to the Physician and ultimately the patient has a surgical procedure to address the pain or loss in mobility that is causing their problem. At times patients will avoid surgery even though it represents a viable option.

Patients certainly handle this outcome differently. Some want more PT, some go to another therapist and some ultimately go to another Physician, or some just give up and "live with it."

If you have treated enough patients it becomes very interesting to watch the current health care system at work with people who do not respond in accordance to standards set by ourselves or doctors or third party payers. When we fail to relieve the patient of their primary reason for coming to us, do we feel like we have let the patient down? Is this really a negative outcome? Or have we just helped the Physician with his own course of action?

Many times PT is the first step in patient care because doctors truly believe that PT is the most suitable treatment. However another perspective is that if a patient does not respond to a good round of PT then the Physician may feel more confident that they need to do surgery since a more conservative approach did not work. In another words, Physicians often are allowed to piggyback off of our success AND failures in treating the patient. I sometimes find this ironic that our inability to succeed in getting the patient better often allows the Physician to calculate a certain level of surgical success especially if the doctor has confidence that the work we do is high quality. A lack of positive patient response may justify surgery not only to the patient and insurance companies but also in the eyes of the Physician. Thus our own lack of success possibly can spur a more favorable outcome for the surgeon because we have helped the Physician in profiling those patients who are best surgical candidates. Imagine that, our inability to progress the patient contributes to greater success through proper heath care management of the problem! Success is achieved not just for us because we have managed the problem from our end but we have also assisted the Physician in getting a better perspective on the severity of the injury. In the end it's all about the patient and their ability to get the most effective treatment. So even light of "perceived" failure we have provided a valuable service.

Obviously I have made this a rather dichotomous outcome (better or not) but sometimes it may not be so simple. Let's turn the tables. You get a postsurgical referral of a patient who has just undergone a rotator cuff repair. After treating the patient, things just are not going well. The patient is getting stiffer, weaker, and more painful. You investigate to the best of your ability and just know something is not right. You speculate that for one reason or another surgery hasn't gone well because from day one the patient just never really got off to a good start in gaining relief and in reaching expected clinical milestones. You refer the patient back to the Physician with a progress/follow-up letter but for whatever reason the Physician just sends the patient back because the Physician still feel s that you should continue therapy. The patient is confused and you now are faced with a lowered probability of success. As opposed to our first scenario where we actually were able to treat "failed" care as a diagnostic aid, we are in a situation that actually reverses our ability to have success. In another words, it is not always a 2-way street. If we continue to treat this patient, the outcome may not change or can even get worse. The deck has not been stacked in OUR favor or the patients. We have been predisposed to failure based on circumstances and poor coordination of care.

As for the patient we might now see a cascade of events. The patient gets frustrated and depressed and you are running out of options. Inevitably after continued return visits to the same Physician, the patient finally hears the dreaded words "you are just going to have to live with it, I have done all I can do." Now what? Many patients will seek out second opinions but second opinions following an unsuccessful outcome can be somewhat elusive. Many Physicians do not like to clean up after other surgeons work mainly because they view a possible decreased level of probability of success as well getting dragged in to a situation that is destined to be viewed as troublesome. All along, the therapist is caught in the middle. As therapists we do not have the luxury to say no. We persevere. Often we try to assist the patient with referral resources or strategies to cope with the continued disability. We view this as the least we can do since we ultimately become the patient's best source for providing solutions even when there may not be any.

Such is the nature of the art and science of medicine. There are no facts just probabilities. The question then becomes how well we understand the probabilities we are dealt and how can we respond. Even in perceived defeat (ie, patient doesn't get better) we still have a continued impact on the patient's potential for success through education, communication, and persistence in solving the problem. We do not like it when our patients do not get better. These scenarios point to the uniqueness of PT and our role in health care. Even when we are faced with reduced odds, we remain diligent to the cause of patient health and we can play the game on both ends. What a great job. Even when all else fails, we succeed.

# president'smessage

James J. Irrgang, PT, PhD, ATC

With the New Year, it is a time to reflect on past accomplishments and look forward to the future. During the last year, "change" has been the operative word. With the new administration in Washington, DC and strengthening of the congressional majority, change in direction for the country in 2009 is a certainty. However the direction and magnitude of this change is uncertain. For some, the promise of "change" has raised hope, but for others it has increased their fear. The uncertainty of this change, coupled with increasing bad debt has contributed to a worsening economic crisis that appears will continue well into 2009. Much of the economic crisis was created by individuals not living within their means. The natural reaction for most in this time of economic crisis is to become more conservative in their spending, which further contributes to the economic downturn. As a result of this, many individuals are eliminating personal expenses that are considered unnecessary. Some reading this column may be considering dropping their membership in the Association and Section; however, now is not the time to do so.

One area that is considered a priority area for the administration and congress is health care reform. Issues which are of vital importance to physical therapists include improving patient access to physical therapists and rehabilitation services under Medicare and Medicaide, including elimination of the Medicare cap and improvements in the Medicare physician fee schedule; maintaining integrity of physical therapist services, including delivery of services only by qualified personnel and preventing referral for profit arrangements and advancing rehabilitation research. It is critical that the APTA and individual professionals take an active role to ensure the resulting health care reform ensures access and payment for physical therapy services, while not creating an undue burden on society and the taxpayer. Given that health care reform is a priority, it is now more important than ever that the APTA and the Section have a strong voice, which requires members that are committed to supporting the Association and Section.

Now more than ever, physical therapists that are successful will be those that strive for excellence and provide cost effective evidence-based care that achieves optimal patient outcomes. For those interested in management of musculoskeletal conditions, the Orthopaedic Section is the premier professional organization to promote professional growth and evidence-based practice and advocate for the practice of orthopaedic physical therapists.

Over the last year, the Section has experienced x.x% growth in membership. Some of the accomplishments that foster the mission and vision of the Section during the last year include:

- Pledging $500,000 over 7 years to the Foundation for Physical Therapy to create endowment for orthopaedic physical therapy research
- Increasing the funding available for the Orthopaedic Section Research Grants from three $10,000 grants to three $25,000 grants per year
- Initiating a process to create a research agenda for orthopaedic physical therapy
- Publishing two clinical practice guidelines in *JOSPT*, one on examination and treatment of heel pain and plantar fascitiis and the other on examination and treatment of neck pain
- Successfully petitioning the court to dismiss the lawsuit brought forward by the NATA
- Establishing a Public Relations and Marketing Committee to position the Section to participate in the APTA's branding and communication plan that will be announced and implemented in 2009
- Expanding the Education Committee
- Initiating a membership survey in preparation for 2009 Strategic Planning process.

Currently the Section is on sound financial ground with reserves beyond the recommended levels. However taking the current economic climate into consideration, this past fall, the Section carefully reviewed the budget for 2009. The Section was able to develop a balanced budget using conservative revenue estimates while still supporting key initiatives to promote the mission and vision of the Section. Some of the initiatives planned for 2009 include:

- Development of additional clinical practice guidelines related to low back pain, hip osteoarthritis, and shoulder pain;
- Development of web-based tools to enhance the use and dissemination of clinical practice guidelines;
- Strategic planning for 2010 to 2012;
- Development of tools and educational materials to foster the development of orthopaedic residencies and fellowships;
- Initiatives to enhance branding and marketing of orthopaedic PT; and
- Finalizing and disseminating the research agenda.

The Orthopaedic Section appreciates your continued support and encourages taking advantage of the benefits of Section membership and getting involved in Section activities. The Board of Directors and staff wish you the best for a happy, healthy, and productive 2009. As always, please contact us with any concerns or issues that you would like us to address by calling the Section Office at 800/444-3982…..or by contacting me via e-mail me at jirrgang@pitt.edu.

# financecommitteereport

Steven R. Clark, Chairman

## FINANCE COMMITTEE REPORT

The Finance Committee met in August to review financial operations and to make recommendations for the 2009 budget. The Gillette & Associates audit of the 2007 Section income/expenses has ascertained that Section operations and its cash flow is in conformity with accepted accounting principles through December 31, 2007.

In addition, the following operating budget for fiscal year 2009 has been approved by the Section Board of Directors. Expectations are that income will exceed expenses allowing the Section to continue offering membership at $50/year.

The Committee also recommended that $200,000 be placed in laddered certificates of deposit due to the current turmoil in the finance markets. Our analysts at LPL and AG Edwards both felt that the market could be limited through 2009, thus the Board of Directors moved forward with this recommendation.

If you have questions regarding the audit report or 2009 operating budget, feel free to contact me at Steven@clarkphysicaltherapy.com.

## AUDIT REPORT 2007 – STATEMENT OF ACTIVITY

**Years ended December 31, 2007 & 2006**

| | 2007 | 2006 |
|---|---|---|
| **UNRESTRICTED NET ASSETS Unrestricted Revenues, Gains, Losses** | | |
| Membership dues | $697,619.00 | $661,366.00 |
| Registration, meetings | $522,620.00 | $536,231.00 |
| Advertising income | $47,266.00 | $44,665.00 |
| Shipping and handling income | $20,701.00 | $23,198.00 |
| Publishing and administrative | $55,865.00 | $53,878.00 |
| Sale of promotional items | $1,282.00 | $1,283.00 |
| Miscellaneous | $13,591.00 | $4,204.00 |
| Investment income | $126,358.00 | $63,924.00 |
| Rental income | $51,388.00 | $48,580.00 |
| Sale of assets | $24,136.00 | $103,604.00 |
| **Total Revenue** | **$1,560,826.00** | **$1,540,933.00** |
| **Less: Administrative Expenses** | ($231,850.00) | ($224,478.00) |
| **Program Expenses** | ($1,117,890.00) | ($912,392.00) |
| **Add: Unrealized Gain (loss) on Investments** | ($20,585.00) | ($10,067.00) |
| **Change in Unrestricted Net Assets** | $190,501.00 | $393,996.00 |
| **Net Assets at Beginning of Year** | $2,829,275.00 | $2,361,779.00 |
| Adjustment for accounting error in using equity method for JOSPT | | $73,500.00 |
| **Balance at Beginning of Year as Restated** | $2,829,275.00 | $2,435,279.00 |
| **Net Assets at End of Year** | **$3,019,776.00** | **$2,829,275.00** |

## MARKETABLE SECURITIES FAIR MARKET VALUE

| | 2006 | 2007 | % Change |
|---|---|---|---|
| LPL Investment Reserve | $734,140.00 | $716,183.00 | -2.45% |
| A.G Edwards- Endowment Fund | $775,229.00 | $1,081,479.00 | 39.50% |

## 2009 OPERATING BUDGET

| | Proposed Expenses | Proposed Income |
|---|---|---|
| GOVERNANCE | $202,040.00 | $60,000.00 |
| OPERATIONS | $257,081.00 | $48,462.00 |
| MEMBER SERVICES | $393,923.00 | $685,850.00 |
| EDUCATION | $111,548.00 | $146,750.00 |
| JOURNALS/NEWSLETTERS | $292,105.00 | $197,725.00 |
| INDEPENDENT STUDY COURSES | $274,502.00 | $411,729.00 |
| NOMINATING COMMITTEE | $5,625.00 | $0.00 |
| OCCUPATIONAL HEALTH SIG | $2,500.00 | $0.00 |
| FOOT AND ANKLE SIG | $2,500.00 | $0.00 |
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| PERFORMING ARTS SIG | $2,500.00 | $0.00 |
| ANIMAL REHABILITTION SIG | $2,500.00 | $0.00 |
| | **$1,549,324.00** | **$1,550,516.00** |

# Functional Outcomes following Rotator Cuff Repair based on Tissue Quality: A Pilot Study

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John A. Carrino, MD, MPH[4]
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## ABSTRACT

**Study Design:** Prospective nonrandomized descriptive repeated measures design.

**Objective:** The specific aims of this study were to: (1) determine agreement between magnetic resonance imaging (MRI) and intraoperative soft tissue assessment of the rotator cuff (RC), (2) determine if postoperative range of motion (ROM) and manual muscle test (MMT) gains are different based on severity of RC pathology, and (3) determine if there is a difference in postoperative functional outcomes based on severity of RC pathology.

**Background:** Successful treatment of RC tears is presumed to be dependent upon surgical intervention and appropriate rehabilitation. Many factors are alleged to have an impact on postoperative functional outcome. Determining whether age, presence of glenohumeral osteoarthritis, duration of symptoms, extent of tear, or presence of muscle atrophy have an influence on outcome may be helpful to the practicing clinician.

**Methods and Measures:** Ten subjects who had an arthroscopic RC repair underwent preoperative and postoperative examination for pain, range of motion, muscle performance, and function.

**Results:** Patients with less severe RC pathology had marked increases in postoperative active range of motion (AROM) forward flexion, AROM external rotation at 0 degrees abduction, and increases in manual muscle test (MMT) measures of anterior deltoid, middle deltoid, and internal rotators (all, $p < .042$). No differences in functional outcome were observed based on the extent of tear, presence of atrophy, and duration of symptoms.

**Conclusions:** Improvements in postoperative AROM and MMT measures appear to be dependent upon severity of pathology.

**Key Words:** atrophy, extent of tear, rotator cuff, shoulder

## INTRODUCTION

Rotator cuff (RC) tears are a common and prevalent condition,[1] with a variable presentation. The presence of a RC tear can cause a vast array of impairments.[2-5] These impairments include pain, loss of motion, and weakness. These impairments eventually lead to disabilities such as the inability to participate in throwing sports or complete occupational tasks of lifting and reaching. Many patients dealing with a full thickness RC tear require surgical intervention in order to restore shoulder function. The conventional management for a painful RC tear that has failed conservative treatment is operative repair with subacromial decompression.[6-8] Postoperative outcomes for patients having undergone a RC repair are quite good.[4,9-19] General health status has been shown to significantly improve in individuals that have undergone surgery for chronic RC disease.[9] Patients who have undergone an arthroscopic RC repair have shown to have a more rapid recovery of function than those whose procedures were performed with an open procedure.[20-22] The biomechanical strength of the repaired RC has been reported to be dependent upon tissue quality, surgical technique, and materials used.[2,23-25] Despite the literature that demonstrates that arthroscopic RC repair leads to good functional results, it is still not known which of the soft tissue variables of the RC have an impact on functional outcome. An increase in postoperative strength and a decrease in pain have been correlated with early surgical repair.[3,26] Patients with smaller tears have had better outcomes.[5,11]

Given the many variables that influence a RC tear, it is understandable that the surgical and rehabilitation process can be a challenge for the orthopaedic surgeon and physical therapist. To date, there is no standard that a surgeon or physical therapist can use to predict outcomes and guide postoperative care. Successful treatment is presumed to be dependent upon surgical intervention and appropriate rehabilitation. In addition, many variables have been presumed to impact the functional outcomes of patients who have undergone a RC repair; these variables include: age of the individual, activity level of an individual, duration of symptoms, extent of the tear, location of tear, number of tendons involved, overall RC tissue quality, presence of muscle atrophy, as well as the presence or absence of other pathology within the shoulder complex. Despite these prognostic indicators there are minimal reports of functional outcome based on classification of these defining RC variables.

Most studies reporting outcomes of patients who have undergone a RC repair have only reported correlation's between size of the tear and/or type of tear and functional outcome.[27-30] In 1994, Gazielly et al[27] found a significant correlation between type of tear and the postoperative functional score; those with a smaller tear had better postoperative shoulder function. In contrast, Pai et al[14] reported that with the exception of massive tears there is no correlation between the size of the cuff tear and functional outcome. Others support this as well.[31] The presence of atrophy and fatty infiltration are very important factors in RC repair success.[32]

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However, very few studies have described the presence of atrophy and its effect on postoperative functional outcomes; yet supraspinatus atrophy is a strong predictive factor of postoperative retearing of RC repairs.[33,34] Postoperative retearing certainly has an impact on function. However, other than the incidence of retearing, there are no reported correlations between the presence of atrophy and functional outcome.

There are no reported studies examining all the previously mentioned variables: age of the individual, activity level of an individual, size of the tear, location of tear, number of tendons involved, overall RC tissue quality, the presence or absence of other pathology within the shoulder complex and their correlation to functional outcome. One reason this may be the case is that there is not an established universal grading scale for soft tissue pathology, making it difficult to describe all the characteristics of RC pathology. If one cannot universally describe pathology, it makes it difficult to correctly classify and investigate such pathology and interventions needed to correct the pathology and determine their impact on functional outcome. The specific aims of this study are to: (1) determine agreement between magnetic resonance imaging (MRI) and intraoperative soft tissue assessment of the RC, (2) determine if postoperative range of motion (ROM) and manual muscle test (MMT) gains are different based on severity of RC pathology, and (3) determine if there is a difference in postoperative functional outcomes based on severity of RC pathology.

## METHODS

### Subject Information and Consent

Approval for this study was granted by the Institutional Review Board of Partners HealthCare System, Inc., Boston, Massachusetts. Subjects were provided written information explaining the purpose of this study. Their rights were protected and consent was received from all subjects prior to participation. Subjects were free to withdraw from the study at any time.

### Power Analysis

The subjects in this study were presumed to have better outcomes in comparison to other subjects following RC repair due to the fact that our subjects underwent arthroscopic procedure. Therefore, there would only likely be 2 groups of subjects: those with good results and those with excellent results. A significance level of 0.05 and a power of 0.9 to detect a change of greater than 10 raw points on the American Shoulder and Elbow Surgeon's Shoulder Evaluation Short Form (ASES)[10] and 8 raw points on the Simple Shoulder Test (SST)[35] would be considered an acceptable difference between the two groups. The sample size based on these factors would need to be 18 people in each of these groups in order to delineate significance between them. Hence, a total sample size of 36 subjects was indicated for this study.

### Experimental Design

A prospective nonexperimental descriptive repeated-measures research design was employed in this investigation, with subjects being assessed both preoperatively and 6 months postoperatively in regards to range of motion, muscle performance, pain, and function. Preoperative MRI assessments were conducted along with an intraoperative visual assessment.

### Inclusion/Exclusion Criteria

Potential subjects between the ages of 18 and 65 years of age, with a RC tear, as diagnosed by an orthopaedic surgeon, of at least 3 months duration who failed conservative treatment and were electing to undergo an arthroscopic RC repair participated in this study. The exclusion criteria included: an open surgical repair of a RC tear, history of previous RC surgery, previous deformity and/or fracture of the glenohumeral joint, clinically symptomatic cervical spine pathology, previous brachial plexus injury, history of cognitive impairments, progressive neurological disorder, and pending litigation and/or workman's compensation.

### Procedure

After informed consent was obtained, preoperative data collection included demographic information of past medical history, age, gender, activity level, and social support. Functional performance as reported by the subject was measured using the Simple Shoulder Test (SST) self-evaluation tool.[35,35] The SST is a quick, subjective questionnaire consisting of 12 yes-no questions pertaining to shoulder function. Pain, range of motion, muscle performance, and functional performance was measured by the American Shoulder and Elbow Surgeon's Shoulder Evaluation Short Form (ASES).[10] This measure includes a visual analog scale and functional ability questions. Shoulder active and passive range of motion as outlined on the ASES was measured using a plastic goniometer using standardized methods of goniometric assessment.[36] Those ROM measurements included: active range of motion (AROM) and passive range of motion (PROM) forward flexion, AROM and PROM external rotation at 0° of abduction, and AROM external rotation at 90° of abduction. Muscle performance, also as outlined on the ASES, was assessed by standardized MMT[37] for the anterior deltoid, middle deltoid, internal rotators, and external rotators. Health related quality of life factors were assessed using the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36). These 3 assessment tools were again used by the physical therapist for follow-up assessments at 6 months postoperatively.

Preoperative MRI was used to quantify the presence of supraspinatus atrophy by calculating the occupation ratio (r) of the supraspinatus in the suprascapular fossa as first described by Thomazeau.[38] The occupation ratio of the supraspinatus fossa by its muscle was quantified from I (no atrophy) to III (complete atrophy) along a 3-grade classification. This was calculated from r = S1 (cross section of the supraspinatus muscle)/S2 (cross section of the suprascapular fossa) (Figure 1). This ratio is a highly reliable measure and there is a strong correlation between a decrease

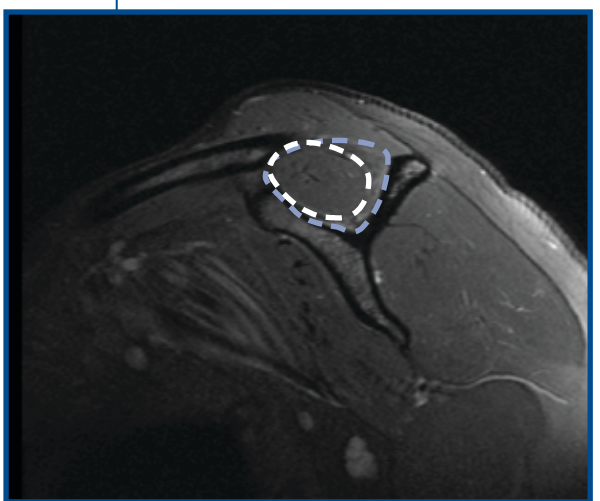

**Figure1. Magnetic resonance imaging schematic representation of a sagittal section through the midportion of the supraspinatus fossa. Landmarks for the occupation ratio of the supraspinatus. Ratio = S1/S2**

**S1 = cross section of the supraspinatus muscle**
**S2 = cross section of the suprascapular fossa.**

in the occupation ratio and the presence of a RC tear.[38] Normative values of each of the 3-grade classifications exist (Table 1). In addition, to the occupation ratio, the RC musculature was graded using the Patte Classification System.[39] The Patte Classification System was devised to classify RC tears during the 1980s through the use of a descriptive study that analyzed the findings of 256 cuff repairs. The classification is based on the: (1) extent of the tear, (2) topography of the tear in the sagittal plane, (3) topography of the tear in the frontal plane, (4) trophic quality of the muscle of the torn tendon, and (5) state of the long head of the biceps. In addition, the presence or absence of glenohumeral osteoarthritis and subluxation was documented based on visual inspection of the MRI. The same radiologist conducted all MRI assessments. Intraoperative assessments were conducted by the orthopaedic surgeon and included the extent and topography of the tear using the Patte classification system and the presence or absence of glenohumeral osteoarthritis and subluxation. All investigators were blinded to the other's measures until after the patients had completed their 6-month postoperative functional assessment.

**Table 1. Occupation Ratio of the Supraspinatus Fossa**

| Mean | Range | Descriptor |
|---|---|---|
| I | 1>R≥0.6 | No Atrophy |
| II | 0.6>R≥0.4 | Atrophy |
| III | R<.04 | Complete Atrophy |

All subjects received their postoperative physical therapy care at a clinical site of their choice. Their care was guided on an evaluation-based protocol written by the orthopaedic surgeon and physical therapist investigators. The researchers based the protocol on the best available knowledge of basic science, biomechanics, and clinical outcomes.[40]

### Data Analysis

Descriptive statistics were calculated and computed for each study variable. Percent agreement between MRI and intraoperative assessment measures were determined. Patients were subdivided into groups based on extent of tear, presence of atrophy, and duration of symptoms. Paired t tests were used to compare all preoperative and postoperative outcome values for the entire sample size and then for each of the subdivided groups. Unpaired t tests were used to describe the relationship between groups of each subdivision. Alpha level = 0.05 was used to determine significance for all statistical tests. Statistical analysis was conducted using Microsoft Excel: Office 2003 (Redmond, Wash) and SAS v 10.0 software package (SAS Institute, Cary, NC).

## RESULTS

### Demographic Data

Twenty-four of 34 patients referred for study enrollment were excluded based on the inclusion and exclusion criteria; 3 due to previous RC tear, 10 because they were 65 or older, 1 had symptomatic cervical spine pathology, 8 with pending litigation, and 2 that declined consent. Ten patients (7 males and 3 females) between the ages of 18 and 65 years of age (mean age ± SD, 52.1 ± 5.2 years), with a RC tear, as diagnosed by an orthopedic surgeon, of at least 3 months duration despite conservative treatment who were electing to undergo an arthroscopic RC repair participated in this study. The mean (± SD) duration of symptoms was 15.8 ± 12.46 months. The dominant arm was involved in 7 subjects, while the nondominant arm was involved in 3 subjects. All subjects completed the study assessments without difficulty.

### MRI and Intraoperative Rotator Cuff Characteristics

Nine of the 10 subjects had a preoperative MRI. Of the 13 common soft tissue variables assessed both by MRI and intraoperatively the mean (± SD) number of variables that were scored exactly was 8.56 ± 3.61 per subject. The status of the glenohumeral joint matched with 83% (15/18) of variables scored exactly the same, with the muscle bulk of the 4 RC muscles matching with exactly 83% (30/36) of the time. The status of the long head of the biceps was scored the same a majority of the time (62%, 17/27), while the extent and topography of the tear was consistent 44% (12/27) of the time. Operative findings of the status of RC pathology, based on the Patte Classification system, consisted of 2 subjects having an Ia tear, 1 having a Ib tear, 4 having an Ia and Ib tear, and 3 having a type III tear. All subjects except those with a type III tear had normal muscle bulk of the RC (Table 4).

### Preoperative Scores

There was a large degree of variability in preoperative AROM and PROM. Preoperative muscle performance as measured by MMT also demonstrated variability in all muscles tested. Preoperative shoulder ROM and muscle performance are outlined in Table 2. Preoperatively, all subjects had significant impairment of upper extremity function as determined by both of shoulder specific measures, the SST and the ASES total scores. In addition, all patients demonstrated general health status impairment as measured by both sections of the SF-36 questionnaire, the physical health component and the mental health component (Table 3). As compared to the general population, normative values for the SF-36[41] physical health component scores for this subject group were significantly lower (p = 0.017); however, the mental health component was not statistically different than normative data (p = 0.350).

**Table 2. Range of Motion and Muscle Performance (n=10)**

| | Mean | SD | Range |
|---|---|---|---|
| AROM Forward Flexion | | | |
| Initial | 146.60 | 23.74 | 85-160 |
| 6 Months | 164.00 | 10.22 | 160-180 |
| PROM Forward Flexion | | | |
| Initial | 160.30 | 7.23 | 150-171 |
| 6 Months | 166.50 | 9.44 | 165-189 |
| AROM External Rotation (at 0° abduction) | | | |
| Initial | 53.30 | 17.13 | 35-80 |
| 6 Months | 73.00 | 10.32 | 60-90 |
| AROM External Rotation (at 90° abduction) | | | |
| Initial | 52.00 | 32.68 | 0-90 |
| 6 Months | 81.00 | 10.02 | 60-90 |
| PROM External Rotation (at 0° abduction) | | | |
| Initial | 58.80 | 17.29 | 35-85 |
| 6 Months | 76.00 | 9.94 | 60-90 |
| MMT: Anterior Deltoid | | | |
| Initial | 3.80 | 0.79 | 2-5 |
| 6 Months | 4.70 | 9.94 | 4-5 |
| MMT: Middle Deltoid | | | |
| Initial | 3.30 | 0.95 | 2-5 |
| 6 Months | 4.40 | 0.52 | 4-5 |
| MMT: External Rotation | | | |
| Initial | 3.60 | 0.84 | 2-5 |
| 6 Months | 4.50 | 0.53 | 4-5 |
| MMT: Internal Rotation | | | |
| Initial | 3.70 | 0.95 | 2-5 |
| 6 Months | 4.60 | 0.51 | 4-5 |

### Postoperative Scores

The subject sample as a whole did not demonstrate significant improvements in postoperative ROM (all, $p > .083$); however, there was a large degree of variability in most postoperative ROM measures. Postoperative improvements (all, $p < .0001$) in muscle performance of the anterior deltoid, middle deltoid, external rotators, and internal rotators was seen. Postoperative shoulder ROM and muscle performance are outlined in Table 2. All postoperative functional outcome scores were higher than the preoperative scores. The shoulder specific measures showed the greatest of improvement. The mean SST score improved from 43% to 89% ($p = 0.0002$), the mean ASES total scores rose from 54.4 to 89.5 ($p = 0.0001$), the mean ASES pain score improved from 26 to 43.75 ($p = 0.0022$), and the mean ASES function score improved from 28.5 to 45.75 ($p = 0.0001$). In addition, all patients' demonstrated improvement in general health status impairment as measured by the SF-36 questionnaire. The mean physical health component score improved from 41.5 to 48 ($p = .0001$), and the mean mental health component score rose from 54 to 60 ($p = .0001$).

### Subdivision of groups based on severity of pathology

The subject sample was divided based on the extent of tear as determined by the intraoperative Patte classification. Seven subjects formed group 1 which consisted of individuals who had either an Ia or Ib tear, which is a partial or full-substance tear measuring less than 1 cm on the articular or bursal surface, respectively. Group 2 consisted of 3 subjects who had a full thickness tear involving more than one tendon, classified as a type III tear. Those in group 1 demonstrated a postoperative improvement in AROM forward flexion ($p = 0.005$), PROM forward flexion ($p = 0.003$), AROM external rotation at 0° of abduction ($p = 0.011$), and PROM external rotation at 0° of abduction ($p = 0.025$). Those individuals in group 2, with larger RC tears, had no significant improvements in ROM (all, $p > 0.053$). Improvements in muscular performance were seen in group 1 for MMT of anterior deltoid ($p < 0.001$), middle deltoid ($p = .003$), and internal rotation ($p = 0.003$). Muscular performance improvements were not significant for those in group 2 (all, $p > 0.061$) (Table 3).

The subject sample was also divided based on the presence of muscle atrophy as determined by the occupation ratio of the supraspinatus as measured by MRI. Five subjects formed group 1, which consisted of individuals who had no atrophy, who

**Table 3. Postoperative Range of Motion and Muscle Performance, Extent of Tear**

| | Mean | SD | Range | n |
|---|---|---|---|---|
| AROM Forward Flexion | | | | |
| Group 1 | 167.8 | 6.36 | 160-180 | 7 |
| Group 2 | 155 | 13.2 | 140-165 | 3 |
| PROM Forward Flexion | | | | |
| Group 1 | 170.7 | 5.34 | 165-180 | 7 |
| Group 2 | 156.6 | 10.4 | 145-165 | 3 |
| AROM External Rotation (at 0° abduction) | | | | |
| Group 1 | 77.14 | 9.06 | 65-90 | 7 |
| Group 2 | 66.3 | 5.77 | 60-70 | 3 |
| AROM External Rotation (at 90° abduction) | | | | |
| Group 1 | 77.14 | 10.74 | 60-90 | 7 |
| Group 2 | 66.6 | 5.77 | 60-70 | 3 |
| PROM External Rotation (at 0° abduction) | | | | |
| Group 1 | 80 | 8.66 | 60-90 | 7 |
| Group 2 | 66.6 | 5.77 | 60-70 | 3 |
| Strength: Anterior Deltoid | | | | |
| Group 1 | 4.85 | 0.377 | 4-5 | 7 |
| Group 2 | 4.33 | 0.577 | 4-5 | 3 |
| Strength: Middle Deltoid | | | | |
| Group 1 | 4.42 | 0.534 | 4-5 | 7 |
| Group 2 | 4.33 | 0.577 | 4-5 | 3 |
| Strength: External Rotation | | | | |
| Group 1 | 4.57 | 0.534 | 4-5 | 7 |
| Group 2 | 4.33 | 0.577 | 4-5 | 3 |
| Strength: Internal Rotation | | | | |
| Group 1 | 4.57 | 0.534 | 4-5 | 7 |
| Group 2 | 4.66 | 0.577 | 4-5 | 3 |

Group 1 consisted of individuals who had either a Ia or Ib tear, which is a partial or full-substance tear measuring less than 1 cm on the articular or bursal surface.

Group 2 consisted of those subjects who had a full thickness tear involving more than one tendon, classified as a type III tear.

**Table 4. Postoperative Range of Motion and Muscle Performance, Atrophy**

| | Mean | SD | Range | n |
|---|---|---|---|---|
| AROM Forward Flexion | | | | |
| Group 1 | 169 | 6.51 | 165-180 | 5 |
| Group 2 | 158.7 | 13.14 | 140-170 | 4 |
| PROM Forward Flexion | | | | |
| Group 1 | 171 | 5.47 | 165-180 | 5 |
| Group 2 | 161.2 | 12.5 | 145-175 | 4 |
| AROM External Rotation (at 0° abduction) | | | | |
| Group 1 | 78 | 10.36 | 65-90 | 5 |
| Group 2 | 65 | 5.77 | 60-70 | 4 |
| AROM External Rotation (at 90° abduction) | | | | |
| Group 1 | 78 | 12.54 | 60-90 | 5 |
| Group 2 | 67.5 | 5 | 60-70 | 4 |
| PROM External Rotation (at 0° abduction) | | | | |
| Group 1 | 80 | 10 | 70-90 | 5 |
| Group 2 | 68.75 | 6.29 | 60-75 | 4 |
| Strength: Anterior Deltoid | | | | |
| Group 1 | 5 | 0 | 5 | 5 |
| Group 2 | 4.5 | 0.577 | 4-5 | 4 |
| Strength: Middle Deltoid | | | | |
| Group 1 | 4.6 | . 547 | 4-5 | 5 |
| Group 2 | 4.25 | 0.5 | 4-5 | 4 |
| Strength: External Rotation | | | | |
| Group 1 | 4.33 | 0.577 | 4-5 | 5 |
| Group 2 | 4.5 | 0.577 | 4-5 | 4 |
| Strength: Internal Rotation | | | | |
| Group 1 | 4.6 | 0.547 | 4-5 | 5 |
| Group 2 | 4.75 | 0.5 | 4-5 | 4 |

Group 1 consisted of individuals who had no atrophy, who were classified as having an occupation ratio of I.

Group 2 consisted of 4 subjects who demonstrated atrophy, classified as having an occupation ratio of either a II or III.

were classified as having an occupation ratio of I. Group 2 consisted of 4 subjects who demonstrated atrophy, classified as having an occupation ratio of either a II or III. Those in group 1 demonstrated a postoperative improvement in AROM forward flexion ($p = 0.023$), PROM forward flexion ($p = 0.031$), AROM external rotation at 0° of abduction ($p = 0.020$), and PROM external rotation at 0° of abduction ($p = 0.022$). Those individuals in group 2, with RC atrophy, had significant improvements in AROM external rotation at 0° of abduction ($p = 0.022$) all other ROM improvements were not significant. (all, $p > 0.091$). Improvements in muscle performance were seen in group 1 for MMT of anterior deltoid ($p < 0.001$), middle deltoid ($p = 0.003$), and internal rotation ($p = 0.034$). Muscle performance improvements were not significant for those in group 2 (all, $p > 0.057$) (Table 4).

Finally, the subject sample was divided based on the length of duration of symptoms. Six subjects formed group 1 which consisted of individuals who had experienced symptoms ≤ 12 months, with group 2 consisting of 4 subjects who had symptoms of > 12 months. Those in group 1 demonstrated a postoperative improvement in AROM forward flexion ($p = 0.032$), AROM external rotation at 0° of abduction ($p = 0.038$), and PROM external rotation at 0° of abduction ($p = 0.042$). Those individuals in group 2, whose symptoms were > 12 months, had significant improvements in AROM forward flexion ($p = 0.040$) and AROM external rotation at 0° of abduction ($p = 0.042$) all other ROM improvements were not significant. (all, $p > 0.072$). Improvements in muscle performance were seen in group 1 for MMT of anterior deltoid ($p = 0.042$), middle deltoid ($p = 0.040$), and internal rotation ($p = 0.004$). Muscle performance improvements were seen in MMT of anterior deltoid ($p < .001$) and middle deltoid ($p = .015$) for those in group 2.

No difference in functional outcomes, as measured by the SST and ASES, were seen between individuals based on the extent of their tear, presence of atrophy, or duration of symptoms (all, $p > 0.061$)

## DISCUSSION

In this pilot study, it was found that there was good agreement between MRI and intraoperative soft tissue classification of the RC, with the best agreement seen in the area of rating the status of glenohumeral joint and the degree of muscle bulk. This finding is consistent with other published radiology work.[42-44] There are very few studies that compare MRI findings with operative findings. Yamakawa et al[45] compared MRI to operative findings, and found that MRI correctly identified 85% (46/54) of full-thickness tears and 83% (5/ 6) of the partial thickness tears. The comparison of MRI and operative findings in full-thickness tears showed a sensitivity of 85%, a specificity of 83%, and a positive predictive value (PPV) of 99%. A sensitivity of 83%, a specificity of 85%, and a PPV of 39% was demonstrated in a comparison of the partial thickness tears compared to the operative findings. They calculated a linear regression, which showed an excellent correlation between the operative findings and the MRI assessment ($r = 0.90$, $P < 0.01$). Hence, MRI may be helpful in determining large and medium sized RC tears, but less helpful in delineating a small full-thickness tear from partial thickness tears. Magnet resonance imaging is the primary diagnostic tool for the evaluation of the shoulder due to its superior soft-tissue contrast and ability to delineate structures in multiple planes.[46,47] The use of MRI has been shown to be accurate for detecting or ruling out RC tears, measuring the size of tears, and differentiation of partial from full-thickness tears.[42,43,48] In addition, MRI using atrophy specific imaging parameters are ideal for optimal postoperative management of the patient with a RC repair.[34] Most subjects in our study did not have RC atrophy as measured by the occupation ratio of the supraspinatus. Those individuals that did have atrophy had minimal gains in ROM and muscle performance at the 6-month follow up assessment point. One has to question whether their minimal ROM and MMT gains are the result of atrophy and/or the presence of a significant type III tear. The occupation ratio has not been reported to be used for directly predicting postoperative impairment or functional measures. The occupation ratio has been used to predict postoperative retearing of the RC, which certainly impacts function, and it has been shown that there is a 25% to 85% chance of retearing if one has significant atrophy as determined by a high occupation ratio.[33] Schaefer et al[34] also reported that the presence of preoperative atrophy of the supraspinatus was the primary predictive factor for a postoperative retear. The use of validated and standardized MRI assessments of the soft tissue characteristics of the RC should assist both the surgeon and patient in operative planning as well as the surgeon, therapist, and patient in devising the most optimal postoperative rehabilitation plan.

Preoperatively, it was found that patients with RC tears have a significant level of impairment as measured by goniometry and MMT. Strength impairments are typical in the presence of tendinopathy and RC tears.[3,49-51] Our data suggests that those subjects with a larger extent of tear had less preoperative ROM than those with smaller tears. This is consistent with Post et al[52] who reported that patients with larger tears typically have a decrease in AROM forward flexion. However, Hawkins et al[5] reported no correlation between tear size and shoulder AROM or PROM.

In addition, our results found that overall shoulder function was impacted in the presence of RC pathology. This is consistent with other reports.[4,9-19,41] Extent of a RC tear, atrophy, and duration of symptoms appear to have an impact on such impairment measures of ROM and MMT at 6 months postoperatively. Our data demonstrates that those individuals with less of an extent of tear, no atrophy, and less duration of symptoms had a significant improvement in certain ROM and MMT measures as compared to those with larger tears, muscle atrophy, and longer duration of symptoms, respectively. This is consistent with other reports of patients with smaller tears having had better outcomes.[5,11,27-30] However, it has been reported that with the exception of massive tears there is no correlation between the size of the cuff tear and functional outcome.[14,31] In the present study, no difference in postoperative functional outcomes based on the extent of tear, presence of atrophy, or duration of symptoms was seen. This may be an accurate finding; however, it may also be a result of the limitations of this pilot study.

The small sample size, which fell short of the prestudy power analysis sample size, may have lead to a large variability between subjects in terms of impairment outcomes and relatively small variability in terms of functional outcomes. The exclusion criteria of an upper age limit of 65 and only including those individuals

that underwent an arthroscopic RC repair selectively enrolled only those individuals that likely had the least pathologic RC tears, leading to the potential skewed variability between subjects. In addition, enrolling only those patients who underwent RC repair by only 1 surgeon also contributed to the potential distorted variability between subjects because of the lack of variability in surgical techniques for RC. A short follow-up time of only 6 months may not have been enough time for those individuals with the larger tears or more atrophy to have reached their maximal outcome, since most patients require 7 months to 1 year postoperatively to return to preinjury levels of activity.[4,9,11,13-16,53] Future work should include a larger sample size of subjects of any age who are electively undergoing RC repair regardless of arthroscopic or open procedures referred from various surgeons. This would reduce the likelihood of such variability in impairment and functional measures, allowing for a more diverse and truly representative sample of subjects with varying degrees of RC pathology. In addition, a longer follow-up of at least 1 to 2 years should allow for accurate assessment of postoperative functional outcome.

## CONCLUSION

Improvements in postoperative ROM and MMT measures appear to be dependent upon severity of cuff injury. No differences in functional outcome were observed based on the extent of tear, presence of atrophy, and duration of symptoms. Despite some correlations between variables of the RC and functional outcome, the variables of the RC tear did not predict functional outcome. Further work is needed with a larger sample size to attempt to describe functional outcomes following RC repair based on tissue quality.

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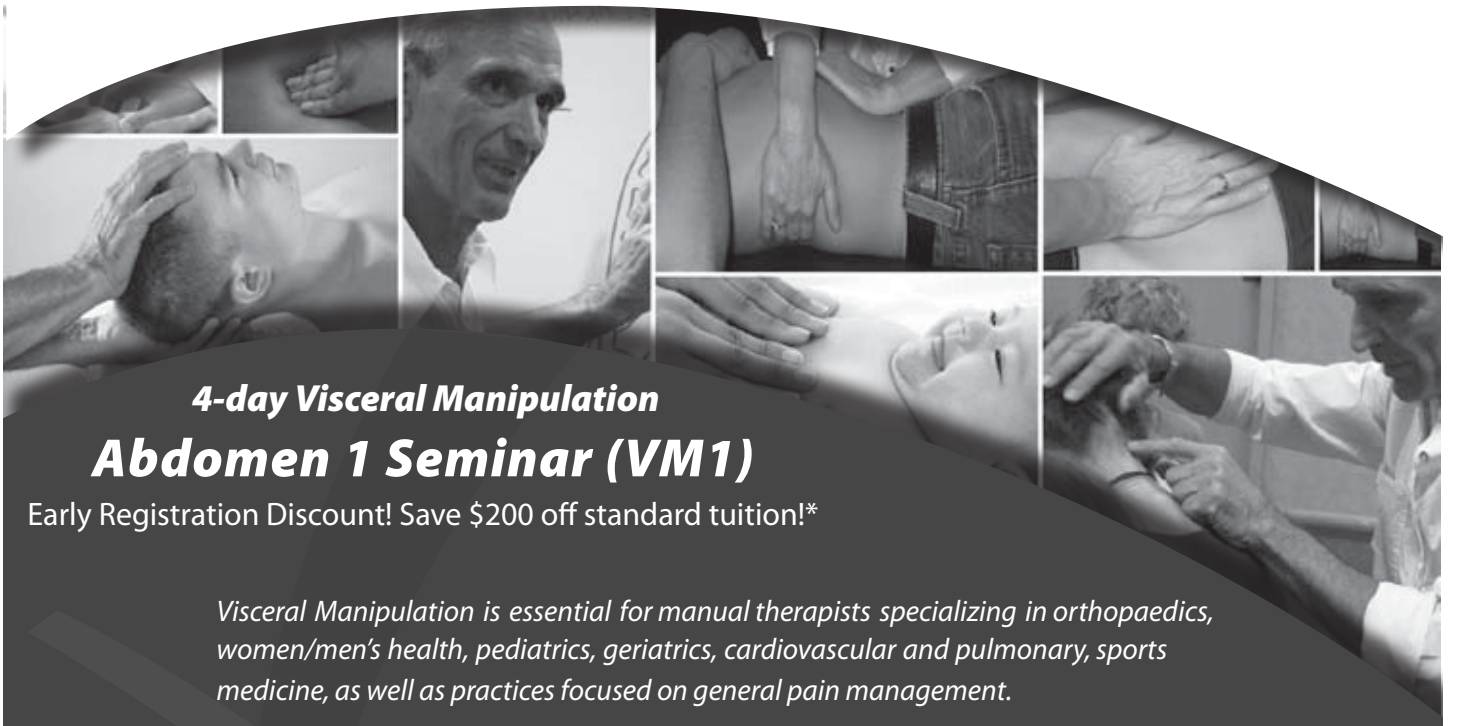

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# The Use of Rearfoot Positional Taping in the Treatment of Achilles and Peroneal Tendinitis in an Adolescent Female Soccer Player: A Case Report:

Melissa Eagleton, PT, DPT[1]


## ABSTRACT

**Study Design:** Case report.

**Background:** Taping is an economical and effective intervention used frequently in physical therapy to modify joint position, provide stability, and improve joint mechanics. Research has identified an increase in the frequency of ankle injuries in adolescent female soccer players. Specifically, the presence of excess rearfoot varus has been associated with increased tendency for ankle sprain and tendinitis. Minimal literature is available that describes taping of the rearfoot as an intervention to modify mechanics and reduce tendon stresses.

**Case Description:** A 16-year-old female soccer player presented to outpatient physical therapy in August 2006 with referral and diagnosis of Achilles tendinitis. Her chief complaint was of occasional swelling at the Achilles insertion, popping, and persistent pain in the lateral ankle that progressed proximally into the lateral leg when playing soccer. The patient reported the original mechanism of injury as a hyperinversion sprain of the right ankle in April 2006 while playing soccer. Following physical examination, it was determined that the patient had lower extremity structural anomalies that would contribute to repetitive inversion-type ankle sprains and that she may benefit from rearfoot taping to limit excessive rearfoot varus.

**Outcomes:** The patient was seen for a total of 12 therapy visits. Rearfoot taping to decrease calcaneal varus was applied a total of 7 times. She reported increased stability in the ankle, decreased frequency and intensity of lateral ankle pain, and decreased incidence of the right ankle hyperinversion during soccer practice with taping. Treatment was concluded after the 12th visit, with patient reporting absence of right ankle pain and having been fitted for custom orthotics.

**Discussion:** This case reports demonstrates the successful use of positional rearfoot taping in addition to therapeutic exercise and modalities to influence ankle and foot mechanics and decrease peroneal and Achilles tendon inflammation in an adolescent female soccer player. Additionally, taping was used to provide intermediary stabilization and as a trial to determine whether orthotics would be appropriate for this patient as she intends to continue to play soccer.


**Key Words:** calcaneal varus, rearfoot, taping, Achilles, peroneals, tendinitis, physical therapy

## INTRODUCTION

In the past 20 years, soccer has become increasingly popular in the United States for both males and females of all ages. There are over 40 million players in the world and it is the fastest growing sport in the U.S.[1] The American Academy of Pediatrics estimates that youth soccer participation in the U.S. increases between approximately 11% and 22% annually.[2] Between 1990 and 2003, high school soccer team participation more than doubled, with over 650,000 participants.[3] With an increase in the number of participants, there has been an increase in injuries that occur while participating in the sport, ranging from concussions to ankle sprains.

A recent study by Leininger, Knox, and Comstock[4] examined the incidence of pediatric soccer injuries (age range of 2 to 18) presenting to emergency rooms throughout the United States by examining data submitted to a national database. Of the over 1.5 million injuries in that time span, the most commonly injured region of the body was the lower extremity. Specifically, the most common diagnoses were sprain/strain (36%), with the ankle (18.2%) ranking second only to wrist/finger/hand (20.3%). Girls were found to have a higher risk of injury to the ankle and knee and were more prone to sprain and strains, whereas boys were more susceptible to head, neck, and facial injuries.[4] A prospective study of youth soccer injuries by Backous found a greater overall incidence for girls (10.6/1000) than boys (7.3/1000).[5]

Multiple studies have examined the intrinsic and extrinsic risk factors that may predispose a soccer player to risk of injury.[1,6-8] Extrinsic factors are shoewear, playing surface, protective equipment, training schedules, and use of ankle tape or bracing. Intrinsic factors have included age, gender, muscle strength imbalances, muscle tightness, physical conditioning, foot morphology, history of previous injury, and psychological factors/sports behavior.[6]

Specific to gender, a review conducted by Engstrom and Renstrom[1] concluded that females sustain more injuries than males, with a significantly higher rate of knee ligament injuries. They cited effects of the menstrual cycle, overall fitness, skill level, and intensity as possible explanations for gender differences.[1] Beynnon, Murphy, and Connolly[6] report a substantially higher number of injuries in females than males, specifically ACL sprains and tears.

Muscle tightness, strength, and range of motion are another grouping of intrinsic factors, specifically in ankles, that can adversely affect a player's susceptibility to injury. Basic anatomy predisposes the ankle to more lateral inversion-type sprains; the medial deltoid ligament complex is collectively stronger than the three separate ligaments of the lateral ankle (anterior and posterior talofibular and calcaneofibular ligaments), and the fibula extends more distally than the tibia.[9] One study reported several variables specific to the foot and ankle in female collegiate athletes.[10] They reported increased calcaneal eversion motion and increased tibial varum to be risk factors for ankle sprains in females. They also reported a trend of faster gastrocnemius reaction time and a delayed tibialis anterior reaction time in women that could predispose them

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to ankle injury. Since the most common orientation of the ankle during a sprain is plantarflexion (created by gastrocnemius contraction) and inversion, the trend toward faster reaction time of the gastrocnemius in females may contribute to incidence of ankle sprain.[10] Their findings were supported by another study that examined risk factors specific to the Achilles tendon found hindfoot inversion and increased tightness of the gastrocnemius to be risk factors for Achilles tendinitis in military recruits.[11]

Several studies reported that players with history of previous injury of the ankle were more likely to sustain recurrent sprains with continued play.[1,6,12,13] Possible explanations include mechanical instability from repetitive ligament strain, proprioceptive deficits, limitations of ankle ROM or strength, the presence of scar tissue formation, and incomplete rehabilitation of the original injury.

Foot morphology is an intrinsic factor that varies greatly between individuals. Several studies have questioned the potential for overuse injuries in relation to characteristics such as arch height, subtalar range of motion, Achilles tendon stiffness, and rearfoot position.[8,11,14,15] Cowan, Jones, and Robinson[14] demonstrated the highest risk of exercise-associated injury in army trainees with the highest measures of arch height. Williams, McClay, and Hamill[15] offered more specific findings to the nature of injury based on foot type. Subjects with high arches had more lateral structure, bony, and foot/ankle injuries (plantar fasciitis, lateral ankle sprains, IT band syndrome) whereas those with low arches had more medial structure, soft tissue, and knee injuries (knee pain, patellar tendinitis, and plantar fasciitis).[15] Kaufman, Brodine, Shaffer, Johnson, and Cullison[11] identified dynamic pes planus, pes cavus, restricted ankle dorsiflexion, and increased hindfoot inversion as risk factors that predispose people to lower extremity overuse injuries. They found a high incidence (33%) of overuse injuries in the lower extremity during training and found a statistically significant association between Achilles tendinitis and either a tight gastrocnemius or increased hindfoot inversion.[11]

As stated previously, extrinsic factors include shoewear, playing surface, protective equipment, training schedules, and use of ankle tape or bracing. Specific to this case report, training schedule and use of ankle taping were especially relevant. The level of competition has become intense, even in younger participants, with an increase in the number of club teams in addition to school athletics. High school players are in competition for college scholarships and may participate in sports enhancement programs in addition to practice, games, and tournaments. Training schedules are an important factor as players may be attending separate practices for each team of which they are members, participating in conditioning sessions for performance enhancement once or twice per week, and spending weekends playing multiple games in tournaments. This does not allow much time for the athlete to rest and recover in the event that an injury is sustained.

Most of the literature describing taping techniques for the ankle refers to stabilization of the ankle to allow the player to continue competing or as prevention of recurrent injury. Athletic trainers employ tape on a regular basis for these purposes. The general purpose of tape application is to limit abnormal or excessive movement in a sprained joint.[9] Specific to the ankle, trainers may use a "closed basketweave" technique that involves applying a stirrup around the calcaneus. If the trainer is preventing or protecting an inversion sprain, the stirrup is applied from medial to lateral; the direction is reversed for an eversion sprain.[9]

Physical therapists have been also using tape as an intervention for several decades, with increasing popularity over the past few years for controlling rearfoot motion that may result in pain and pathology.[16] The goal of foot and ankle taping in physical therapy is typically directed at modifying joint mechanics and improving proprioception. It can also be used to provide joint stabilization to allow healing to occur. The theories as to why taping is an effective intervention vary and include mechanical stability, afferent input from stimulation of mechanoreceptors in the skin, increased kinesthetic awareness, and modification of gait mechanics.[6,12,17,18] Taping has been demonstrated to continue to provide an effect at the ankle even though it loses its mechanical stability after short amounts of time, suggesting that it may provide functional (proprioceptive) stability instead of mechanical (ligamentous) stability.[12,18]

One theoretical cause of ankle instability is the loss of afferent input from joint proprioceptors, leading to delayed peroneal reaction time and impairment of the ankle's innate protection from sprain.[18] External orthotics or tape may provide stimulation to skin mechanoreceptors, thereby altering postural stability and control.[12] Karlson and Andreasson[19] studied the effect of tape on talar tilt and anterior talar translation and found insignificant changes using taping; however, they found that peroneus muscle reaction time was significantly shortened. They theorized that this was due to effects on ankle proprioception.[19] Glick, Gordon, and Nashimoto[20] examined the effect of tape and a cloth wrap on ankle support in college football players with significant talar tilt (greater than 5°) with electromyography. They found that taping provided a stabilizing effect in the ankle for up to 20 minutes of vigorous exercise but the cloth wrap was ineffective, and that taping increased the time of peroneus brevis contraction at the end of swing phase for increased stability prior to heel strike.[20] No studies were found that suggested that ankle taping was ineffective for preventing injury or controlling motion although Surve et al found that bracing of the ankle is more effective for injury reduction in individuals with previous ankle injury.[12]

The relevant literature was searched for a description or technique specific to the method of taping used in this study. Searches through the online database of *Physical Therapy* using several combinations of key terms were unsuccessful at yielding any specific description but yielded several other relevant articles.

Most of the physical therapy literature on taping for biomechanical alteration refers to variations on the low-dye technique for treatment of plantar fasciitis or motion control in the pronatory foot.[16,21-23] The low-dye technique is a common short-term intervention that can be used to decrease pain and to assess a patient's potential response to orthotics. One study examined the specific effects of low-dye taping on the pronated foot and found that it is effective in reducing calcaneal eversion.[22] Another reported that low-dye taping increased maximum inversion of the rearfoot but that high-dye taping (placing a stirrup around the ankle with higher medial and lateral ankle supports) significantly reduces the maximum eversion of the rearfoot in subjects with plantar fasciitis.[16] Vicenzino et al[23] applied low-dye tape to asymptomatic subjects with a positive navicular drop

and found that taping was effective in producing changes in static foot posture and controlling pronation during static and dynamic activity.

The rearfoot has been defined as the functional unit comprised of the calcaneus and talus, while the forefoot encompasses the rest of the tarsals, metatarsals, and phalanges.[24] The rearfoot and forefoot are delineated by the midtarsal joint. In the ideal foot, the calcaneus rests in 2° to 4° of varus while 5° to 6° is considered mildly excessive, 7° to 8° moderate, and 9° to 10° severe.[24]

In normal gait mechanics, the role of the foot varies through the stance phase of gait. The foot and subtalar joint supinate at initial contact and then pronate through heel strike to provide shock absorption, diffuse ground reaction forces, and adapt to uneven surfaces. Through mid-stance and propulsion, the subtalar joint supinates to create a rigid lever. The role of peroneus longus (PL) during these phases of the gait cycle is to stabilize the first ray as the foot re-supinates. The PL uses the cuboid as a pulley to increase its mechanical advantage as the tendon passes across the plantar aspect of the foot. The role of the gastrocnemius/soleus complex during gait is primarily to decelerate closed chain dorsiflexion through stance but also to assist in supination of the subtalar joint during mid-stance.[24]

In the excessively pronated foot, the cuboid can become hypermobile, leading to increased time spent in pronation as it is difficult for the foot to re-supinate.[25] Decreased stability of the cuboid causes the peroneal muscles to over-work and leads to strain and inflammation. When the tarsal bones are poorly aligned, the load is carried more by the surrounding muscles, and can lead to arch collapse.[11] Such impaired mechanics can lead to conditions such as plantar fasciitis, tibialis posterior tendinitis, and Achilles tendinitis.[25] Kaufman et al[11] found that Naval trainees who presented with Achilles tendinitis had increased rearfoot varus or inversion.

Over-pronation can result when the rearfoot rests in excess varus when in open chain. In closed chain standing, the calcaneus appears to be vertical or slightly valgus as the subtalar joint pronates excessively to compensate and allow the medial aspect of the foot to come into contact with the ground. The appearance of the calcaneus in a valgus position when standing is likely indicative of a forefoot problem.[24] Over-pronation as a compensation strategy is even more pronounced as the subtalar joint must continue to pronate through midstance and into propulsion, causing excess forefoot mobility at heel raise. The foot is unable to re-supinate as it must remain in pronation for the forefoot to remain in contact with the floor.[24]

The taping technique used in this study was intended to modify the biomechanics of the right foot and ankle. By limiting the amount of rearfoot varus, there would be decreased need for over-pronation in the subtalar joint to compensate, thus reducing the amount of repetitive strain at the Achilles tendon insertion. In addition, taping could also decrease the strain to the peroneal tendons by decreasing tissue tension and allowing the inflamed tendon to heal.

This case study encompasses a combination of trend toward injury in female soccer players, the potential effects of foot morphology on gait mechanics and subsequent musculotendinous injury, and the use of taping as an intervention to modify joint position and mechanics to decrease tendinitis and assist the patient in return to pain-free soccer participation. The purpose of this case study is to describe the management of right Achilles and peroneal tendinitis using taping to decrease rearfoot varus as an adjunct to manual therapy, modalities, and therapeutic exercise in a 16-year-old female soccer player.

## CASE DESCRIPTION:

The patient was a 16-year-old female soccer player referred to outpatient physical therapy in August 2006 by the physician's assistant at a local Urgent Care clinic with the diagnosis of right Achilles tendinitis. She had not had any diagnostic tests performed. The mechanism of injury was described as hyperinversion of the right ankle in April 2006 while playing soccer. She had an 11-year history of soccer participation. Like many athletes, she continued to play on the injured ankle throughout the spring and summer. One month prior to her physical therapy consult, she experienced severe pain and swelling along the right Achilles tendon following soccer practice. She also reported lateral ankle pain that progressed proximally into the lateral portion of the leg while playing soccer, which she continued to do 5 to 6 days per week. The patient's goal was to continue to play soccer without interference of ankle pain.

### History

The patient completed a medical history form that was reviewed by the physical therapist with the patient and her mother prior to the physical assessment. A Pain Assessment Scale combining a numeric pain rating scale and a "Faces" scale was used for self-assessment of pain. The patient was able to use the numeric scale as she demonstrated an appropriate understanding. It is comprised of a subjective 0 to 10 rating scale that is useful in providing a comparison of an individual's symptoms in response to modifications in activity or treatments over time. Reliability and validity of data obtained using numeric pain scales have been found to be high.[26] Using the numeric pain rating scale, she reported resting pain of 5/10 at the time of evaluation with 3/10 reported as best and 8/10 as worst in the previous 2 weeks. The patient noted that 8/10 pain was typically in concurrence with lateral 'popping' in the ankle that occurred during and following soccer practice and games.

### Examination

The physical assessment was initiated with observation of the patient in standing. No observable edema was noted in the right ankle or around the distal Achilles tendon. Abnormal orthopaedic findings included right internal tibial torsion, bilateral pes planus, slight rearfoot valgus bilaterally, and right forefoot pronation (Figure 1).

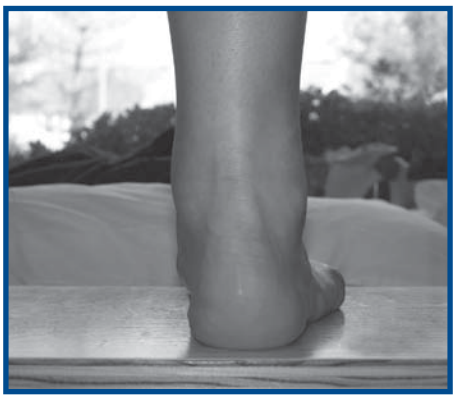

**Figure 1. Posterior view of foot and ankle in standing.**

A seated strength assessment of the lower extremities was performed with the patient demonstrating grade 5/5 with manual muscle testing of the hip, knee, and ankle

bilaterally. The patient did not report any increase in pain with right ankle testing.

Active range of motion (ROM) of the hips and knees was assessed to be within normal limits and pain-free bilaterally. Ankle ROM measurements for plantarflexion and dorsiflexion, inversion, and eversion were assessed using a goniometer with the patient in long-sitting with her feet off the edge of the mat. The patient was then asked to assume the prone position (Figure 2) for the measurement of subtalar joint neutral (STJN) to identify potential abnormalities of the rearfoot and forefoot position that may contribute to inversion sprains and tendinitis. Measurements are listed in Table 1. Subtalar joint neutral was assessed using the Langer method as described by Gary W. Gray.[27] The patient was asked to lie prone with ankles freely hanging off the mat table. Small ink markings were made at midline of the lower one-third of the calf and posterior calcaneus to use for measurement. The therapist assessed for neutral position of the subtalar joint by placing the thumb and index finger of one hand over the medial and lateral talo-navicular joint lines anteriorly while the other hand was used to hold the lateral foot and guide it through open chain supination and pronation. At the position of the ankle where the therapist felt the talus was most congruent with the navicular, the ankle was passively dorsiflexed and measurements were taken. A study by Elveru, Rothstein, and Lamb[28] determined intratester reliability of STJN and ankle measurements had intraclass correlation coefficient (ICC) values of 0.74 to 0.90 although ICC values for intertester reliability were significantly worse at 0.25 to 0.72.

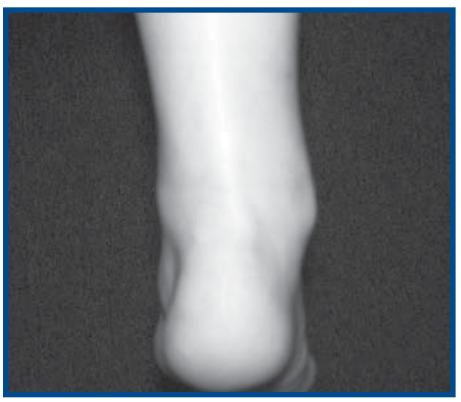

**Figure 2. Resting right ankle position in prone.**

**Table 1. Ankle ROM measurements (in degrees)**

| | Right | Left |
|---|---|---|
| *Long-sitting* | | |
| Dorsiflexion | 10 | 9 |
| Plantarflexion | 49 | 45 |
| Inversion | 30 | 40 |
| Eversion | 11 | 8 |
| *Prone* | | |
| Subtalar joint neutral | | |
| Rearfoot position | 5 varus | 3 varus |
| Forefoot position | 3 varus | normal |
| Dorsiflexion w/ 90° knee flexion | 27 | Not assessed |

The therapist also assessed for mobility along the oblique midtarsal joint axis, the longitudinal midtarsal joint axis, and first ray with increased mobility identified in the midtarsal joint. As midtarsal joint function is dictated by subtalar joint position, excessive mobility in the midtarsal joint can be related to excessive compensation in this part of the foot.[24] The assessment of the subtalar joint position and mobility of the foot and ankle joints in combination provide insight to the underlying cause of the tendonitis and repetitive hyperinversion sprains of the ankle. This information also provides the basis for the interventions chosen in the treatment plan.

Palpation of the soft tissues surrounding the right ankle joint revealed tenderness of the peroneus longus and brevis muscle bellies and tendons posterior to the lateral malleolus, proximally along the lateral Achilles tendon and lateral head of gastrocnemius, and distally along the medial and lateral borders of the Achilles. Tenderness can be a sign of possible underlying inflammation with repetitive strain.[29] Gait observation was significant for in-toed position of the right foot while walking. In-toeing affects gait by causing early pronation in stance due to an adducted position of the talus,[24] further contributing to over-pronation. Functional testing consisted of bilateral heel raise (10 repetitions) to assess plantarflexion strength in full weight bearing, which the patient was able to complete without pain or difficulty. Unsupported static standing balance was maintained for 10 seconds in right single limb stance, suggesting moderate stability at ankle or ability to compensate further up the kinetic chain. The patient was able to maintain balance unassisted but dropped into right Trendelenburg with single leg stance, suggesting weakness of the right gluteus medius.

A brief cardiopulmonary assessment was conducted in sitting to complete the systems review. The patient's resting blood pressure was 110/68 and resting heart rate was assessed at 56 beats per minute. Skin integrity was good with absence of any type of abrasion or lesion on the lower extremities. The patient was 5'4" and weighed 120 pounds, giving her a body-mass index of 20.5, within normal range.[30] Communication and cognition were appropriate for a healthy young adult.

At the conclusion of the initial assessment, it was hypothesized that excessive forefoot varus combined with mildly excessive rearfoot varus positioning of the patient's right foot could be causing a repetitive strain injury leading to Achilles and peroneal tendinitis. The increase in forefoot varus and weakness of the strained peroneus longus tendon could have contributed to repetitive hyperpronation of the foot. This may have detrimentally affected the alignment of the midtarsal bones and decreased the effectiveness of the cuboid pulley mechanism. When the tarsal bones are poorly aligned, the sufficient support must be obtained by increased contribution from strength of contraction of the surrounding muscles.[11]

The plan of care was established to decrease inflammation through modalities, manual therapy, and taping, with a gradual strengthening progression to increase intrinsic stability of the right ankle. The case was classified as Preferred Practice Pattern 4E: Impaired Joint Mobility, Motor Function, Muscle Performance, and Range of Motion Associated With Localized Inflammation, as described in the *Guide to Physical Therapist Practice*.[31] The prognosis within this pattern is for optimal recovery to occur over the course of 6 to 24 visits, within 2 to 4 months.[31]

## Intervention

The patient's treatment plan was established to address the hypothesized causes of inflammation, restore strength and ankle stability, and facilitate the patient's return to soccer, unlimited by ankle symptoms. Treatment was initiated with soft tissue mobilization of the right peroneal muscles and lateral gastrocnemius head to alleviate any muscular restrictions. Transverse friction massage to the Achilles

tendon and prone passive stretching of the calcaneus into eversion were also performed by the physical therapist to increase blood flow to the area, break up tissue adhesions, and produce an analgesic effect.[32] The patient performed active ROM and strengthening exercises for ankle and hip abductors, external rotators, and extensors, in open chain. As the patient continued to play soccer on 2 teams throughout course of treatment, she was educated to rest her ankle when possible, ice following soccer matches, and try wearing a soft brace for additional ankle support while playing.

Pulsed ultrasound to the distal peroneal tendons was initiated at the third visit (12 days following initial evaluation) as an anti-inflammatory modality prior to manual therapy and completion of exercises. At this time, taping was also initiated to modify the position of the calcaneus and decrease resting rearfoot inversion. Cover Roll stretch (BSN medical, Hamburg, Germany) was first applied as a strap beginning medially over the height of the calcaneus and running over the plantar aspect of the calcaneus and several inches proximally along the lateral leg. Leukotape P (BSN Medical, Pinetown, South Africa) was then applied over top of the Cover Roll stretch with increased tension applied as the tape was pulled superiorly from the lateral border of the heel to pull the calcaneus into a more neutral position and decrease rearfoot inversion (see Figures 3, 4, & 5). Leukotape P was used instead of standard athletic tape due to the increased rigidity that it provides as its purpose was to limit motion and modify the joint position. Rearfoot varus of greater than 3° is considered abnormal,[29] and the subject presented with 5°. The theory behind the tape application was to decrease rearfoot varus so that the patient would have decreased need to compensate with over-pronation. This would result in decreased tissue strain to the peroneal tendons and Achilles. The patient reported increased feeling of stability along the lateral ankle with tape in place.

The taping technique was repeated for the following 5 visits with the patient reporting progressive decline in pain with soccer and increased feeling of stability in the lateral ankle. She also was seen on a Friday (not a scheduled treatment visit) to have the ankle taped prior to participating in a soccer tournament over the weekend, for a total of 7 tape applications. Therapeutic exercises were progressed from open chain to dynamic closed chain to provide proprioceptive re-training in addition to ankle strengthening (Table 2). Self-taping was not taught to the patient as the plan was to obtain orthotics; however, the patient's mother attended a session to learn how to assist in self-treatment during weekend tournaments by performing massage.

## Outcomes

Treatment continued with strengthening of the lower extremities without tape for an additional 4 visits. The patient reported feeling increased stability in the ankle, even when tape was not in place. She reported increased soreness following soccer practice for the first few days after last application of taping but this seemed to resolve between visits 10 and 11 as she took approximately 10 days off from soccer. Pulsed ultrasound had been performed on visits 3 through 8 and was discontinued as the patient reported decreased pain and tenderness in the lateral ankle. Over the course of physical therapy intervention, the patient reported a progressive decrease in the pain experienced during running and cutting associated with soccer practice and games. Tenderness to palpation of the distal peroneal and Achilles tendons dissipated and the patient's report of pain and instability continued to decrease without taping. During this period, the patient and her mother were educated on potential benefits of custom orthotics to

**Table 2. Therapeutic Exercises**

| | |
|---|---|
| Open-chain (nonweight bearing) strengthening | • Four-way ankle resistance band exercises (dorsiflexion, plantarflexion, eversion, inversion)<br>• hip abduction and 'clamshell' exercise in side-lying<br>• hip extension in prone |
| Closed-chain (weight bearing) strengthening | • Single leg standing (initially on floor with light upper extremity support, then unsupported, then on mini-trampoline)<br>• BAPS board<br>• Tilt board for frontal and sagittal plane weight shifting and balance<br>• Heel raises (progressed from partial to full weight bearing<br>• Fitter exercise |
| Flexibility | • Standing gastrocnemius and soleus stretches; wedge added under lateral foot during session 8 to increase stretch to medial portion of Achilles tendon<br>• Incline board |

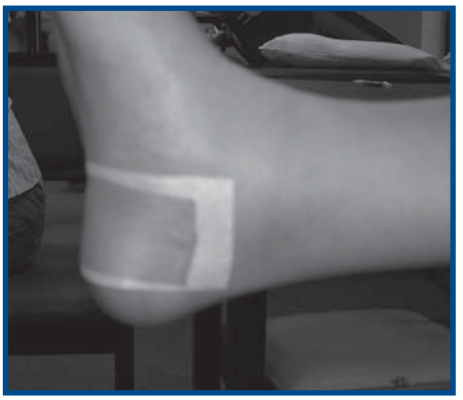

**Figure 3. Medial view of foot with tape in place.**

**Figure 4. Lateral view of foot with tape in place.**

**Figure 5. Standing posterior view of foot with tape in place.**

control rear- and forefoot position, to be used in conjunction with continued lower extremity stretching and strengthening to prevent injury reoccurrence. At the time of discharge, the patient had an appointment with a local podiatrist for fabrication of orthotic inserts. The physical therapist forwarded a letter to the podiatrist with measurements and a summary of treatment to assist with fabrication. The patient was issued a home exercise program with the goal of preventing reoccurrence of ankle inversion sprain. Refer to Table 3 for a summary of outcomes.

At a 5-month follow-up interview with the patient, she reported that she continued to wear the off-the shelf inserts given to her by the podiatrist in her regular tennis shoes and had obtained custom orthotics to wear in her soccer cleats. She reported that she rarely experienced her previously described symptoms since discharge from physical therapy and since the beginning of wearing the orthotics. The patient had taken a few weeks off from soccer following the conclusion of her club season prior to beginning conditioning for both the high school and spring club soccer seasons. At the time of the follow-up, she had returned to playing soccer 6 to 7 days per week including practices, performance enhancement sessions, and weekend tournaments. Physical therapy intervention occurred during the patient's junior year of high school. She had verbalized her intentions to play soccer on the collegiate level either as a varsity or club sport, depending on the level of competition at the college she decides to attend.

## DISCUSSION

This case report describes the successful physical therapy management of a 16-year-old female soccer player with right rearfoot and forefoot varus and a subsequent predisposition to ankle sprains. Based on the patient's foot morphology and history of recurrent hyperinversion sprains, the decision was made to employ a taping technique to decrease excess calcaneal inversion. Taping was performed in addition to manual therapy, therapeutic exercise, and modalities to treat symptoms of Achilles and peroneal tendinitis.

The literature is conflicting in the reports of whether pronated foot structure is a cause of lower extremity injury. Cowan et al[14] reported increased incidence of foot and knee injury with subjects whose arches were high but not low. Kaufman et al[11] reported no association between rearfoot inversion and iliotibial band syndrome, patellofemoral syndrome, or femoral stress fractures but found increased incidence of tarsal and metatarsal stress fractures. In contrast, Williams et al[15] associated low arches with more medial structure, soft tissue, and knee injuries (knee pain, patellar tendinitis, and plantar fasciitis). Based on the concept of the lower extremity as a kinetic chain, the position of the rearfoot and, consequently the subtalar joint would have effects higher in the chain. The talocrural joint rotates internally during pronation with resultant internal rotation of the tibia and knee flexion,[29] subjecting the knee to abnormal shear forces. Excessive femoral internal rotation has also been associated with excessive pronation and may secondarily produce knee pain due to malalignment of the knee joint and excessive patellofemoral compressive forces.[29] Theoretically, if taping can improve rearfoot position, it may be a potential intervention in the treatment of injuries higher in the kinetic chain, including patellofemoral pain, iliotibial band syndrome, and possibly hip and low back pain. More conclusive research addressing the specific contribution of foot morphology to lower extremity injury is needed to determine whether rearfoot taping has a role in successful physical therapy intervention and management of these conditions.

Over-pronation and rearfoot varus have been more definitively demonstrated as contributing factors in the development of ankle injuries and tendinitis. Kaufman et al[11] demonstrated that athletes who suffer from Achilles tendinitis are likely to have increased hindfoot inversion and/or decreased gastrocnemius length. A prospective study of female collegiate athletes performed by Reinking concluded that foot pronation, sport, and history of previous injury were all associated with increased risk of exercise-related leg pain.[33] Glick et al[20] reported that intercollegiate football players with increased talar tilt (greater than 5°) had an increased incidence of ankle injury and that strong peroneus muscles are important in supporting the ankle mortise to prevent injury.The underlying cause of over-pronation in this case was an increase in resting rearfoot and forefoot varus when the subtalar joint was in neutral. For the patient's first ray to contact the ground during stance, it was necessary for her subtalar and midtarsal joints to over-pronate. As described previously, increased pronation through midstance prevents midtarsal joint lock-up prior to propulsion and increases forefoot mobility at heel raise, so the patient is pushing off of an unstable first ray.[24] The gastrocnemius-soleus complex and the peroneals are important providers of increased stability of the foot as it re-supinates through midstance. With repetitive over-pronation, the Achilles and the peroneus longus may become susceptible to the development of tendinitis. Repetitive over-pronation may also contribute to the breakdown of the transverse arch of the foot, affecting the position of the cuboid in relation to the first cuneiform. Peroneus longus (PL) stabilizes the first ray prior to toe off. If the first cuneiform sits lower than the cuboid, PL loses its plantarflexion vector (a component of supination) and only pulls laterally.[24] Without correcting the positional faults, strengthening will be useless.

In this case, tape was employed in an attempt to decrease the positional fault of excess rearfoot varus. The theory behind the tape application was to decrease the

**Table 3. Outcomes**

| Evaluation | Discharge |
|---|---|
| Subjective report of right ankle instability and lateral popping | Report of improved ankle stability without tape; 0 incidence of lateral popping |
| Pain rating of 5/10 at rest, 8/10 playing soccer | Pain rating of 0/10 at rest, 3/10 or less playing soccer |
| Able to maintain static single leg stance on the right for 10 seconds, unsupported | Able to maintain right single leg stance on mini-tramp while catching a 5 pound medicine ball thrown outside of patient's cone of stability |
| Pain and limited ability to participate in soccer | Able to return to soccer with in-shoe orthotics |

need for over-pronation through stance to compensate for the excess varus and thereby reduce the potential for repetitive overuse and strain of the peroneals and Achilles. A weakness in this treatment approach was the lack of medial support or posting of the forefoot to attempt to control hypermobility through the midtarsal joint; however, there is the possibility of decreased forefoot varus with improved alignment of calcaneus. One study specific to low-dye taping has theorized that controlling pronation at the calcaneus indirectly reduces pronatory stresses and effects distally in the foot. This may allow tape to act as a comprehensive pronatory control device.[22]

There are several theories behind the effectiveness of tape. The most basic explanation is the mechanical control of joint motion although several studies have questioned the durability of the stabilization provided by taping.[12,17,20,23,34] However, the research demonstrates that there is a continued benefit of taping that remains even after the supportive function is diminished with dynamic activity.[20,23] This suggests that tape may provide afferent stimulation provided by tape application to the skin, leading to enhanced proprioceptive input about the ankle.[12,17,18] The study by Glick et al[20] supports this concept. They found that individuals with increased talar tilt had brief muscle activity of the peroneus brevis (PB) just before heel strike, possibly in an attempt to evert the foot or stabilize the ankle. Taping provided a stimulating effect to PB as it increased the amount of time that muscle was active at the end of swing phase.[20] They also reported that strong peroneals are important for the provision of support at the ankle mortise for injury prevention.[20] In contrast, a study examining the relationship of foot type to lower extremity injury did not find any significant predictive relationship between foot type and ankle sprain, but were able to establish foot alignment as a predisposing factor to knee injuries.[35]

Taping of the foot and ankle may serve as an intermediary and as a good predictor of success with orthotics as they also provide postural support by reducing ankle or subtalar joint motion, maintaining subtalar joint neutral alignment, providing improved tactile sensation on the plantar aspect of the foot, and/or reducing muscular strain about the ankle.[18] Taping is best used as a temporary intervention as orthotics can be customized to the patient, require less time and effort to use (inserting into shoe versus tape application), are less irritating to the skin, and more cost effective over time. Also, several studies have shown that the stability provided by taping only lasts for 10 to 20 minutes at the most once the individual commences any sort of exercise.[17,20,23,34]



The subject of this case report was a 16-year-old female soccer player. While hyperinversion injuries are not exclusive to this population, there may have been other predisposing factors in addition to foot morphology and lower extremity biomechanics. A literature review reported that female soccer players are more prone to lower extremity injury than males, adolescent soccer players are just as likely to sustain injuries as professional players during practice, and that increased level of competition leads to increased risk of injury.[7] Reasons cited for the differences in injury rates among females include fluctuating hormonal levels affecting ligamentous integrity and intensity of play.[7] Additionally, females generally have a wider pelvis than males, predisposing them to a more valgus knee posture and potentially increased pronation through the foot and ankle. The sport of soccer itself also holds substantial injury risk for its players due to the nature of the game. Players wear cleats which are good for traction but do not provide much support of the longitudinal arch or the ankle. The sport revolves around dribbling and kicking a ball while running, cutting, and jumping to evade or block other players who are trying to do the same. This is all done primarily using the feet, increasing the potential for tripping and collisions. Another factor is the condition of the field as any sort of divot in the ground or uneven terrain could also leave a player susceptible to ankle injury.

The primary weakness of this study is the lack of an objective and quantifiable description of the taping technique used or any literature supporting the theory behind the taping technique used. The tape was applied generally to control for rearfoot varus but did not address the specific amount of correction needed in a measurable manner (number of degrees), a possible avenue for future research. In contrast, the techniques for visual analysis and goniometric measurement of the foot and ankle are well-defined in the literature but reliability has been established as poor due to examiner interpretation and calculation.[28,35] In the study by Elveru et al,[28] however, it should be noted that the therapists who were tested were inexperienced in the assessment of subtalar joint neutral and did not use it often in clinical practice. Additionally, a functional scale for the lower extremity or specific to the foot and ankle would have been a simple adjunct to assessment that would have provided measurable outcomes measures and allowed for comparison pre- and postintervention. Lack of discharge range of motion (ROM) measurements could also be considered a weakness of this study although the patient's active ROM was not significantly impaired at the time of the evaluation and was not expected to improve with the taping technique that was utilized.

## CONCLUSION

It appears that the taping technique used to decrease excess rearfoot varus in this patient was a supportive adjunct to physical therapy intervention. Taping was used to decrease repetitive loading of the peroneal and Achilles tendons while the patient was treated with manual therapy and modalities to decrease symptoms of tendinitis. Strengthening for the ankle and continued participation in soccer were able to progress as palliative treatments were reduced without any reoccurrence of pain or limitation. At the 5-month follow-up, the patient reported that she had continued to play soccer for multiple teams with orthotics in her cleats and had not suffered any reoccurrence of ankle injury or limitation of performance.

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and was approved by the Institutional Review Board. Informed consent was obtained from the patient and her mother prior to completion of this case report and submission for publication.

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# The Use of a Clinical Prediction Rule for Diagnosis and Treatment Based Classification System for the Treatment of a Cervical Radiculopathy Patient: A Case Report

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## ABSTRACT

**Background and Purpose:** Currently there is a lack of literature validating interventions for patients with cervical radiculopathy. A new cervical classification system was created to classify and treat cervical pain patients based on their signs and symptoms. The purpose of this case study is to describe the clinical examinations used to help rule-in cervical radiculopathy, and also to look at outcome measures for a patient with cervical radiculopathy receiving matched interventions based on the cervical classification system.

**Case Description:** A 65-year-old female presented with C6 radiculopathy of her left arm which was affecting her ability to perform functional activities such as extending her head, rotating her head to the left, and raising her left arm overhead. Scores on the Neck Disability Index (NDI) showed initial disability with pain intensity, lifting weights, symptoms while driving, and a decrease in ability to work. She also exhibited moderate pain and decreased strength along the C6 distribution. The patient was seen for 13 visits over a 7-week period. Treatment was based on matched interventions from the cervical classification system and included mechanical cervical traction, repeated movements to centralize symptoms, and upper extremity strengthening. The SF-36, NDI, Patient-Specific Functional Scale, Numerical Pain Rating Scale, and C6 myotomal distribution strength were used as outcome measures.

**Outcomes:** The patient's scores on the NPRS, NDI, and PSFS showed a clinically meaningful improvement between visits 1 to 10, a decrease in between visits 10 to 11, and a clinically meaningful improvement between visits 11 to 13.

**Discussion:** It was our belief that the patient's improvements were in large part due to the use of cervical traction. Further research is needed to look at the long-term effectiveness of the neck pain classification system, and if certain anatomical abnormalities may contribute to the lack of improvement in some patients.

**Key Words:**

## INTRODUCTION

Cervical radiculopathy is a dysfunction of a nerve root as it leaves the spinal canal. The incidence of cervical radiculopathy is much less than that of lumbar radiculopathy, occurring at a rate of 2.1 cases per 1,000 people.[1] This condition is most commonly caused by a herniated disc, osteophyte, or thickened soft tissue which may compress the nerve root or spinal cord and lead to upper extremity symptoms.[2] Patients with cervical radiculopathy may exhibit decreased strength in a myotomal pattern, decreased deep tendon reflexes, decreased neck mobility, as well as altered sensation in a dermatomal pattern.[3] The most common characteristics of cervical radiculopathy include: arm pain (99.4%), sensory deficits (85.2%), neck pain (79.7%), reflex deficits (71.2%), motor deficits (68%), scapular pain (52.5%), anterior chest pain (17.8%), and left-sided chest and arm pain (1.3%).[4]

The clinical diagnosis of cervical radiculopathy is made from patient symptoms, clinical findings, results from special tests, and from imaging results. Electrophysiological studies are also used for diagnostic purposes, as these tests can be considered to be the most accurate means of diagnosing cervical radiculopathy.[5] To refine the diagnosis of cervical radiculopathy, Wainner et al has identified a test item cluster which can be used to rule-in the diagnosis. The test item cluster includes an orthopedic special test, neural tension test, distraction test, and cervical rotation.[5]

Physical therapists use a wide array of interventions ranging from cervical postural education, cervical and scapular stabilizing exercises, manual therapy techniques, modalities, and cervical traction to treat patients with cervical radiculopathy.[6,7] Though these interventions are commonly used, they lack evidence for use with this patient population. A study by Joghataei et al looked at the difference in grip strength for C7 radiculopathy patients who did and did not receive cervical traction along with conservative physical therapy. After 5 treatment sessions, the change in grip strength was significantly greater in the experimental group compared to the control group ($p = 0.04$); however both groups exhibited similar outcomes in grip strength after 10 treatment sessions.[7] Though this study shows the short term benefits of using cervical traction, this study only looks at grip strength as an outcome measure. Currently there is a lack of literature looking at outcome measures for cervical radiculopathy patients who receive physical therapy, with or without cervical traction. With a lack of research in this population, the effect of certain interventions and modalities are not known.

Ideally, evidence-based literature will guide our interventions based on the diagnosis. Childs et al developed a system to classify cervical pain patients based on their signs and symptoms. According to this system, therapeutic interventions are determined by the patient's classification group (Appendix A).[8] In a nonrandomized study, subjects who received their matched interventions had greater improvement in Neck Disability Index scores and in pain ratings than subjects receiving nonmatched interventions.[9] Patients with cervical radiculopathy whose symptoms can be centralized are placed into the centralization group. The purpose of this case study is to describe the clinical examinations used to help rule-in cervical radiculopathy, and also to look at outcome measures for a patient

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with cervical radiculopathy receiving matched interventions based on the neck classification system.

## CASE DESCRIPTION

### History

The patient is a 65-year-old part-time personal trainer, who was referred to physical therapy by a physician with a medical diagnosis of cervical radiculopathy. She states that one evening while helping her husband push hay at her ranch, she injured her neck. The next day she began to have neck pain accompanied with "awkward" sensations going down her left arm. The patient described the sensation as tingling going from her neck towards her thumb and index finger, with occasional minimal pain. The patient waited 3 months to seek medical attention because she was "too busy traveling and working." She decided to seek medical attention when her left arm pain increased, and was accompanied by left scapular pain. Her physician gave her a corticosteroid injection in the left upper quadrant, as well as a prescription of Flexeril. The injection and medication helped alleviate the symptoms temporarily, but they returned shortly thereafter. The physician also ordered an MRI of the cervical spine, the results were not known at the time of the initial evaluation. Three days after the initial evaluation, the MRI results were obtained that showed a small extruded disc herniation on the left at C5-6, left spondylotic protrusion, and mild foraminal narrowing on the left at this level. On the day of her initial evaluation she stated she had neck and arm pain, persistent left arm achy sensation, and occasional "worms crawling on skin" sensation. During her explanation of the altered sensation in her left arm, she would continually describe and point along the C6 dermatomal pattern. As a result of her injury she was not able to help her husband manage the ranch, lift weights with her upper extremities, and train clients. Her goals for therapy were to perform these activities, and to decrease her overall symptoms.

### Examination

Using the Numeric Pain Rating Scale (NPRS) we asked the patient to state her current pain level, and the best and worst pain levels she had experienced during the previous 24 hours. Her current and best pain was 3/10, and her worst pain was 6/10. In a seated position the patient exhibited left sided rounded shoulders and increased height of the left shoulder compared to the right. The patient exhibited increased muscle tone in her bilateral suboccipitals, left trapezius, left levator scapulae, and left pectoralis major and minor. She also exhibited tenderness in the left scapular region. Her muscle tightness was based on clinical experience and compared against the other side. Range of motion (ROM) of the neck was measured with the patient in a seated position using an inclinometer, except for rotation which was measured by a standard long-arm goiniometer. All directions were pain free except left lateral flexion, left rotation, and extension; these particular motions reproduced the "worms crawling on her skin" sensation. Cervical ROM for flexion was 63º, extension 60º, right lateral flexion 25º, left lateral flexion 33º, right rotation 50º, and left rotation 65º. The patient's biceps (C5-6), triceps (C6-7), and flexor carpi radialis (C7-8) reflexes were intact and equal bilaterally. Light touch was examined along a dermatomal distribution with her eyes closed. The patient was asked to describe where she was being touched as well as describe if there was a difference in sensation from one side to the other, no difference was observed between sides. Manual muscle testing of the neck and upper extremities was also performed. The rationale behind testing strength in the upper extremities was to observe a difference from side to side, and also determine if there was a strength deficit along a myotomal pattern. The elbow flexors and wrist extensors were a 4/5 on the left and a 5/5 on the right, which corresponds with the C6 nerve distribution.

To diagnose cervical radiculopathy the following item cluster of special tests were performed: Upper Limb Tension Test A (K= 0.35), Spurling's Test A (K= 0.61-0.71), distraction test (K= 0.50), and involved cervical rotation less than 60º.[5] When all 4 tests are positive the diagnosis of cervical radiculopathy has a high probability with a positive Log-likelihood ratio (LLR) of 30.3. When 3 out of 4 tests are positive, the positive LLR is 6.1.[8] The description of each examination and the patient's reaction are described in Table 1. She had a positive response on 3 out of the 4 tests. Based on the test item cluster the diagnosis of cervical radiculopathy had a specificity of 94%, a pretest probability of 23%, a posttest probability of 65%, and a positive LLR of 6.1.[5]

**Table 1. Special Test Item Cluster**

| Test | Description | Patient Reaction |
|---|---|---|
| Spurling's Test A | Patient is sitting, the examiner laterally flexes and rotates the neck slightly, then applies a compressive force of ≈7kg. A positive test will reproduce the symptoms. | Positive |
| Upper Limb Tension Test A | Patient is supine, the examiner depresses the scapula, abducts the shoulder abduction, supinates the forearm, extends the wrist and fingers, laterally rotates the shoulder, extends the elbow, then performs contralateral and ipsilateral side-bending of the neck. Contralateral side-bending should increase the symptoms while ipsilateral side-bending will decrease the patient's symptoms | Positive |
| Distraction Test | Patient is supine, the examiner then proceeds to grasp the patient's head under the occiput and chin. The examiner then flexes the patient's head and proceeds to apply an axial traction force up to ~14kg. A positive test reduces or eliminates the symptoms. | Positive |
| Less than 60º of rotation to the involved side | Patient is seated, the patient rotates her head while looking forward, the neck in a neutral position. The subject is asked to rotate as far as possible; the measurement is taken with a universal goiniometer. A positive test is less than 60º of rotation to the involved side | Negative |

Finally, during the examination the patient was asked to perform repeated chin retractions to see if her symptoms would centralize. According to this classification system, the hallmark finding for patients in the centralization group is their ability to centralize their symptoms. After 12 repeated chin retractions, the patient's symptoms centralized from her left hand to her shoulder. Several special tests were also performed to rule-in or rule-out other possible diagnoses which include thoracic outlet syndrome and carpel tunnel syndrome. All of the tests performed for these diagnoses were negative (Table 2).

The 36-Item Short Form Health Survey Questionnaire (SF-36), Neck Disability Index (NDI), Patient-Specific Functional Scale (PSFS), Numerical Pain Rating Scale (NPRS), and C6 myotomal distribution strength were used as outcome measures. These measures were administered during therapy sessions 1, 5, 10, 11, and 13 (Table 3).

## Diagnosis

Based on the patient's description of her symptoms, as well as the positive findings during the examination, she was classified into the centralization group. As a result of her diagnosis, she was placed in the impaired motor function, peripheral nerve integrity, and sensory integrity associated with nonprogressive disorders of the spinal cord practice pattern from the *Guide to Physical Therapist Practice.*

## Prognosis

Cervical radiculopathy varies in prognosis depending on the nature of the injury with up to 75% of individuals having spontaneous improvements.[10] Previous studies have shown that an active treatment approach is more beneficial than a passive treatment approach when treating cervical radiculopathy patients. Based on previous clinical experience with similar patients, it was expected that the patient would require 4 to 6 weeks of treatment with 3 sessions per week to decrease her symptoms and achieve her goal.

## Intervention

The patient was seen for 13 visits over a 7-week period. The interventions were matched based on the classification system which included mechanical cervical traction and repeated movements to centralize the symptoms. Based on the patients's symptoms and goals, soft tissue work, stretching, and strengthening were also incorporated into her therapy sessions (Table 4). Soft tissue massage was not incorporated into each treatment session, but was used as needed based on her symptoms to improve mobility of her neck. After the initial evaluation, soft tissue massage was performed on the left upper quadrant to help decrease tissue tension. The patient was educated on how to properly perform chin retractions, so she could perform them at home when the symptoms became bothersome. Chin retractions have been shown to increase H-reflex amplitudes, decreased H-reflex is indicative of a compressed nerve. This change has been shown to decrease the patient's radicular symptoms on a visual analog scale.[11] To perform the chin retractions, she was told to find a neutral cervical spine position while seated and then nod her neck similar to forming a double chin. Manual

**Table 2. Differential Diagnosis Special Tests**

| Test | Description | Patient Reaction |
|---|---|---|
| Adson's Test | Patient is seated, with arm extended. The therapist finds the radial pulse. The head is turned to face the tested shoulder and extended, the patient is then asked to take a breath and hold it. Positive results is an absence of pulse and should reproduce symptoms. | Negative |
| Wright's Test | Patient is seated, with arm extended. The therapist finds the radial pulse. The symptomatic arm is then abducted maximally. Compare pulse with the arm by the side and in abducted position. A positive test is an observable decrease in pulse with arm in abducted position and should reproduce symptoms. | Negative |
| Tinnel's Test | Patient is seated with arm supinated. Examiner then taps over the median nerve at the wrist crease. Positive test produces parasthesia in the hand. | Negative |
| Phalen's Test | The patient is seated with her elbows resting on a table. The wrists are then flexed simultaneously, allowing complete volar flexion for 1 minute. Positive test produces parasthesia in the hand. | Negative |

**Table 3. Outcomes**

| | Visit 1 | Visit 5 | Visit 10 (2/11) | Visit 11 (2/26) | Visit 13 |
|---|---|---|---|---|---|
| Current pain level | 3/10 | 1/10* | 0/10 | 3/10 | 0/10* |
| Best pain level | 3/10 | 0/10* | 0/10 | 3/10 | 0/10* |
| Worst pain level | 6/10 | 5/10 | 1/10* | 5/10 | 2/10* |
| Biceps strength | 4/5 | 4+/5 | 5/5 | 5/5 | 5/5 |
| Wrist extensor strength | 4/5 | 4+/5 | 5/5 | 5/5 | 5/5 |
| NDI | 40% | 26%* | 14% | 36% | 12%* |
| PSFS | 2.33 | 6.16* | 8.5* | 7 | 9* |
| SF-36: Limitations due to Physical Health | 0 | 0 | 75 | 0 | 75 |
| SF-36: Limitations due to Pain | 32 | 45 | 77 | 45 | 77 |
| SF-36: Physical Functioning | 75 | 75 | 90 | 80 | 90 |

* Based on previous research, these values represent a clinically meaningful change
- NDI: Neck Disability Index
- PSFS: Patient Specific Functional Scale
- SF-36: 36-Item Short Form Health Survey Questionnaire

**Table 4. Interventions**

| | Visit 2 | Visit 3 | Visit 4 | Visit 5 | Visit 6 | Visit 7 | Visit 8 | Visit 9 | Visit 10 | Visit 11 | Visit 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Soft tissue massage | Yes | Yes | No | No | Yes | Yes | No | No | No | Yes | Yes |
| Cervical retraction | 15 reps | 15 reps | 15 reps | 15 reps | 15 reps | 15 reps | * | * | * | 15 reps | 15 reps |
| Stretches | 1' each | 1' each | 1' each | 1' each | 1' each | * | * | * | * | Yes | Yes |
| Rows | 2 sets 12 reps Yellow | 2 sets 15 reps Yellow | 2 sets 15 reps Yellow | 2 sets 10 reps Red | 3 sets 10 reps Red | 3 sets 12 reps Red | 3 sets 15 reps Red | 2 sets 10 reps Green | 3 sets 12 reps Green | 3 sets 12 reps Green | 3 sets 15 reps Green |
| Lat pull-downs | 2 sets 12 reps Yellow | 2 sets 15 reps Yellow | 2 sets 15 reps Yellow | 2 sets 10 reps Red | 3 sets 10 reps Red | 3 sets 12 reps Red | 3 sets 15 reps Red | 2 sets 10 reps Green | 3 sets 12 reps Green | 3 sets 12 reps Green | 3 sets 15 reps Green |
| Horizontal abduction | 2 sets 12 reps Yellow | 2 sets 15 reps Yellow low | 2 sets 15 reps Yellow | 2 sets 10 reps Red | 3 sets 10 reps Red | 3 sets 12 reps Red | 3 sets 15 reps Red | 3 sets 15 reps Red | 2 sets 10 reps Green | 2 sets 10 reps Green | 3 sets 10 reps Green |
| 2 new exercises for home | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No | No |
| Mechanical traction | 12 lb 15' | 12 lb 15' | 14 lb 16' | 16 lb 17' | 18 lb 18' | 20 lb 18' | 20 lb 20' | 20 lb 20' | 20 lb 20' | 20 lb 20' | 20 lb 20' |

* Discontinued during therapy and performed at home
- Colors denote resistance of Theraband

cervical distraction was also performed for 2 minutes to see if the patient had any adverse reactions; none were observed. Finally the patient was placed on mechanical traction for 15 minutes (Saunders Cervical Device, PT Clinic Inc, Shoreview, MN). The mechanical traction unit force was set on 12 lbs, an intermittent setting with an on/off cycle time of 20 seconds/10 seconds. The cervical spine was placed in 22º of flexion during manual traction. Since no definitive parameters for the use of cervical traction exist, the parameters were based on our educational knowledge, as well as our combined clinical experience. The angle of traction was based on the angle which provided relief of her symptoms during the distraction test. The mechanical traction unit force was eventually increased to 20 lbs, as this provided the patient with a relief in symptoms and did not cause discomfort during the axial distraction. The time was also increased to 20 minutes in small increments.

During the second visit, the patient was instructed to perform stretches to decrease some of the tissue tension. For her upper trapezius she was taught to laterally flex her neck to the side, and not allow her shoulders to shrug up or allow her head to rotate when performing the stretch. At the beginning of therapy, only her left upper trapezius was stretched, secondary to pain when stretching her right trapezius. During the fifth therapy session, she began to stretch her right upper trapezius without any pain or symptoms. The patient's upper back was stretched by having her grasp onto an immovable object in front of her while standing; she was then instructed to lean back while holding on with her hands. This allowed her scapulas to protract. Both of these stretches were performed for 1 minute each. The patient was instructed to perform these stretches twice a day on nonclinic days. Once she was able to perform these stretches in the clinic without any verbal cueing, they were eliminated from therapy. The patient was also educated on how to perform strengthening exercises at her house using her own exercise equipment. These exercises included seated latissimus pull downs, seated rows, and seated horizontal abduction. In the clinic she performed these exercises with resistive Thera-Band® (The Hygenic Corporation, Akron, OH). The resistance and repetitions were progressed based on the ease of performing these exercises. These exercises were incorporated to help improve her scapulothoracic muscle strength in order to improve her general posture. The patient was instructed to perform 2 sets of 12 to 15 repetitions once per day at home between therapy sessions.

The other therapy sessions were similar to the second visit, as described in Table 4. Once the patient's symptoms began to decrease and subside new exercises were introduced to help her achieve her goal of working out her upper extremity. From visits 4 through 10 she was given 2 new resistance exercises each visit that could be performed independently at home using her resistance equipment. The patient was educated on how to perform exercises that focused on muscle groups such as biceps, triceps, deltoids, pectorals, middle trapezius, lower trapezius, and core stabilizing muscles. Given her background as a personal trainer, she was able to learn the exercises with minimal to no verbal cuing with proper form. Exercises that were given to her to perform at home did not reproduce any of symptoms while in the clinic. She was instructed to only perform the new exercises introduced during the therapy session. The patient was also asked to document if any of the exercises caused any discomfort or reproduced the symptoms when she performed them at her house. If any of the exercises reproduced the symptoms at home, she was asked to perform the exercise in the clinic and was then given cuing on how she performed it incorrectly. The importance of keeping her neck in a neutral position and avoid exercises that reproduced her symptoms was stressed to her during each visit.

Based on the patient's progression and lack of symptoms, she was placed on an independent home exercise program after the tenth visit to see whether her symptoms would return without treatment. Therapy session number 11 was a reevaluation after the patient was absent from therapy for 2 weeks. Her symptoms returned and were the same as those during visit 1. The patient was still able to centralize the symptoms with repeated cervical retractions, but the symptoms would return within hours. She could not pick an event which caused a return in the symptoms, but stated they gradually returned. After discussing with the patient, we believed that a home cervical traction unit would benefit the patient since this seemed to be the single variable that was absent over the previous 2 weeks. During visit 12 the patient was given instructions on setting up and using the home cervical traction unit (Saunders Cervical Hometrac Deluxe, PT Clinic Inc, Shoreview, MN). Once she was able to demonstrate proper set up and use of the home unit, the session ended. The patient was told to use the cervical traction unit every other day. Two weeks later the patient came in for a follow-up, visit 13, in which her symptoms had drastically decreased and she was discharged.

### Outcomes

Strength of the impaired cervical level, scores of the NDI, PSFS, and SF-36, and current, best, and worst pain intensity levels were documented on visits 1, 5, 10, 11, and 13 (Table 3). Using the NPRS, we asked the patient to state her current pain level during the examination, and the best and worst pain levels she had experienced during the previous 24 hours. The NPRS is a subjective way for the patient to quantify her pain. The scale is based on a 0 to 10 scale, with 0 representing no pain at all, and 10 representing the worst pain imaginable.

Pain intensity was compared from one visit to another to determine if the patient improved, a reduction of 2 points is indicative of a clinically important change.[12] The patient's current and best pain decreased by 3 points (from 3 to 0) from visits 1 to 10, but her pain returned to a 3/10 on visit 11 after her 2 weeks of independent self management at home. Her current and best pain once again decreased by 3 points (from 3 to 0) from visit 11 to 13 after she began using the home cervical traction unit. Her final current and best pain scores differed by 3 points from the initial scores during visit 1 (from 3 to 0). Her worst pain decreased by 5 points (from 6 to 1) from visits 1 to 10, but returned to a 5/10 on visit 11. Once she was given a home cervical traction unit, her worst pain intensity decreased by 3 points (from 5 to 2) from visit 11 to 13. Her final worst pain differed by 4 points (from 6 to 2) from visit 1 to visit 13. Based on the change criterion for the NPRS, all these differences in pain intensity appear to be clinically meaningful.

The NDI contains 10 items, 7 related to activities of daily living, 2 related to pain, and 1 related to concentration. Each item is scored on a 0 to 5 scale, all the items are then totaled and expressed as a percentage, the higher the percentage the greater the disability. The NDI has been shown to have moderate test-retest reliability (ICC=0.68) and moderate construct validity (r = 0.19) when correlated with the Global Rating of Change scale.[13] For the NDI, the minimum clinically meaningful change for patients with cervical radiculopathy is 14% (13). The patient's NDI score decreased by 26% (from 40% to 14%) between visit 1 and visit 10, her NDI score increased to 36% on visit 11 following her 2 weeks of independent self management. Once she began using her home cervical traction unit, her score decreased by 24% (from 36% to 12%) between visit 11 and visit 13. The difference in her final NDI score between visit 1 and visit 13 was 28% (from 40% to 12%). Based on the change criterion for the NDI, all these differences appear to be clinically meaningful.

The PSFS is a form that uses at least 3 activities which are difficult or are unable to perform secondary to the injury. Each activity is then scored on a 0 to 10 scale, 0 being unable to perform the activity, and 10 is being able to perform the activity at the same level as before injury or problem. All the scores are then taken and averaged together. The 3 activities she chose were lifting weights with her upper extremity, unloading the dishwasher, and drying her hair. The PSFS has been shown to have good test-retest reliability (ICC=0.82) and good construct validity (r = 0.82) when correlated with the Global Rating of Change scale.[13] For the PSFS the minimum clinically meaningful change for patients with cervical radiculopathy is reported as 2 points.[10] The patient's PSFS score increased by 6.77 (from 2.33 to 8.5) points between visit 1 and visit 10, her score declined to an 8 on visit 11. Once she began using her home cervical traction unit, her score improved by a point 1 (from 8 to 9) from visit 11 to visit 13. The difference in her final PSFS score between visits 1 to visit 13 was 6.67 (from 2.33 to 9). Based on the change criterion for the PSFS, the difference in scores between visits 1 to 5, 5 to 10, and 11 to 13 were all likely to be clinically meaningful.

The SF-36 is a health questionnaire which has 8 categories that look at how the patient's physical and mental health are affected, with a score of 0 representing severe limitations and 100 representing no limitations. The SF-36 has been shown to have high reliability (ICC 0.94) and high discriminant validity (r = 0.92).[14] The patient's scores improved in 3 areas of the SF-36, between visit 1 and visit 13. SF-36 scores for psychological well-being, general health, and social functioning were not used as outcomes since they were not problematic on initial evaluation. No minimal detectable change has been established for this outcome measure, though a population standard deviation of 10 has been reported and can be used for such purposes.[14] Her limitations due to physical health improved by 75 (from 0 to 75) between visits 1 and 13, limitations due to pain improved by 45 (from 32 to 77), and physical functioning improved by 15 (from 75 to 90). Similar to the other outcome measures, the patient's scores worsened between visit 10 and visit 11, and then improved between visit 11 and visit 13. Direct implications about clinical meaningfulness can not be taken from changes in the SF-36, but the difference scores greater than 10 indicate improvements were likely not due to chance.

The patient's strength steadily improved from a 4/5 on visit 1 to a 4+/5 on visit 5, and eventually reached a 5/5 on visit 11 and 13. Her final bicep and wrist extensor strength of her left arm was equivalent to that of her right arm, a 5/5 on visit 13. Manual muscle testing was administered solely by the author during the specified treatment sessions so was not applied in a blinded fashion. Currently there is a lack of evidence on what changes in manual muscle testing correspond to a meaningful clinical change.

## DISCUSSION

The purpose of this case report was to describe the outcome measures for a cervical

radiculopathy patient who was diagnosed using the item cluster and treatment based classification for neck patients. During the initial evaluation, the patient had a positive response to 3 of the 4 tests, in the item cluster described by Wainner et al.[5] These test results were further validated by the results of the MRI, which showed a small extruded disc herniation on the left at C5-6, left spondylotic protrusion, and mild foraminal narrowing on the left at this level. Collectively, these results were indicative of spinal compression which may be causing the radicular nerve root symptoms. The diagnosis of cervical radiculopathy was then used to match the patient into the centralization group. The interventions that were matched for centralization patients are based on research evidence, clinical experience, and expert opinion.[8] These matched interventions were studied in a preliminary examination research report, which found that the use of matched interventions leads to a greater improvement in NDI and in the NPRS scores compared to patients who received nonmatched interventions.[9]

The patient showed improvements in all her outcome measures from visit 1 to visit 10. Based on her progression, it was our decision to follow-up with her in 2 weeks before discharging her. If she was able to maintain her improved status visit 10 outcomes with an independent home program, we would precede with a discharge on visit 11. On visit 11 her initial symptoms from the initial examination returned. She stated that she was performing her daily exercises at home, and began to notice the return of her symptoms gradually. The patient could still centralize her symptoms, but the symptoms would reappear within an hour. Our next course of action was to decrease her symptoms and prescribe a cervical home traction unit. Since she was very independent with her home exercise program, it was our belief that the 1 variable absent during the last 2 weeks was traction. On visit 12, she was educated on use of the home traction unit. Visit 13 was 2 weeks after she began the use of her home traction unit. The patient was instructed to call the clinic if her symptoms reappeared and needed immediate treatment. On visit 13, her symptoms once again decreased (Table 3) and she was discharged. During the discharge visit, she discussed with us the possibility of seeking surgery as an alternative, since she believed that traction was only temporarily masking the symptoms.

It is important to know that the patient was a highly motivated and active individual who did not allow her condition to control her life. An example of this was between visit 5 and visit 6, the patient's symptoms had returned. During the treatment we observed that her left upper quadrant displayed increased muscle tone in comparison to her right side. This was surprising to us since she was progressing so well. Upon discussing this with her, she stated that she helped her husband round up the cattle on her ranch. This is just one of many activities she was performing throughout the therapy sessions, which may have increased her symptoms. Though we do not believe that the patient should be inactive to prevent any provocation of her symptoms, we did stress the importance of not performing physically challenging activities. It was our opinion that during these activities she must have been placing her neck in a compressive position, thus leading to an exacerbation of her condition. However, the patient's determination to participate in normal activities and not allow her injury to dictate her daily activities may have led to some of her improved outcomes. Some studies for treatment of low back pain patients have found that patients who receive physical therapy and also resume their normal daily activities have better outcomes than patients who do not stay active through their treatment.[15] Currently there are no similar studies in regards to cervical radiculopathy patients.

It was our belief that mechanical cervical traction was the variable that seemed to improve the patient's symptoms. We came to this conclusion based on the decline in her status after visit 10, as well as the improvement seen from visit 12 to visit 13 once the use of the home mechanical traction unit began. Currently there is a lack of evidence which solely looks at the use of mechanical traction with cervical radiculopathy patient. One intervention which we did not perform that may have benefited her was thoracic spine manipulation. Thoracic spine manipulations have been shown to benefit patients with neck pain and decreased cervical range of motion.[6] We decided to just use the matched interventions to begin treatment, and would alter our therapy sessions according to her response to treatment. Based on her positive progression, we never had reason to use thoracic spine manipulation. We decided to perform 2 follow-up visits (visit 11 and 13) with her to see if her symptoms were still improved. We believe that the reason she regressed between treatment sessions may be secondary to the spondylotic protrusion compressing the nerve root at the level of C5-6. The patient's noncompliance in regards to avoiding strenuous physical may have been another contributing factor in her regression. With a boney protrusion compressing the nerve, there is no way to completely eliminate her symptoms and use of continued traction may be appropriate in this case, despite the lack of definitive evidence. Although no cause and effect relationship can be taken from a case study, it was our belief that the patient's improvements were in large part due to the use of cervical traction. We based our opinion on the fact that the patient improved initially with the use of cervical traction, worsened without the use of traction, and improved once again when cervical traction was reintroduced.

Further research is needed to determine the effectiveness of the treatment based classification system and its matched interventions on cervical radiculopathy patients and outcome measures including the NPRS and PSFS. The author proposes a randomized control trial that collects follow up outcome measure data 6 months following discharge from patients who receive and did not receive matched interventions based on the treatment based classifications system for neck pain, to determine what percentage of these patients did not improve in both group. The patients who did not improve should have an MRI performed to determine whether certain anatomical abnormalities, such as osteophytes or foraminal narrowing may be a common factor.

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## Appendix A. Treatment Based Classification System for Neck Pain[8]

| Classification | Examination Findings | Proposed Matched Interventions |
|---|---|---|
| Mobility | - Recent onset of symptoms<br>- No radicular/referred symptoms in the upper quarter<br>- Restricted ROM with side-side rotation and/or discrepancy in lateral flexion ROM<br>- No signs of nerve root compression or peripheralization of symptoms in the upper quadrant with cervical ROM | - Cervical and thoracic spine mobilization/ manipulation<br>- Active ROM exercises |
| Centralization | - Radicular/referred symptoms in the upper quarter<br>- Peripheralization and/or centralization of symptoms with ROM<br>- Signs of nerve root compression<br>- May have pathoanatomic diagnosis of cervical radiculopathy | - Mechanical/manual cervical traction<br>- Repeated movements to centralize symptoms |
| Conditioning and increase exercise tolerance | - Lower pain and disability scores<br>- Longer duration of symptoms<br>- No signs of nerve root compression<br>- No peripheralization/centralization during ROM | - Strengthening and endurance for the muscles of neck and upper quadrant<br>- Aerobic conditioning exercises |
| Pain control | - High pain and disability scores<br>- Very recent onset of symptoms<br>- Symptoms precipitated by trauma<br>- Referred or radiating symptoms extending into the upper quarter<br>- Poor tolerance for examination or most interventions | - Gentle active ROM within pain tolerance<br>- ROM exercises for adjacent regions<br>- Physical modalities as needed<br>- Activity modification to control pain |
| Reduce headache | - Unilateral headache with onset preceded by neck pain<br>- Headache pain triggered by neck movement or positions<br>- Headache pain elicited by pressure on posterior neck | - Cervical spine manipulation/ mobilization<br>- Strengthening of neck and upper quarter muscles<br>- Postural education |
| ROM= Range of motion | | |

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# Treatment of Cervicogenic Headaches Using Mulligan "SNAGS" and Postural Reeducation: A Case Report

C. Jason Richardson, PT, DPT, OCS[1]


## ABSTRACT

**Background and Purpose:** Cervicogenic headaches are a neck-generated headache syndrome that stems from upper cervical dysfunction. These types of headaches cause an array of functional impairments and are commonly seen in the outpatient physical therapy setting. The purpose of this case report is to report the effects of using Mulligan's headache SNAGs and postural reeducation on an individual with cervicogenic headaches.

**Case Description:** The patient is a 29-year-old white female with a primary complaint of left-sided suboccipital headaches with associated complaints of neck stiffness and pressure behind the left eye. The patient's headache intensity was assessed daily using the visual analog scale and weekly using the Headache Rating System described by J. Edeling.

**Outcomes:** Upon discharge, this patient was headache free and full cervical active range of motion was achieved in all planes.

**Discussion:** Physical therapists have many options to treat cervicogenic headaches. The most effective for this patient seemed to be the use of headache SNAGs and postural reeducation.


**Key Words:** cervicogenic headaches, manual therapy, mobilization with movement, postural reeducation

## INTRODUCTION

Chronic headaches are a common complaint from patients in the outpatient physical therapy setting. They are sometimes the primary complaint or a secondary complaint contributing to the inability of a patient to function optimally due to neck stiffness, limited cervical active range of motion, and pain into various parts of the head and behind the eyes.[1-4] Physical therapists treat headaches with cervical facet joint mobilization, cervical manipulation, soft tissue release or massage, postural reeducation, therapeutic exercise, and cervical traction.[3,5-10] Migraines, tension-type headaches, and cervicogenic headaches are the most common forms of recurrent and chronic headaches.[5,11-13]

Cervicogenic headache (CGH) is a neck-generated headache syndrome. The World Cervicogenic Headache Society defines cervicogenic headaches as "referred pain perceived in any part of the head caused by a primary nociceptive source in the musculoskeletal tissues innervated by cervical nerves."[14,15] Cervicogenic headache represent approximately 15% to 20% of patients seen with chronic headaches. These individuals tend to be female (4:1 ratio female to male) with a mean age of 42.9 years.[11] Specific criteria for diagnosis of CGH have been established by the International Headache Society (IHS). These criteria are presented in Figure 1 and must be met to have a diagnosis of CGH.[2,14,16,17]

According to Sjaastad, the most important differentiating variables when recognizing a CGH are the site of radiation of the pain to the temporal region, and the trigger of attacks from sustained neck posture, movements, and/or pain triggered by digital pressure on the upper neck.[4,12]

## SYMPTOMS

Typical symptoms and pain descriptors of CGH sufferers are: boring, burning, throbbing, feeling of pressure, pounding, nausea, sinus congestion, visual disturbances, and auditory disturbances.[1,18] Cervicogenic headaches can be present at the time one wakes, or they can begin or worsen as the day goes on, usually with sustained neck postures. These types of headaches can begin at any age, but the frequency and intensity may increase with time or with neck trauma.[9,14,18] Other potential aggravating factors include: postural abnormalities, physical exertion, stress, smoking, and alcohol.[1] Individuals with CGH tend to complain of pain in the head which is unilateral into the frontal, temporal, and/or occipital area.[2,14,18] Cervicogenic headache sufferers often describe 2 to 3 episodes per week lasting hours to days.[3,4] Complaints from individuals with CGH may vary to some degree in terms of location, intensity, frequency, triggers, and can have migrainous features to accompany the findings.[8,11,14]

## NEUROANATOMY

The neuroanatomical basis of cervical headaches is due to the convergence of

**International Headache Society Criteria for the diagnosis of cervicogenic headaches.**
**All must be met for the diagnosis of CGH.**

A. Pain is localized to the neck and occipital region and may project to forehead, orbital region, temples, vertex, and ears

B. Pain is precipitated or aggravated by special neck movements or sustained neck posture

C. At least one of the following:
1. Resistance to or limitation of passive neck movements
2. Changes in neck muscle contour, texture, tone or response to active and passive stretching and contraction
3. Abnormal tenderness of neck muscles

D. Radiological exam reveals at least 1 of the following:
1. Movement abnormalities in flexion/extension
2. Abnormal posture
3. Fractures, congenital abnormalities, bone tumors, rheumatoid arthritis, or other distinct pathology except spondylosis and osteochondrosis

**Figure 1. International Society Criteria for the diagnosis of cervicogenic headaches.**

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trigeminal and cervical afferents in the trigeminocervical nucleus.[1,19] Noxious stimulation of joints and ligaments of the upper 3 cervical segments, the associated anterior and posterior muscles, the sternocleidomastoid and trapezius, the vertebral artery, and the dura mater of the posterior cranial fossa have produced referred pain to the head.[19,20]

Several in vivo studies indicate that stimulation via saline injection, or electrical stimulation of various cervical muscles, periosteum around occipital condyles, paramedian tissues at the suboccipital level, the upper 4 cervical interspinous spaces, and the C3 dosal ramus have evoked referred pain to the head.[19-21] For example, Cyriax demonstrated that stimulation of the posterior neck muscles with saline would produce referred pain to the forehead and or vertex.[20,21] Kerr and Bogduk et al illustrated that electrical stimulation of C1 dorsal root and C3 dorsal ramus have produced pain in the orbit, frontal region vertex, occiput, and mastoid region.[19,20] These clinical experiments clearly support the growing body of research that support that dysfunction in the upper cervical region contribute to headaches.

## PHYSICAL THERAPY TREATMENT

Headaches arising from neck disorders are common and may include: trigger points/muscle dysfunction, zygapophyseal/cervical facet joint dysfunction, and cervical spondylosis. Conservative therapies, including physical therapy, are often recommended as the first treatment of choice.[1,3,6-9,14,18,22] Evidence of the effectiveness of cervical joint mobilization/manipulation, soft tissue release/massage, and exercise is mounting to support the use of these treatment techniques when treating CGH.[2,5,6-9,17] There is no study that has investigated the effect of using Brian Mulligan's Sustained Natural Apophyseal Glides "SNAGS" and exercises for postural reeducation to treat CGH.

Manual therapy techniques described by Brian Mulligan are predicated on the same basic principles described by Freddie Kaltenborn, Geoffery Maitland, Stanley Paris, R. A. McKenzie, and others, in that the primary goal with joint mobilization and manipulation is to aid in reestablishing joint range of motion, reduce muscle guarding, and pain. Mulligan also shares the principle that the joint mobilization force are always applied at right angles or parallel to the treatment planes of the facet joints. The variable that is unique with the manual therapy techniques Brian Mulligan describes is that the mobilizations of nearly all his techniques are performed with the patient weight bearing and with active or passive physiologic motion.[26]

Mulligan describes the use of headache SNAGs and reverse headache SNAGs to treat patients suffering from headaches. Mulligan assumes, "if a headache stops with a manual technique involving the upper cervical spine, then this must be diagnostically significant as to the site of the lesion causing the problem and the fact that there is a mechanical component."[26] Mulligan hypothesizes that the SNAG techniques are effective at restoring gliding malfunctions of the facets and/or may correct a slight positional shift of the vertebrae which allows for restoration of normal joint function.[23-26] It is also hypothesized that Mulligan's SNAGs, and MWMs assist in restoring joint memory, and influences the motor control system to restore normal joint function.[23,25,26]

A literature review by the author revealed articles studying the effects of Brian Mulligan's SNAGs and mobilizations with movement (MWMs) techniques for treating tennis elbow, lateral ankle pain, and low back pain.[23-25] However, no studies were found investigating the effects of Mulligan's headache SNAGs on the treatment of cervicogenic headaches.

The purpose of this case report is to report the effects of using headache SNAGs, reverse SNAGs, and postural reeducation based exercise on an individual with CGH.

## CASE DESCRIPTION

The patient is a 29-year-old white female with a primary complaint of left sided suboccipital headaches with complaints of neck stiffness and pressure behind the left eye. This patient was referred by her orthodontist who was treating her for temporomandibular joint (TMJ) syndrome. This patient worked as a marketing manager where she reported 50% of her work day requiring her to sit at a desk working on her computer and 50% driving and making calls to clients.

### History

### Subjective

The patient presented to physical therapy with the chief complaint of constant deep throbbing pain from the left side of her neck into the back of her head with exacerbations of increased intensity 3 to 4 times per week with a duration that was variable. She reported when the exacerbations were at the worst they could last 6 to 8 hours and impact her ability to rest comfortably. She complained of occasional pressure behind the left eye, pressure in the left side of her face, and dizziness when her symptoms were at their worst. She complained of occasional nausea but no vomiting.

A Headache Rating System described by J. Edeling in the *Manual Therapy for Chronic Headache* and The Visual Analog Scale were used to establish the patient's headache intensity baseline.[18] The headache rating system score is determined by the patient rating his/her headache symptoms based on frequency, intensity, and response to medication with a 1 to 5 score for each category (Figure 2).[18] This score can be assessed on a weekly basis. A headache rating score of 15/15 is the most severe and a headache rating score of 3/15 is the least severe. It is suggested by Edeling that a 3 point change in the headache rating score is needed to illustrate significant change.[18] The patient rated her pain on the initial exam at a 9/10 on the visual analog scale and a headache rating system score of 12/15. She

| Headache Frequency | Headache Intensity | Headache Response to Medication |
|---|---|---|
| 1) Less than 1x/week | 1) Low | 1) Complete decrease in intensity |
| 2)1x per week | 2) Low-moderate | 2) Strong decrease in intensity |
| 3) 2-4x per week | 3) Moderate | 3) Moderate decrease in intensity |
| 4) Daily but intermittent | 4) Moderate-severe | 4) Mild decrease in intensity |
| 5) Constant | 5) Severe | 5) No decrease in intensity |
| Each number is added up from each of the three columns to get the headache score. 15/15 is the most severe, 3/15 is the least severe. | | |

**Figure 2. Headache rating scale.**

recalled occasional clicking into her TMJ, but denied pain with chewing or end range of open mouth. The patient reported that the headache intensity and frequency has been getting worse for the last 6 months without any specific trauma, or change in activity or lifestyle which could have precipitated the symptoms. She reports stress, driving long periods in the car, working greater than 2 hours on the computer, and bright lights aggravate the intensity of the headaches and can trigger their worsening. She reported that she was unsure what gave her relief once an exacerbation occurred.

### Past history and interventions

The patient reported insidious onset of symptoms approximately 6 months ago with her symptoms progressively getting worse since the onset. She was initially treated by her family physician with Zoloft, Ativan, and Maxall for 8 weeks with minimal to no subjective improvements. She was referred to a neurologist who did a trigger point injection in the left suboccipital region which she reported made her symptoms worse. An MRI of her brain and neck were unremarkable.

A friend advised her to see a chiropractor, so she underwent 4 treatments. She reported that the symptoms seemed to improve initially, but then became more intense and more frequent so she stopped going. She later reported being referred to an orthodontist by her dentist with the thought that her symptoms could be coming from her TMJ. After examination by the orthodontist, she was given a prescription for Flexeril and referred to physical therapy for treatment of suboccipital headaches. Her goals for PT were to reduce the intensity and frequency of her headaches, be able to drive greater than 2 hours, work on the computer for 4 hours, and care for her 2-year-old son without triggering increased pain.

## PHYSICAL EXAMINATION

### Observation

The patient presented to the clinic with a negative attitude regarding her chances of improvement. She presented with a significant forward head with associated upper cervical extension, rounded shoulders, and elevated left scapula.

### Range of Motion

Shoulder range of motion was normal with no scapular dyskinesis and no aggravation of symptoms. Cervical range of motion was normal in all planes except right cervical rotation and right lateral flexion. The patient reported a "pull" on the contralateral side and pain at the end ranges of lateral flexion bilaterally and at the end range of right rotation. Visual angulation was evident at the C3-C4 area with lateral flexion and extension. Lateral facet gliding and passive intervetebral motion testing (PIVM) revealed limited segmental motion at the C1-C3 and C5-T1 segments with both directions of sidegliding. Active cervical right lateral flexion was 37°, left was 43° with goniometric measurements. Active cervical right rotation was 71° and left rotation was 80°. Passive ROM for right cervical rotation was limited slightly compared to the left rotation. No signs or symptoms of vertebral artery insufficiency were present when tested.

### Muscle Testing

Upper extremity strength was symmetrical bilaterally with manual muscle testing scores of 5/5 for sternocleidomastoid, upper trapezius, deltoid, biceps, wrist flexors, wrist extensors, and triceps.

### Palpation

The patient presented with significant trigger points upon palpation to the left levator scapula superior to the scapular attachment that slightly increased the patient's headache intensity. She also presented with excessive tone and tenderness to the suboccipitals, upper trapezius (left greater than right), and to the sternocleidomastoid muscles. First rib heights were symmetrical bilaterally. Bilateral pectoralis minor muscles were tight and tender to deep palpation.

Hypomobility and reproduction of the headache complaints were also noted with posterior to anterior (PA) mobilization to first resistance point unilaterally on the left at C0-C1 and C1-C2. Posterior to anterior (PA) mobilization also revealed hypomobility at segments C5-T1 bilaterally but no reproduction of the patient's headache.

### Summary of Exam Findings

From the initial examination, the patient's primary impairments were limited cervical ROM, limited cervical facet accessory motion, painful trigger points along the left levator scapula and suboccipital muscles, and postural dysfunction. She reported inability to work a full day, loss of concentration, and irritability secondary to the headaches.

## INTERVENTION

The patient was seen a total of 11 visits at a frequency of 3 times per week for 4 weeks. She missed one treatment session on the third week secondary to her son being sick.

The patient's treatments consisted of headache SNAGs and reverse SNAGs, massage, ischemic tissue release (ITR), patient education, therapeutic exercises to address postural dysfunction, moist heat, and electrical stimulation. The goals of physical therapy were to reduce the patient's headache rating score to 3/15 so that the patient could drive, perform a full week of her job and motherly duties, and improve the patient's cervical AROM to normal limits.

### Treatment 1

The first treatment session followed the initial exam with the performance of Mulligan's headache SNAG (HA SNAG) technique. This technique requires the patient to sit up with erect posture while the therapist stands beside the patient and cradles the occiput with one hand while his/her fifth middle phalanx lies over the spinous process of the patient's second cervical vertebrae (Figure 3). The lateral


**Figure 3. Mulligan headache SNAG and reverse headache SNAG.**

border of the thenar eminence of the therapist's opposite hand is then placed over the contralateral fifth ray. Pressure is then applied anteriorly through the patient's C2 spinous process while the cranium remains stationary. This force is gently applied until end range is felt and sustained for a count of 10 seconds. Mulligan reports that this technique is indicated if there are no complaints of pain by the patient and if the headache subsides or eases.[16] This was the case with this patient and the HA SNAG was repeated as above 8 times. Upon the end of the HA SNAG treatment, the patient was headache free and rated the visual analog scale at 1/10. The first treatment was ended with moist heat and electrical stimulation to the cervical and upper thoracic region.

### Treatment 2

The patient reported significantly reduced intensity of her headache after the first treatment. She reported that her headache was nonexistent until she performed 3 hours of computer work the day of her second visit. Her visual analog (VAS) pain rating was 4/10. The second treatment consisted of soft tissue work and massage of the upper trapezius, levator scapula, rhomboids, and pectoralis minor bilaterally. Ischemic tissue release (ITR) was performed to the palpable trigger points of the left levator scaula. She reported mild increase in her headache after the ITR, but the palpable trigger point size was reduced. The HA SNAGs were then performed as described above. The patient complained of mild sensitivity to the pressure applied after the first HA SNAG, so the reverse HA SNAG was performed with no complaints from the pressure applied. The reverse HA SNAG was performed, similar to the HA SNAG, with the patient seated with the head held in the same manner. The therapist's fifth ray wraps around the base of the occiput with no contact to the cervical spine (Figure 3).[18,26] The therapist's contralateral thumb and index finger wrap around C2 so the web between them rests against the back of the patient's neck. The spine was held stable with this hand, while the head was taken forward on the column to end range and held there for approximately 10 seconds. According to Brian Mulligan, this technique is indicated if the headache subsides and is not painful.[26] After 6 to 10 repetitions of the reverse HA SNAG, the patient reported no headache, with a VAS rating of 1/10. The treatment was ended with moist heat and electrical stimulation to the cervical and upper thoracic spine.

### Treatment 3

The patient returned to her third appointment with a VAS rating of 2/10. The third treatment session began with soft tissue work to the upper trapezius, rhomboids, levator scapula, and pectoralis muscles bilaterally. We then discussed importance of postural awareness with driving, standing, and sitting. We also addressed proper ergonomic principles regarding her seated work site. Therapeutic exercise was prescribed to be performed 3 times per day for improving upper thoracic and cervical posture including: green Thera-Band® (Hygenic Corporation, Akron, Ohio) bilateral scapular retraction, green Thera-Band® alternating shoulder extensions with scapular depression cues each at 15 repetitions, corner stretch repeated 2 times with a 30 second hold. We ended the treatment session with reverse HA SNAGs for 10 repetitions. The patient verbalized no headache and a VAS rating upon leaving at 0/10.

### Treatment 4

The patient returned from the weekend stating that she felt great until this morning after approximately 3.5 hours of computer work. She verbalized noticing less pain and effort with driving and reported that she was sleeping better. She presented to the clinic with VAS rating of 3/10 and a headache rating system score of 6/15 (Figure 4). Active range of motion was reassessed with improved right cervical rotation to 77° (improved from 71° at initial exam), and right lateral flexion to 40°(from 37° at initial exam). Palpation revealed reduced trigger point size and tenderness to the left levator scapula. Patient denied increased headache intensity with deep palpation of the left levator scapula or with left unilateral facet mobilization to O-C1 or C1-C2. Treatment included soft tissue release of the upper traps, levator scapula, ITR of the left levator scapula, and review of her prescribed home exercise program (HEP). Swiss ball prone rows with 3 pounds for 15 repetitions, and thoracic stretch with 4 inch diameter towel roll for 4 minutes in duration was added. The HA SNAG technique was tolerated and performed for 8 repetitions. Patient reported 0/10 on the VAS and no headache upon leaving.

### Treatment 5

Patient presented to the clinic with no complaints of headaches and a VAS of 1/10. She reported being on the computer that day for approximately 3 hours on and off. The therapy session was the same as in treatment 4 with increased duration of thoracic towel stretch and 2 sets of her HEP.

### Treatment 6

Patient presented to the clinic without any headache complaints and a VAS of 1/10. Treatment included review of the Swiss ball prone rows with 1.5 pounds at 2 sets of 15 repetitions, unilateral scapular rows with cable system at 2 sets of 15 repetitions with 10 pounds bilaterally. No soft tissue mobilization, headache SNAGs, or reverse SNAGs were performed.

### Treatment 7-10

The patient returned from the weekend to her seventh visit with no complaints of headaches, and verbalized "feeling the best she has felt in years." Her headache rating score was 3/15 and the VAS was a 0/10. Her cervical AROM was reassessed with forward bending and extension normal, right lateral flexion to 45°, left lateral flexion to 47°, right rotation to 83°, and left rotation to 83°. No palpable trigger points were noted in the upper trapezius, levator scapula, or the rhomboids. The suboccipitals were nontender. Unilateral cervical PA mobilizations were symmetrical bilaterally from 0-C1 through C7-T1. The patient's treatments for the remainder of her visits consisted of increased repetitions and weight of the above mentioned exercises. The Swiss ball rows were progressed to using 5 pound dumbbells at 15 repetitions for 3 sets. The cable unilateral scapular rows were progressed to 3 sets of 15 with 20 pounds. During the ninth visit, we added prone on Swiss ball alternating shoulder flexion with 1 pound at 3 sets of 15 repetitions. On the tenth visit, D2 shoulder flexion with green Thera-Band® for 15 repetitions, 3 times a day, were added to her HEP.

### Treatment 11/Discharge

Patient reported she remained headache free with a headache rating scale score of 3/15, and a VAS rating of 0/10 (Figure 4). She reported being able to work a full day with greater than 4 hours at the computer, and drive greater than 2 hours without a headache nor have a feeling of fatigue. She reported sleeping better and being able to handle her motherly duties pain free. She presented with increased cervical active ROM to bilateral lateral flexion to 48°, right rotation to 83°, and left rotation to

| Treatment | Headache Rating System Score (HRS) | Visual Analog Score (VAS) |
|---|---|---|
| Initial Evaluation and Treatment 1 | 12/15 | 9/10 |
| Treatment 2 | | 4/10 |
| Treatment 3 | | 2/10 |
| Treatment 4 | 6/15 | 3/10 |
| Treatment 5 | | 1/10 |
| Treatment 6 | | 1/10 |
| Treatment 7 | 3/15 | 0/10 |
| Treatment 8 | | 0/10 |
| Treatment 9 | | 0/10 |
| Treatment 10 | | 0/10 |
| Treatment 11 | 3/15 | 0/10 |
| Headache rating system was assessed on a weekly basis, while the visual analog scale was used on a visit basis. | | |

**Figure 4. Treatment summary.**

84°. Unilateral cervical PA mobilizations remained normal and symmetrical from 0-C1 through C7-T1. No palpable trigger points were noted in the upper trapezius, levator scapula, rhomboids, nor the suboccipitals. The patient was advised to continue her HEP for maintenance for 3 more weeks. She was discharged with all goals achieved.

## DISCUSSION

This patient presented to the physical therapy clinic with significant impairments (limited cervical A/PROM, limited cervical segmental motion, muscle guarding), and functional limitations (severe headaches with driving, working on computer, caring for her 2-year-old son). She was treated by her family practitioner, neurologist, chiropractor, and orthodontist before being seen by a physical therapist. She presented with cervicogenic headaches meeting the criteria as defined by the International Headache Society.[16] The pain was localized to the left suboccipital region and neck that was aggravated by sustained postures. She presented with abnormal cervical muscle tone, limited passive and active cervical range of motion, and abnormal posture. After 4 PT visits the patient reported no headaches, and after 11 PT visits she was discharged back to a normal pain-free life (Figure 4).

Headaches caused by dysfunction or injury to the cervical spine are of great interest to manual physical therapists. Various investigators have demonstrated a strong correlation of headaches with stimulation to the levels of 0-C1 through C2-3.[1-4,6,7,14,19,21] Some of the investigators injected saline, or used electrical stimulation of dorsal ramus to evoke referred pain to the head.[1-4,6,7,14,19,21] Such clinical experiments suggest that pathological painful stimuli to the structures innervated by the upper cervical nerves are capable of producing referred pain to the head, possibly resulting in headaches. From the initial examination, left unilateral posterior to anterior mobilization to the left facet column of 0-C1 and C1-C2 reproduced the patient's headaches. The headache SNAGS used to treat the woman in this paper directly affected the levels of 0-C1 and C1-C2 and appeared to reduce her headache intensity and frequency. The ergonomic education and postural education components could have also played a significant role in her reduced headache intensity and frequency.

Physical therapists often are the professional of choice when treating headaches. Manual therapy (cervical joint mobilization, manipulation, and soft tissue release) and exercise have been shown to effectively reduce headache intensity, frequency, and duration.[5-8,10,14] For this patient, the headache SNAG, reverse SNAG, and postural reeducation were the interventions of choice to reduce the intensity, frequency, and duration of headaches. The headache rating system (HRS) was used weekly to track the severity of the patient's headaches since the HRS takes into account the intensity, frequency, and response to medicine.

Currently, there are no known studies that have investigated the reliability or validity of the HRS. However, Edeling describes the HRS and suggests that a 3 point change is needed to illustrate significant change.[18] The visual analog scale was used to track daily pain perception. She rated her HA on the HRS upon the initial exam at 12/15 and her VAS at 9/10. On the fourth visit, her HRS was 6/15, the VAS was 3/10, her headache was no longer reproduced with left unilateral facet mobilization of O-C1 and C1-C2, and significant improvements were noted with cervical AROM. By the seventh visit, the HRS score was 3/15 (lowest possible score), the VAS was 0/10, and the cervical AROM and facet mobility was normal.

Potential contributing factors of her headaches after the HA SNAG technique could include poor ergonomics at her computer desk and in her car, poor activation of the deep cervical flexors, and poor postural control. There is relatively little research which suggests a strong correlation between CGH and postural dysfunction. Further research is needed to examine the relationship of scapular and cervicothoracic position on cervicogenic headaches. Recent case reports by Stanton and Jull[8] suggest a link in cervical segmental motion and deficiencies in deep neck flexors, lower trap, and CGH. Jull et al[7] also found that manipulative therapies and a low load exercise program were an effective way to reduce headache frequency, duration, and intensity.

The use of Mulligan's headache SNAG and reverse SNAG has not yet been investigated as an effective manual technique for reducing cervicogenic headache intensity and frequency. The efficacy of Mulligan's headache SNAG on treatment of CGH needs further investigation. This patient was treated for 6 months by 4 medical providers without any subjective improvements of her headaches prior to physical therapy intervention. The treatment intervention of Mulligan's headache SNAGs and postural reeducation may have played a role in the patient achieving full cervical active range of motion and reducing this patient's headache intensity, frequency and duration by 100%.

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| | | |
|---|---|---|
| San Diego, CA | Turner | Aug 21 - 24 |
| Washington, DC | Busby | Sep 11 - 14 |
| Tampa, FL | Turner | Sep 18 - 21 |
| Birmingham, AL | Busby | Sep 25 - 28 |
| Ft. Lauderdale, FL | Nass | Oct 2 - 5 |
| San Francisco, CA | Turner | Oct 16 - 19 |
| Chicago, IL | Busby | Oct 30 - Nov 2 |
| Knoxville, TN | Nass | Nov 6 - 9 |
| Portland, OR | Turner | Dec 11 - 14 |
| St. Augustine, FL | Pete/Baldwin | Dec 11 - 14 |
| 2009 | | |
| Las Vegas, NV | | Jan 15 - 18 |
| Dallas, TX | | Feb 19 - 22 |
| Denver, CO | | Feb 26 - Mar 1 |
| New York City, NY | | Apr 23 - 26 |
| Indianapolis, IN | | May 14 - 17 |
| St. Augustine, FL | Pete/Baldwin | May 21 - 24 |
| Columbus, OH | | Jun 4 - 7 |
| Atlanta, GA | | Jun 18 - 21 |
| St. Petersburg Beach, FL | | Jun 25- 28 |
| San Francisco, CA | | Jul 16 - 19 |
| Washington, DC | | Aug 6 - 9 |
| Grand Rapids, MI | | Aug 13 - 16 |
| Baton Rouge, LA | | Aug 27 - 30 |
| Seattle, WA | | Sep 17 - 20 |

### CF 1: Basic Cranio-Facial
20 Hours, 2.0 CEUs (no Prerequisite; also available online) — $595

| | | |
|---|---|---|
| St. Augustine, FL | Rocabado | Oct 14 - 16 |

### CF 2: Intermediate Cranio-Facial
20 Hours, 2.0 CEUs (Prerequisite CF 1 Basic Cranio Facial) — $595

| | | |
|---|---|---|
| Chicago, IL | Rocabado | Sep 16 - 18 |
| St. Augustine, FL | Rocabado | Oct 17 - 19 |

### CF 3: Advanced Cranio-Facial
20 Hours, 2.0 CEUs (Prerequisite CF 2) — $595

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| Chicago, IL | Rocabado | Sep 19 - 21 |

*Specifically designed to respect the Sabbath.

### S2 - Advanced Evaluation & Manipulation of Pelvis, Lumbar & Thoracic Spine *Including Thrust*
21 Hours, 2.1 CEUs (Prerequisite S1) — $595

| | | |
|---|---|---|
| Dallas, TX | Yack | Sep 5 - 7 |
| St. Augustine, FL | Irwin | Sep 12 - 14 |
| Denver, CO | Yack | Oct 10 - 12 |
| Las Vegas, NV | Irwin | Oct 10 - 12 |
| Baltimore, MD | Vitt | Oct 24 - 26 |
| Indianapolis, IN | Vitt | Nov 14 - 16 |
| Scranton, PA | Yack | Dec 19 - 21 |
| 2009 | | |
| New Orleans/Metairie, LA | | Jan 16 - 18 |
| Atlanta, GA | | Mar 13 - 15 |
| Chicago, IL | | Mar 27 - 29 |
| San Diego, CA | | Apr 24 - 26 |
| Baltimore, MD | | May 1 - 3 |
| St. Augustine, FL | | May 15 - 17 |
| Birmingham, AL | | Jun 26 - 28 |
| New York City, NY | | Aug 7 - 9 |
| Ft. Lauderdale, FL | | Sep 18 - 20 |
| Las Vegas, NV | | Sep 18 - 20 |

### MF1 - Myofascial Manipulation
20 Hours, 2.0 CEUs (No Prerequisite) — $595

| | | |
|---|---|---|
| Boston, MA | Grodin | Aug 22 - 24 |
| Chicago, IL | Cantu | Sep 26 - 28 |
| Cleveland, OH | Cantu | Oct 10 - 12 |
| Tulsa, OK | Stenborough | Oct 24 - 26 |
| St. Augustine, FL | Stenborough | Nov 7 - 9 |
| Washington, DC | Grodin | Nov 14 - 16 |
| 2009 | | |
| Atlanta, GA | | Jan 30 - Feb 1 |
| San Francisco, CA | | Feb 20 - 22 |
| Ft. Lauderdale, FL | | Mar 13 - 15 |
| Las Vegas, NV | | Mar 20 - 22 |
| *St. Augustine, FL | | Apr 20 - 22 |
| Boston, MA | | May 8 - 10 |
| Cincinnati, OH | | Jun 19 - 21 |
| Baltimore, MD | | Jul 24 - 26 |
| Chicago, IL | | Aug 21 - 23 |
| San Diego, CA | | Aug 28 - 30 |
| St. Augustine, FL | | Sep 18 - 20 |
| Dallas, TX | | Sep 25 - 27 |

### E2 - Extremity Integration
21 Hours, 2.1 CEUs (Prerequisite E1) — $595

| | | |
|---|---|---|
| Rockville, MD | Varela | Sep 19 - 21 |
| St. Augustine, FL | Pete | Sep 26 - 28 |
| Encino, CA | Varela | Nov 14 - 16 |
| Washington, DC | Pete | Dec 12 - 14 |
| Las Vegas, NV | Varela | Dec 12 - 14 |
| 2009 | | |
| Portland, OR | | Feb 20 - 22 |
| Cape Coral, FL | Pete | Mar 6 - 8 |
| Boston, MA | Pete | Apr 3 - 5 |
| Chicago, IL | | Jun 26 - 28 |
| New York City, NY | Pete | Jul 10 - 12 |
| Dallas, TX | Pete | Jul 31 - Aug 2 |
| San Diego, CA | Pete | Aug 7 - 9 |
| Atlanta, GA | | Aug 28 - 30 |

### The Older Adult with a Neurological Impairment
20 Hours, 2.0 CEUs (No Prerequisite) Also available to OTs — $625

| | | |
|---|---|---|
| Encinitas, CA | Howell/Lowe | Oct 4 - 7 |

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### S3 - Advanced Evaluation & Manipulation of the Cranio Facial, Cervical & Upper Thoracic Spine
27 Hours, 2.7 CEUs (Prerequisite S1) — $795

| | | |
|---|---|---|
| Denver, CO | Rot | Sep 11 - 14 |
| Atlanta, GA | Smith | Sep 12 - 15 |
| New York City, NY | Rot | Oct 2-5 |
| St. Augustine, FL | Rot | Oct 23 - 26 |
| Fresno, CA | Rot | Nov 13 - 16 |
| Ft. Lauderdale, FL | Smith | Dec 13 -16 |
| 2009 | | |
| Cape Coral, FL | | Jan 22 - 25 |
| St. Augustine, FL | Paris/Rot | Mar 5 - 8 |
| Baltimore, MD | | Mar 19 - 22 |

### S4 - Functional Analysis & Management of Lumbo-Pelvic-Hip Complex
15 Hours, 1.5 CEUs (Prerequisite S1) — $545

| | | |
|---|---|---|
| Boston, MA | Nyberg | Sep 6 - 7 |
| Las Vegas, NV | Varela | Oct 4 - 5 |
| New Port Richey, FL | Varela | Oct 11 - 12 |
| New York City, NY | Nyberg | Oct 18 - 19 |
| St. Augustine, FL | Nyberg | Nov 15 - 16 |
| St. Louis, MO | Lonnemann | Nov 22 - 23 |
| Chicago, IL | Nyberg | Dec 6 - 7 |
| 2009 | | |
| Rockville, MD | | Jan 10 - 11 |
| St. Augustine, FL | | Feb 21 - 22 |
| New York City, NY | | Apr 18 - 19 |

### MANUAL THERAPY CERTIFICATION Preparation and Examination
32 Hours, 3.2 CEUs (Prerequisites for each Certification vary) — $995

| | | |
|---|---|---|
| St. Augustine, FL | Paris et al | Dec 1 - 6 |
| 2009 | | |
| St. Augustine, FL | Paris et al | Feb 23 - 28 |
| St. Augustine, FL | Paris et al | Mar 30 - Apr 4 |
| St. Augustine, FL | Paris et al | Aug 3 - 8 |
| St. Augustine, FL | Paris et al | Nov 30 - Dec 5 |

### CRANIO FACIAL CERTIFICATION Preparation and Examination
32 Hours, 3.2 CEUs (Prerequisites for each Certification vary) — $995

| | | |
|---|---|---|
| 2009 | | |
| St. Augustine, FL | Paris/Rocabado et al | Aug 3 - 8 |

### SPORTS THERAPY CERTIFICATION Preparation and Examination
16 Hours, 1.6 CEUs (Prerequisites for each Certification vary - contact VISTAS for information regarding additional seminar requirements, testing and fees) — $498

| | | |
|---|---|---|
| 2009 | | |
| St. Augustine, FL | Paris et al | Feb 23 - 25 |

### PRIMARY CARE CERTIFICATION Preparation and Examination
23 Hours, 2.3 CEUs (Prerequisites for each Certification vary) — $995

| | | |
|---|---|---|
| 2009 | | |
| St. Augustine, FL | Paris et al | Feb 23 - 27 |

### The Pediatric Client with a Neurological Impairment
20 Hours, 2.0 CEUs (No Prerequisite) Also available to OTs — $625

| | | |
|---|---|---|
| St. Augustine, FL | Decker | Oct 9 - 12 |
| 2009 | | |
| St. Augustine, FL | Decker | Jun 4 - 7 |
| Chicago, IL | Decker | Jul 23 - 26 |

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# In The SPOTLIGHT

## Paul F. Beattie, PT, PhD, OCS

**Paul Beattie is a Clinical Associate Professor in the Program in Physical Therapy, Department of Exercise Science Blatt Physical Education Center at the University of South Carolina in Columbia, SC. Dr Beattie has a wealth of clinical and academic experience in orthopaedic physical therapy and has published extensively in the area of lumbar pathology and low back pain. Paul can be reached at: pbeattie@gwm.sc.edu.**

### You have published quite a bit in the area of examination and treatment of low back pain. In your opinion, how far have we progressed as a profession in this area ?

Over the last 30+ years we have had a steady cultural shift away from authoritarian levels of knowledge toward the incorporation of evidence-based practice as a component of our clinical decision making. This is consistent with virtually every other field of health care and has allowed us to slowly, but steadily, address some of the huge areas of uncertainty in the management of patients with low back pain (LBP).

To assess how far we have progressed, consider that in 1978 the standard of PT care for people with LBP was moist air massage, diathermy, ultrasound, and William's flexion exercises. Acute episodes were often treated with hospital admission, 2 weeks of strict bed-rest, and narcotic analgesia. The PT's role was to provide modalities (often called "4 to the back") and not do anything to increase the patient's pain. There was no valid data to support these treatment approaches and subsequent, well-performed research studies have demonstrated that none of these interventions are likely to make meaningful contributions to patient recovery, while some such as bed-rest or narcotic analgesia, are likely to have a substantially deleterious effect.

Several important events occurred in the late 1970s and early 1980s to greatly influence the role of PTs in the management of patients with LBP. James Cyriax championed the controversial notion that PTs should do in depth evaluations and perform spinal manipulation. Gordon Waddell, an orthopedic surgeon from Scotland, described the need to address nonbiologic factors, such fear avoidance beliefs that influence the clinical course of many patients with LBP. Robin McKenzie emphasized the importance of the patient taking responsibility for his or her pain through carefully prescribed exercises and postural awareness. These events led to a major paradigm shift, ie, the PT became a decision-maker and was starting to have a lot of treatment tools to choose from. The problem was that there was little or no research to guide the use of these tools in the clinical setting.

A primary barrier to research during this era was the difficulty in diagnosing low back conditions and gauging patient progress. Advancements in imaging technology in the early 1980s had illustrated poor linkages between most imaging findings and the nature of the patient's symptoms. This led us away from the anatomic model of disease toward a patient-centered approach as a means to determine patient status and progress. Things really took off in the mid 1980s when an emphasis on clinical measurement championed by Jules Rothstein, Paul Stratford, and many others led to the development and refinement of patient friendly, valid outcome measures that assessed perceived functional status and quality of life. This opened the door for outcomes research in LBP. At about this time, the field of epidemiology became increasingly popular with PT researchers leading to great advancements in research methodology and statistical interpretation of findings. The imperative for research was strongly fueled by tightening reimbursement. Gradually, research evidence started to emerge.

Unfortunately, many of the initial research findings regarding the efficacy and effectiveness of physical therapy for LBP were disappointing and at odds with clinical beliefs. The development of treatment-based classification systems in the mid and late 1990s by Tony Delitto, Julie Fritz, and others improved the likelihood of detecting meaningful improvements in patients and provided information that assisted in matching patient examination findings with appropriate treatments. A steady progression of multi-entered clinical trials has been gradually emerging. The net result is that today's standard of care strongly emphasizes patient self-management of symptoms through a variety of treatment strategies that are based upon such issues as directional preference of motion, functional demands at home and on the job, and the presence or absence of biobehavioral factors.

We now have good outcome tools and almost universal access to web-based evidence. Our body of research has reached the point where numerous systematic reviews of literature are available. So, instead of relying upon authoritarian levels of knowing we can now get summaries of the best peer-reviewed evidence representing numerous different authors and data sets. Thus, we have the potential to interface the best available research evidence with our clinical experience and the values of the specific patient.

### You currently sit on the editorial review board for Journal of Orthopaedic and Sports Physical Therapy (JOSPT). As an editorial review board member, have you seen any recent trends in articles that are being submitted to JOSPT?

As a profession, the quality of our publications has improved dramatically in the last decade. I believe that the ***JOSPT*** has been a central player in this. Ten to 15 years ago a substantial number of submissions to ***JOSPT*** had limited clinical

relevance. For example, we had enormous data regarding peak torque values for PT students but very little to help guide practice decisions. In recent years, under the editorship of Guy Simoneau, there has been a strong imperative on the clinical application of articles that are submitted, ie, to have a study published in ***JOSPT*** it must be methodologically sound and have relevance to the practicing clinician. This clinical relevance is enhanced not only by research reports, but by an emphasis on case studies and resident case problems. There has also been an emphasis on new technologies such as the use of diagnostic ultrasound by PTs. Guest editorials allow a wide range of opinions to be heard. Because of this, ***JOSPT*** has grown into one of the most widely-read PT journals in the world.

### One of your interests is in lumbar magnetic resonance imaging (MRI). What future role will imaging play in PT?

Lumbar MRI has a great capacity to detect a variety of conditions such as tumors, cysts, occult fractures, nerve compression, and infections that are not easily detectable on plain film radiographs. Unfortunately, in the absence of these conditions lumbar MRI currently has a limited ability to detect sources of symptoms and to guide PT care. In some cases normally occurring phenomena such as "disc bulging" can be falsely thought to be symptom-generators and can be misleading to patients, care givers, and legal representatives. Some studies have even shown that obtaining an MRI early in the course of an episode of LBP actually slows recovery. These observations, coupled with the high cost of this test, limit the current role of lumbar MRI for PTs. Most guidelines recommend MRI only for those patients with delayed recovery, signs of serious disease,and/or strong indications for surgery. Substantially more data is needed that describes the sensitivity and specificity of various findings for lumbar MRI before it can be an effective diagnostic procedure to guide PT. This is likely to happen; however, we are still quite a ways away.

There are however, many exciting uses of MRI for research in PT. Some excellent studies have come out of the University of Southern California using dynamic imaging of lumbar spine, and in our current research at the University of South Carolina, we are using diffusion-weighted imaging to examine the effects of exercise and joint mobilization on the intervertebral disc. Hopefully this work, and other studies using MRI, will help us to understand the mechanisms of action of many of treatments to the spine.

Another interesting use of MRI is in brain imaging of patients with chronic LBP using functional MRI (fMRI). Preliminary findings suggest that there are substantial differences in stimulus-processing in patients with chronic pain compared to those who do not have this condition. This line of research may help us to understand the fundamental neurophysiologic aspects of chronic pain and lead to new interventions to address these phenomena.

### Your thoughts on artificial disk replacement as a treatment for disk pathology?

An enormous amount of money has gone into the development and marketing of the artificial disc. As PTs, we are likely to spend a lot more time with surgical failures than with those patients who have a great outcome, so we have a potential for bias in our judgments when it comes to patients who have had this procedure. That having been said, the best research of which I am aware suggests there is no evidence that artificial disc replacement is superior to lumbar fusion. It is also important to note that there are no long-term follow-up studies that indicate the likely wear-rate in the prosthesis and the potential for complications. Additionally, there have been several reports of very serious adverse events occurring during revision arthroplasty.

Artificial disk replacement may soon be overshadowed by the field of regenerative medicine. The ability to re-grow diseased tissues by the manipulation and implantation of cellular structures will have a profound effect on our profession in the next decade and will require entirely new rehabilitation paradigms. For example, the use of injectable biomaterials, such as stem cells, into degenerative discs is showing remarkable results at improving the chemical environment in animal models and may soon become a minimally invasive option for the treatment of chronic LBP associated with degenerative disc disease.

Considering this, it is unlikely that artificial disk replacement will become as widespread as total hip or knee replacement. There will however, be certain subsets of patients for whom this procedure is likely to be efficacious.

### What do you see as some of the future directions in the role of PT in the management of patients with low back pain?

In the very near future we will have an enormous variety of high-tech options to assist the evaluation and treatment of patients with LBP. Some of these will be shown to be beneficial while others will not. It is my belief however, that the central core of PT management for patients with LBP will remain as an individually-based, hands-on approach. We will be assisted by evidence-based guidelines that will help our decision-making but allow room for individual patient preferences.

As our health care system evolves toward value-centered care, in which the effectiveness of treatment is based upon long-term outcome over the entire course of an illness, we are likely to see changes in the delivery aspects of PT care. For example, due to the recurrent nature of LBP many patients might be seen for 1 to 2 visits every few months for a manual therapy "tune-up" and modification of self-management strategies, rather than the single, intensive course of care followed by discharge that is now frequently used. Within this system we are likely to assume greater accountability for patient outcome; this in turn will lead us to target those patients for whom physical therapy is likely to benefit, and to recognize those patients who will not be helped by our care.

Our great advantage is that our interventions have a low risk of adverse events and are an economic bargain within the health care delivery system. Our challenge is, and always will be, to provide the optimal care for each person that we see.

### Thank you Dr. Beattie for taking the time to share your views with OP readers.

# bookreviews

Coordinated by Michael J. Wooden, PT, MS, OCS

**Frankle MA, ed. *Rotator Cuff Deficiency of the Shoulder.* New York, NY: Thieme; 2008, 188 pp., illus.**

Rotator cuff problems are a common source of shoulder pain and have become more prevalent as the population ages. Orthopaedic surgeons and physical therapists have become more proficient in treating very specific shoulder conditions in the past 10 years. More and more clinicians have focused on diagnosis and treatment of the shoulder as their primary specialty, making this text very timely. The editor states that once a person reaches the age of 65, he or she has a 50% chance of developing a torn rotator cuff. Rotator cuff pathology has been extremely costly in terms of health care dollars and lost time at work. The theme of this textbook is to educate surgeons on the treatment options available for rotator cuff disorders. The text also has clinical relevance to the orthopaedic physical therapist.

The text is divided into 14 chapters, with the focus being on massive rotator cuff tears. Chapters 1 through 3 discuss biomechanics, pathophysiology, and repair of rotator cuff tears. Further discussion includes a classification system of rotator cuff pathology and description of massive tears. The first chapter is particularly descriptive with regard to the role of the rotator cuff in prime movement and stabilization, as well as the detrimental effects of pathology on these mechanisms. Principles of the reverse total shoulder arthoplasty are also discussed, setting the stage for later chapters.

Chapters 4 through 7 describe surgical management of rotator cuff deficiency, including arthroscopic management of massive tears, muscle transfer procedures, and hemiarthroplasty. Chapter 6 includes a historical perspective of rotator cuff pathology, a classification system of rotator cuff tears, and the clinical presentation of the rotator cuff deficient shoulder.

Chapters 8 and 9 describe the rationale and biomechanics of the reversed shoulder prosthesis from an international perspective. American and French surgeons discuss and compare biomechanics, indications, and treatment methods in using the Grammont Reverse shoulder design vs. the conventional reverse shoulder arthroplasty.

Chapters 10 through 13 discuss treatment of the rotator cuff deficient shoulder from 4 different schools of thought including the French perspective, the Mayo Clinic, Columbia University, and The Florida Orthopedic Institute. Each group has a different approach toward treatment options. Excellent photos of the procedures and hardware are also included throughout this chapter.

Chapter 14 discusses the future of tissue engineering for the rotator cuff deficient shoulder, and why some repairs fail. Also discussed are advances in research including extracellular matrix scaffolds, growth factors, and gene therapy.

The strengths of this book are in the author's organization and detail, emphasizing surgical technique, rationale, indications, and contraindications. The figures are a great enhancement to the written text. A weakness of the text is the lack of discussion of postoperative and nonoperative treatment.

Even though this book was not intended primarily for the orthopaedic physical therapist, it would be a useful reference for those therapists who wish to understand more about surgical technique for their reverse shoulder arthroplasty patients.

**David Nissenbaum, MPT, MA, LAT**

**McGill S. *Low Back Disorders: Evidence-based Prevention and Rehabilitation.* 2nd ed. Champaign, Ill: Human Kinetics; 2007, 312 pp., illus.**

This textbook is written by Stuart McGill, PhD who is a world-renowned researcher and lecturer in spinal biomechanics and rehabilitation. A great deal of the research presented in this book came from his laboratories. The book is divided into 3 sections. The first section, *The Scientific Foundation*, covers the anatomy, normal and abnormal lumbar spine mechanics, and epidemiological data. There is also a chapter dedicated to various myths regarding low back pain. In the chapter on epidemiological studies, McGill provides an excellent discussion of the psychological vs. the physiological basis for low back pain. The final chapter in this section discusses lumbar spine stability. The author emphasizes the concept that stabilization exercises for patients with low back disorders should also have the lowest load on the spine.

*Injury Prevention* is the title of the second section. Low back disorder risk assessment, reducing the risk of low back injury, and the evidence behind the use of back belts are presented as separate chapters in this section. Different methods of lifting are analyzed. Ample photos help illustrate key concepts of lifting under different circumstances. Methods of counteracting the influence of prolonged sitting are discussed along with the evidence-based rationale. A nice summary section is provided in a question and answer format as well as an injury prevention primer.

In the third section, *Low Back Rehabilitation*, the focus is on the evidence supporting appropriate exercise programs. McGill proposes a 5 stage back training program. The first 3 phases are appropriate for rehabilitating individuals with low back disorders, while the last 2 phases are for improving performance. The reasons for avoiding certain exercises, especially lumbar flexion, are presented. A chapter is dedicated to patient evaluation. The evaluation process focuses on observing the manner in which the patient moves and the loading of specific tissues. Functional tests such as sitting posture, sit to stand, standing posture, observing the patient's gait pattern, and manual iliac crest compression are discussed. In the chapter, "Developing the Exercise Program," Dr. McGill illustrates spine sparing techniques for stretching. Stabilization exercises are presented along with photos and written instructions. The final chapter, "Advanced Exercises," covers more complex exercises that use unstable surfaces, cables, and weights. Patient handouts are provided along with a disclaimer. McGill stresses the importance of fine-tuning each exercise that is selected to the individual patient.

At the end of the book, the reader will find an appendix, a glossary, and references and additional readings. This text is well-written. The information is arranged for the reader to access easily at a later date. The issues presented have significant clinical implications, and the concepts can be applied readily. The illustrations are clear and arrows are used when needed to show motion or different vectors. I would recommend this text highly to any practitioner who evaluates and treats patients who complain of low back pain.

**Jeff Yaver, PT**

**Loudon J, Swift M, Bell S. *The Clinical Orthopedic Assessment Guide.* 2nd ed. Champaign, Ill: Human Kinetics; 2008, 439 pp., illus.**

As noted in the preface, the goal of *The Clinical Orthopedic Assessment Guide*, 2nd edition, is to provide the orthopaedic physical therapist with a handy and inexpensive reference to assist with patient assessment. All of the authors are physical therapists. The first edition was published in 1998.

The book is divided into 6 parts, which include 19 chapters. In the first part of the book, 2 chapters are presented that discuss basic principles and operational definitions for joint function and concepts related to the subjective examination. The next 3 parts of the book include 13 chapters that take a regional approach, covering the head and spine, upper extremity, and lower extremity. Each chapter follows a similar format and contains a description of basic joint function, active range of motion and passive accessory movement assessment, special tests, neurological assessment, surface palpation, and muscle origins, insertions, actions, and innervations. Each chapter ends with a suggested patient examination sequence and a table that describes regional clinical syndromes, which generally are presented in a pathoanatomical manner. For example, the clinical syndromes included in the cervical spine chapter include fractures of the atlas, axis, and C3-7, whiplash, cervicogenic headaches, discogenic disorders, and spondylosis. The last 2 sections of the book include 4 chapters that familiarize the reader with normal and abnormal gait and posture, as well as adverse neurodynamics. The chapters on the pelvis and adverse neurodynamics are new for this edition of the book.

High quality figures and photographs, many of which are supplemented with arrows that highlight the direction of movement, are routinely used to enhance the text. The tests and measures are presented in a consistent and understandable manner. For example, each special test includes the following information: patient position, clinician position, method, alternative method, and indications. While many of the special tests are accompanied with sensitivity and specificity values, the information is typically limited to only 1 reference. A more thorough discussion of diagnostic accuracy and a CD-ROM that demonstrated some of the tests and measures in this book would have been helpful. A 6-page bibliography is provided at the end of the book.

The second edition of *The Clinical Orthopedic Assessment Guide* is a valuable teaching text and would be a useful resource for physical therapists and physical therapy students. More specifically, this book would be valuable for professional and postprofessional orthopaedic physical therapy courses, especially those taught in physical therapy orthopaedic fellowship or residency programs.

**Michael D. Ross, PT, DHSc, OCS**

**Chew M, Golden S: *The Permanent Pain Cure: The Breakthrough Way to Heal Your Muscle and Joint Pain for Good.* New York, NY: McGraw-Hill; 2008, 250 pp., illus.**

This book, written by a physical therapist, describes an alternative method to drugs and surgery, which he claims will completely eliminate pain. The book is divided into 2 parts, with 3 sections in the first half and 7 sections in the second. Chapter 1 briefly describes the "Ming Method" and how the method came about. Examples of patients and how they were cared for are included, as well as addressing muscle imbalances related to specific sports.

Chapter 2 goes into some general anatomy of muscle and fascia, as this is the main focus of his treatments in relieving pain. It also discusses what fascia is, its functions, how it is injured, and how it can become "kinked."

Chapter 3 briefly talks about the Ming Method, with more detail of each section to follow in the second half of the book.

Starting the second half of the book is a discussion of the importance of hydration, diet, and supplements to begin the initial stages of the healing process in order to prepare the body and fascia for upcoming stretches and exercise. Effects of dehydration/rehydration, and how to properly hydrate are included. Sugar and trans-fatty acids, with their deleterious effects/inflammatory properties on the body are covered as well as foods that have anti-inflammatory properties and why. The use of supplements with anti-inflammatory properties is also included with recommendations on dosages and where to find the products.

Chapter 5 covers how to test your readiness to go into the next level, which is stretching. The importance of assessing pain prior to, during, and after the stretching program is covered, as well as who is ready to stretch and who should not.

Chapters 6 and 7 cover spinal and fascial stretch techniques. All stretching exercises are accompanied by an illustration, written instructions, timing, how each stretch should feel, and ways to ensure proper technique. For several stretches, there are easier versions if someone is unable to start at a given level.

Chapter 8 outlines a strengthening program, including 8 warm-up exercises and 5 to 6 exercises each for the upper body and lower body. Exercises are specific to building lean muscle or explosive strength. The recommended type and amount of weights, speed/tempo of the exercises, proper breathing, and resting are also covered in this section.

Chapter 9 covers strategies to personalize a program depending on the area of pain. There are also 3 separate programs designed for specific types of patient populations: the office worker, the elderly, and the healthy person. The final chapter includes other alternative therapies to boost treatment results, ranging from modalities, alternative practitioners, and self-mobilization techniques.

Overall, this book is very easy to read and follow. It has clear descriptions of all the stretches with 1 to 3 pictures for each stretch to enable the reader to perform them correctly. It offers a way for people to change their lifestyle to a healthier one without consuming a significant amount of time on the daily basis. However, there are some limitations to the book. First of all, the author states that his treatment approach will provide total pain relief. This is a bold statement for someone to apply to the total patient population for

anyone. Has he had results with his treatment? I'm sure, since he has written a book about it, but it is highly questionable if it will be the end all-be all cure for everyone.

Secondly, the book is poorly referenced. There are only a few brief mentions of research related to his topics, but even those are not fully cited at the end of the book. This limits the usefulness of the book for those in academics, research, and practice.

Additionally, the book is written in lay terms, making it seemingly appropriate for the patient population to use. However, even the usefulness of this is questionable from a physical therapy perspective. The first section of the book implies several times that physical therapy is not capable of managing a patient's complaints of pain. He talks about "standard PT" which to him is ultrasound, electrical stimulation, and ice. He then compares it to his fascial techniques and how this is the only thing that has helped him recover from a detrimental shoulder injury that was destined for surgery.

Considering how our profession has grown, and continues to advance with more direct access, evidence and entry-level doctoral degrees, this comes across as an insult to what we do, especially when it comes from a licensed person in our field. Because of what these imply, people not familiar with physical therapy may doubt our abilities to get people back to their highest possible levels of function.

However, on the positive side, pictures and descriptions of the fascial and spinal stretches are clearly described in the second half of the book. Therefore, at best the book's usefulness would be limited to the use of the pictures of the stretches for patient education, in conjunction with the many other treatment techniques (besides ultrasound and electrical stim) that we use.

**Michelle Finnegan, DPT, OCS, MTC, FAAOMPT**


The Combined Section Meetings in Las Vegas is just around the corner, and I hope to see you on the Strip! We will start the conference with another kick off breakfast on Tuesday, February 10th. This breakfast was such a success last year that we have expanded it to invite all new Orthopaedic Section members, in addition to those attending CSM for the first time. Come out and meet your Section leadership while enjoying a bagel and fruit. Another successful adventure from last year will be repeated and also expanded upon. We will be having the Orthopaedic Section social hour prior to our Business Meeting on Wednesday, February 11th at 5:30. This will all be followed by a grand celebration of our 35th Anniversary with former Section Presidents cutting a wonderful birthday cake. Our programming is stellar; we have a series of movement system impairment lectures, a progressive talk on tendonopathies of multiple joints, a series of lectures on the latest rehabilitation and surgery procedures for the shoulder and knee, and the introduction of the latest ICF guideline. For the first time we are offering 5 preconference courses ranging from manual techniques to starting an orthopaedic residency program. Lastly, this is projected to be the highest attended CSM ever. Our registrations are surpassing other years by over 65%. Get out your lucky piece and make your plans now to meet us all in Las Vegas--it is a sure bet for your career!

**Beth M. Jones, PT, DPT, OCS**

# Come Golf with Bill O'Grady in Las Vegas during CSM!

The Orthopaedic and Sports Sections are sponsoring a golf outing, Monday, February 9th, beginning at 11:00 AM. Bring your friends, family, and vendors for some real fun at the Las Vegas National Golf Course located near the strip, not far from the hotels. Green fees are $80.00 per player (a bargain in season) and for those of you who do not want to bring your clubs on the plane, rentals are only $45.00. We would like to get 18 teams of 4 players so we can take over the course for a great shotgun start. The earlier you commit to this event, the more successful it will be. Please contact Bill O'Grady to reserve your place now:

**w.ogrady@comcast.net.**

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# Orthopaedic Section Pre-conference Courses

**Call the Orthopaedic Section office or visit us online for more information and to register!**
**800/444-3982 * www.orthopt.org**

## 2-Day Courses:
## Sunday, February 8 – Monday, February 9, 2009

### Introduction to Manipulation and Exercise for the Thoracic Spine and Rib Cage

**Description:** The use of high velocity low amplitude (HVLA) or manipulation techniques is becoming the standard for entry level clinicians throughout the country. This course is designed to update clinicians, clinical instructors and faculty members to feel confident using and instructing these extremely high yield techniques.

The objectives of this course include providing a framework for clinical decision making along with the interventional skills required to successfully utilize manual therapy for the thoracic spine and rib cage in clinical practice. This course will heavily emphasize lab and the development of psychomotor skills so you can utilize these techniques with confidence on the first day back in clinic. Current evidence that guides interventions will be reviewed to allow the participant to effectively utilize the interventions most likely to be of benefit for a particular patient. Of special interest is recent evidence on the effectiveness of manipulation of the thoracic spine for patients with cervical disorders. Best practice recommendations, lab demonstration and practice for the following evidence based interventions will be included: (1) Lower, Middle and Upper Thoracic high velocity low amplitude (HVLA) thrust manipulation; (2) Muscle Energy Technique for Rib dysfunction and inhalation/exhalation restriction; (3) Impairment based therapeutic exercise for the upper quarter focusing on improving scapulothoracic motion; (4) Exercise integrating thoracic and scapulothoracic therapeutic exercise and neuromotor re-education with cervical and lumbar spinal stabilization techniques.

**Objectives:** (1) Perform a concise and thorough upper quarter screen and thoracic spine evaluation; (2) Identify which patients will most likely benefit from thoracic manipulation and recognize precautions and contraindications to manual therapy/manipulation; (3) Confidently and competently perform select manual therapy techniques (to include high velocity low amplitude (HVLA) manipulation techniques advocated by The Manipulation Task Force) to the thoracic region and be familiar with a variety of techniques to address the rib cage and inhalation/exhalation restrictions; (4) Identify patients with neck or low back pain most likely to benefit from thoracic manipulation and utilize techniques focusing on the thoracolumbar or cervicothoracic regions to improve these conditions; (5) Utilize a biofeedback device to retrain deep craniocervical flexors of the cervical spine and integrate retraining of scapular mechanics and upper thoracic musculature into clinical practice; (6) Integrate impairment based therapeutic exercise prescription with other interventions to maximize patient improvement; (7) Incorporate this approach into clinical practice without requiring further coursework – apply to patients immediately upon return to the clinic.(listed below)

**Speakers: David Browder, DPT, OCS**
**Nicole Raney, PT, DSc, OCS**

### Evaluation and Management of Cervicogenic Headache

**Description:** This course will discuss the pathophysiology, classification, and current evidence for differential diagnosis and management of cervicogenic headache from other common forms of headache. Examination procedures will be discussed, demonstrated, and practiced to include: (1) typical symptom presentation, (2) provocation testing and local mobility testing for the upper and lower cervical spine and upper thoracic regions. Current evidence for the management of cervicogenic headache will be presented and include discussion, demonstration, and practice of selected joint mobilization/manipulation, exercise, and self management techniques.

**Objectives:** (1) Distinguish cervicogenic headache from 3 other forms of headache; (2)Appraise the value of available resources for information regarding headaches; (3)Integrate best-evidence for evaluation of cervicogenic headache;(4)Utilize best-evidence for the management of cervicogenic headache; (5)Describe potential pain generators that contribute to cervicogenic headache; (6)Discuss neurophysiologic mechanisms for cervicocephalic syndrome

**Speakers: Greg Dedrick, PT, ScD**
**Gail Apte, PT, ScD, OCS, COMT**

### Vision 2020 Actualized in the Onsite Occupational Health Setting

**Description:** Applicable to all occupational health settings, this seminar teaches physical therapists advanced clinical methods for determining movement impairment diagnoses and recognizing co-morbid medical conditions prior to their escalation into costly pathological conditions. Using the International Classification of Function, and the Nagi Model of Disablement, the content knowledge and process skills necessary to enhance physical therapists' labeling of differential classifications of movement impairments and functions as essential to early and effective interventions to prevent impairments from progressing toward a recordable pathology will be emphasized. Within the context of a collaborative occupational health paradigm, advanced patient examination, medical screening and evaluation competence will facilitate physical therapists clinical judgments regarding when

to intervene, and when to refer and how to best implement evidenced based guidelines and therapeutic measures.

Until now, physical therapists have lacked widely accepted clinical and medical screening guidelines or decision rules that would decrease the use of unnecessary referrals and tests. The implementation of contemporary medical screening guidelines assures both clients and practitioners less risk without compromising care and thereby reducing costs to the employer. This conference will include education and lab sessions to explore current evidence based guidelines and assure physical therapists that they are following best practice rules and algorithms as related to case scenarios frequently encountered in occupational health practice settings.

**Objectives:** At the end of this educational conference, physical therapists will: (1) Identify the role and responsibility of "Differential Diagnosis" and "Medical Screening" for primary contact physical therapists practicing in a collaborative occupational health setting; (2) Determine the relationships between pathology, movement impairments, functional limitations and disability as related to etiological variables that physical therapists can effectively influence; (3) Determine how to develop movement impairment diagnoses that will efficiently direct plans of action that specifically rectify causative factors frequently encountered in the workplace; (4) Recognize which features of the history, work place observation and physical examination influence not only ergonomic intervention strategies but also management and triage variables as related to engineering consultation, diagnostic imaging, pharmacology, laboratory testing, and specialist referral; (5) Practically implement a Review of Medical Systems tool discussing signs and symptoms that necessitate immediate medical referral and how to effectively communicate with referral recipients; (6) Understand the scientific evidence that supports the Ottawa Ankle Rule, the Ottawa Knee Rule and the DVT/PE Diagnostic Algorithms; (7) Practically implement the Ottawa Ankle Rule, the Ottawa Knee Rule and the DVT Diagnostic Algorithm into occupational health practice; (8) Differentiate medical conditions that do not contraindicate physical therapist intervention but necessitates modification of intervention; (9) Practically apply medical screening and differential diagnostic examination procedures in a competent manner; (10) Understand role as a team member in workplace health and safety regarding aspects of care such as record keeping, OSHA forms, assisting with workplace restrictions, coordinating with employer on light duty/transitional work plans, etc.

**Speaker: Robert DuVall, PT, OCS, SCS**

## 1-Day Courses: Monday, February 9, 2009

### Pearls & Perils for the Management of Individuals with Foot and Ankle Pathologies: Manual Therapy, Taping, and Functional Exercise

**Description:** The evaluation and management of common foot and ankle conditions will be addressed in this one day "hands-on" lab course. Manual therapy, taping techniques, and functional exercises will be presented for leg, rearfoot, midfoot, and forefoot conditions. Anatomical, biomechanical, and supporting evidence will also be integrated throughout lecture and lab presentations. This course will provide physical therapists with useful clinically relevant information that can be immediately applied into every practice.

**Objectives:** Upon completion of this course, you will be able to: 1) Integrate manual therapy intervention strategies for the foot and ankle complex into an individualized, comprehensive rehabilitation program; 2) Critically appraise the manual therapy intervention strategies for the foot and ankle complex, consistent with the available evidence-based literature; 3) Apply the appropriate taping technique to support, unload, or augment function for a given foot/ankle condition; 4) Select at least one exercise for each condition presented that will enhance function, reduce symptoms, and/or strengthen the pathomechanical link in the patient.

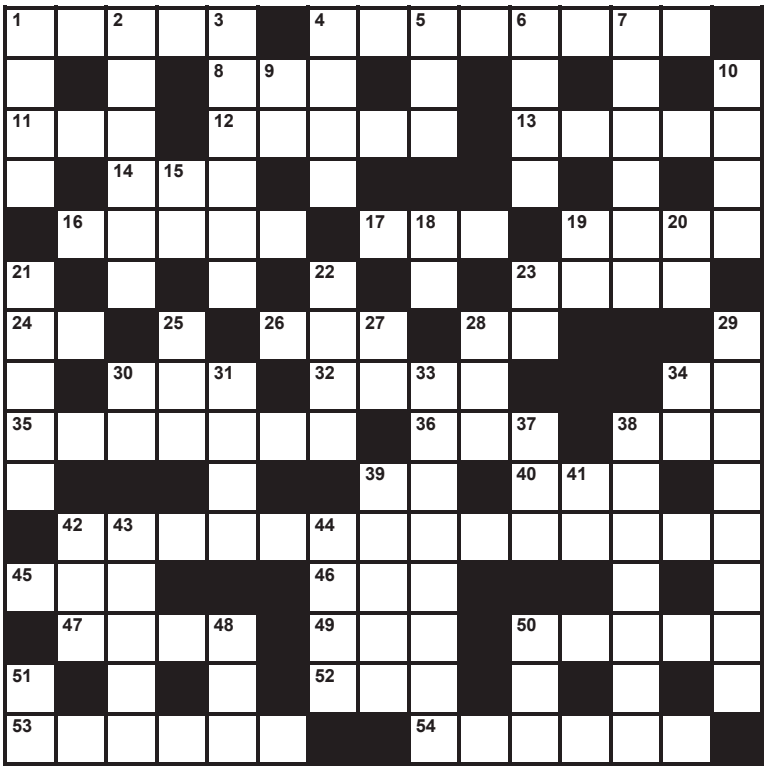
**Speakers: Richard Jackson, PT, OCS**
**Rob Roy Martin, PT, PhD**
**Stephen Paulseth, PT, DPT, SCS, ATC**

### The How-to-Guide to Develop and Manage an Orthopaedic Residency Program

**Description:** The Orthopaedic Section of the APTA has adopted an initiative to promote the expansion of residency training programs in Orthopedic Physical Therapy. Outpatient orthopedic physical therapy clinics are encouraged to explore the value added benefit of residency training on site. Training the next generation of clinical specialists in the area of orthopaedics is a way to contribute to the profession and raise the level and profile of your practice. This pre-conference course will review all the necessary components to the successful development of Residency Training in your clinic. The breadth and depth of material covered will apply equally to those contemplating the idea and to those fine-tuning their application for credentialed status.

**Objectives:** (1) Review multiple financial structures for a fiscally sound residency structure; (2) Determine residency policy and procedures needed and begin the development of a residency handbook; (3) Understand the curricular requirements of a residency program and perform an analysis of those components that can be managed in-house and those that could be outsourced; (4) Identify procedures to evaluate the resident in the areas of knowledge, skills, and abilities; (5) Develop a working list of timelines and goal setting for the development of a residency program and application for credentialed status; (6) Understand and negotiate the residency credentialing application process; (7) Prepare a plan for faculty and program review and development.

**Speakers: Skulpan Asavasopon, PT, MPT, OCS, FAAOMPT**
**Joseph Godges, PT, DPT, MA, OCS**
**Tara Jo Manal, PT, DPT, OCS, SCS**
**Jason Tonley, PT, DPT, OCS**



# CROSSWORDS

by Myles Mellor

**www.themecrosswords.com**

## Across

**1** C1 vertebra
**4** Bone openings
**8** Trouble
**11** Practice suffix
**12** See 18 down
**13** _____sis: "swayback"
**14** Rule out
**16** Spinal ___: tube formed by vertebrae, where the spinal fluid and membranes are
**17** Estimated arrival time, abbr.
**19** Neck connection
**23** Medical trial
**24** Email address intro
**26** Under prefix
**28** First lumbar vertebra
**30** Test site
**32** Medical testees
**34** This, in Paris
**35** Shoulder blade
**36** Color
**38** Oxygenated gas
**39** "The knee bone's connected __ the thigh bone"
**40** Bone connector, after fracture
**42** Type of connective tissue (2 words)
**45** TV control: abbr.
**46** ___ mode
**47** They are part of a cage
**49** Baglike structure
**50** French for love
**52** Three way
**53** Makes a curved shape
**54** Bone at the bottom of the spinal column

## Down

**1** C2
**2** A type of vertebra
**3** Relating to the fused bones forming the pelvis
**4** At the front
**5** Regret
**6** The lumbar curve is more pronounced in the female than the ____
**7** Brain-spinal cord connections
**9** French, of the
**10** Thick whitish collection of nerve tissue
**15** Used before a vowel
**18** It begins at the middle of the second and ends at the middle of the twelfth thoracic vertebra (goes with 12 across)
**19** Guy
**20** __ the base of the spine
**21** L4 is the highest point of the iliac ____
**22** _____ mater: spinal membranes
**23** First thoracic vertebra
**25** Spinal ___: lumbar puncture
**27** College Degree
**28** College Football's Tigers, abbr.
**29** Spine component
**30** West coast city
**31** Whirring noise
**33** One of the type of vertebrae
**34** Unit of radioactive activity
**37** Prefix with dermal
**38** Science of body structure
**39** Anklebone related
**41** Bears' locale
**42** In favor of
**43** Relating to the upper part of the pelvis
**44** Piece of bone setting technology
**48** Watch
**50** Curve
**51** Sodium symbol

# OCCUPATIONAL HEALTH SIG NEWSLETTER

## President's Message January 2009

### Greetings and Happy New Year OHSIG Members!

On behalf of the OHSIG Board, we hope everyone had a wonderful holiday with family and friends.

### Revised FCE Guidelines – A DONE Deal!

The Revised FCE Guidelines have been approved, ratified, and serve as an official APTA Guideline. They will be posted on APTA's website as well as available through the Orthopaedic Section website. We encourage therapists providing functional capacity evaluations become familiar with the revisions to ensure you can meet the guidelines.

### STILL TIME TO REGISTER FOR CSM Las Vegas Feb 8-12, 2009

There is still time to register for CSM and participate in the Occupational Health Programming offered, both in a preconference opportunity and during CSM programming.

### Occ Health Programming Opportunities at CSM

- Preconference: Sunday, Feb 8, 12:30pm-5:30pm and Monday, Feb 9, 8am-5pm
- OHSIG Business Meeting for all OHSIG members: Wed Feb 11, 7am-8am
- Wed Feb 11, 8am-11am Beyond the Hoyer Lift

### PRECON: Vision 2020 Actualized in the Onsite Occupational Health Setting

This seminar teaches physical therapists advanced clinical methods for determining movement impairment diagnoses and recognizing co-morbid medical conditions prior to their escalation into costly pathological conditions. Within the context of a collaborative occupational health paradigm, advanced patient examination, medical screening, and evaluation competence will facilitate physical therapists clinical judgments regarding when to intervene, and when to refer and how to best implement evidence-based guidelines and therapeutic measures. The program will focus on skills necessary to enhance physical therapists' labeling of differential classifications of movement impairments and functions as essential to early and effective interventions to prevent impairments from progressing to a recordable pathology.

### Beyond the Hoyer Lift: New Technology in Equipment for Patient Handling

This program will introduce a variety of the newer options for patient handling in therapy. Strategies for selecting equipment and interacting with vendors will also be presented. Small group case studies of patients/clients in a variety of settings will be used to help participants synthesize consideration across the care spectrum.

Advances in technology have impacted all aspects of health care, including options for the way therapists provide hands-on care to patients. New equipment can be used to assist with tasks such as transferring, repositioning, and ambulating patients. The use of equipment can promote the complementary goals of improving safety for both patient and caregiver, as well as improve the potential for rehabilitation.

### OHSIG BOARD MEMBERS

The Board is here to serve its members. If you have suggestions, questions, or would like to participate, please contact any one of us.

President: Margot Miller
Research Chair: Kathy Rockefeller
Vice President: Steve Allison
Education Chair: Dee Daley
Secretary: Joe Kleinkort
Practice Chair: Drew Bossen
Treasurer: Nicole Matoushek
Membership Chair: Rick Wickstrom
Nominating Committee Chair: Jen Pollack
Nominating Member: John Lowe

**You can find contact information by going to www.orthopt.org.**

Hope to see you at CSM.
Sincerely,

***Margot Miller PT***
***OHSIG President***

# WORK-RELATED MUSCULOSKELETAL PREVENTION: A CASE STUDY OF AN INDUSTRIAL MSD PREVENTION PROGRAM

Gregory P. Schroeder, PT, DPT
TEAMWORKS! Therapy, LLC
greg@teamworkstherapy.com

## BACKGROUND

In the United States it is estimated that the total economic cost of work-related injuries is $160 billion per year. In 2005, $80 billion was spent on wage and productivity replacement, $31.3 billion in medical costs, and $34.4 billion in administrative costs. In 2005, 60% of work injuries were musculoskeletal disorders (MSD). Musculoskeletal disorders includes a variety of conditions including sprains, strains, cumulative trauma disorders, contusions, and spinal pain. The average MSD costs $17,065 in medical and indemnity costs according to the National Safety Council.

On the job injuries can have an enormous effect on the viability of local and national economies. Employers are often looking for better ways to prevent and manage work injuries, claims, and associated costs. As physical therapists we are uniquely qualified and positioned to become the profession that provides the answers to employers' MSD problems. Our unique knowledge base of musculoskeletal pathology, kinesiology, and biomechanics allows us to intervene at numerous stages during the work injury lifespan. From prevention to management, we have the answers that employers and workers need to reduce MSD. This paper describes one program that has been successful in reducing work-related MSD in a packaging manufacturer.

## COMPANY INJURY HISTORY

Graphic Packaging Corporation (GPC) is a leading provider of paperboard and integrated paperboard solutions to beverage and consumer products producers. In the location that the current program was implemented the focus was converting raw cardboard material into attractive, color printed packaging for dry and frozen food producers. The facility had a history of MSD that primarily involved the arms and spine. For the 3-year period (1997 to 2000) prior to the program, the facility averaged 20 recordable injuries per year; of these they were averaging 16 work-related MSD per year. Fifty percent of injuries were sprains/strains, 10% to 20% were cumulative trauma with the remaining injuries due to a variety of causes such as slips or trips. Prior to the implementation of the injury prevention program GPC had not implemented any significant programs or efforts to address their MSD problem. The interventions recommended for this client were designed to assist them to first prevent injuries and second improve the management of the injuries and complaints that did occur.

### Phase 1: Injury Prevention Program

Initially, a detailed analysis of the historical injury data for the current year and the previous 2 years was performed. Particular trends in body region, injury type, and job were noted. This was followed by a systematic analysis of all production related jobs in the facility. The purpose of the analysis was to identify risk factors that may contribute to MSD. Common risk factors include heavy lifting, pushing, pulling, grasping, and pinching. Often these were associated with awkward body or joint postures and/or excessive repetitions. Poor choices on the part of the worker contributed in most cases. For example, poor lifting mechanics was indentified frequently. Improper tool use or selection was another common choice that contributed to their MSD risk. Based on the analysis findings, a list of recommendations was generated to guide GPC in beginning to address their problem. The recommendations identified workstation layout and tools/equipment design modifications that would be helpful. In addition, a heavy emphasis was placed on implementing an education process to influence habits and choices that seemed to contribute to injuries. We developed a 3-level training program to address all levels on the workplace hierarchy from the production worker to top level management. The first level of training was targeted at the management team from the plant manager to the direct production supervisors. Subjects addressed in this session were designed to create awareness and commitment among the management team on the issues in the workplace from risk factors to appropriate response to an injury. The management training was quickly followed by training for employees. Our goal with this training was to create a desire to change poor work habits or choices and to motivate the employee to improve the commitment to care for their body both at work and home. The final session was directed to the safety team and provided them with training and tools to continuously analyze and identify risk factors that may contribute to the development of MSD. The team consisted of both management and production level employees who were interested in identifying solutions to the MSD problem.

### Phase 2: Injury Management

After implementation of the prevention phase, we developed an injury response or management process to assist GPC in earlier, more effective identification and response to MSD. The program involved creating a culture that encouraged, even welcomed the reporting of minor MSD complaints. Employees were given access to a physical therapist who would provide first-aid level interventions to assist the employee in the self treatment of their complaints. This was made available to all employees for all MSD complaints regardless of whether they were work-related. First-aid level interventions used in this program were those defined by OSHA as first-aid (**Figure 1**). The physical therapist was guided by an algorithm of care that was developed with the input of a board certified occupational medicine physician. A significant emphasis was placed on the employee modifying work technique and habits that seemed to be associated with their condition and providing them with exercises that could be performed at work and/or at home to facilitate healing. **Figure 2** illustrates the types and frequency of interventions provided by the physical therapist. The physical therapist was very familiar with all the jobs in the facility and their physical demands and risk factors. He was able to provide job specific advice that was meaningful to the employee. In addition, the physical therapist consulted with the plant safety manager and the employee's supervisor regarding interventions they might implement to address risk factors that were likely contributing to the employee's complaints. When examination finding indicated a condition that required medical attention

## OSHA ALLOWED FIRST-AID INTERVENTIONS

Visits to a physician or other licensed health care professional _____for observation or counseling

The conduct of a diagnostic procedure, such as x-rays, and blood tests, including the administration of prescription medications used _____ for diagnostic purposes

Using a non-prescription medication at non-prescription strength

Administering Tetanus Immunizations

Cleaning, Flushing, or soaking wounds on the surface of the skin

Using wound coverings such as bandages, Band-Aids™, gauze pads, etc.; or using butterfly bandages or Steri-Strips™

Using hot or cold therapy

Using any non-rigid means of support, such as elastic bandages, wraps, non-rigid bak belts, etc.

Using temporary immobilization devices while transporting an accident victim

Drilling of a fingernail or toenail to relieve pressure, or draining fluid from a blister

Using eye patches

Removing foreign bodies from the eye using only irrigation or a cotton swab

Removing splinters or foreign material from areas other than the eye by irrigation, tweezers, cotton swabs or other simple means

Using finger guards

Using Massages

Drinking fluids for relief of heat stress

**Figure 1.**

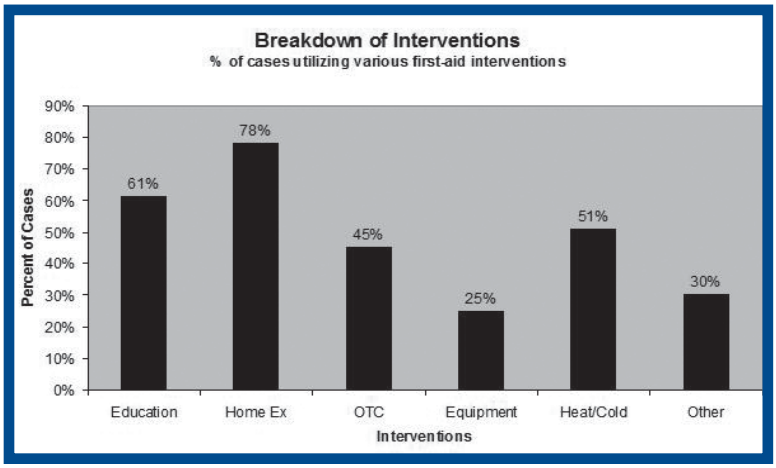



**Figure 2.**

because it was either not musculoskeletal in nature or the MSD had progress to a point beyond the level of first-aid interventions, the physical therapist worked with the safety manager and the employee to have the employee seen by a physician. Often this was a referral to a specialist in the area of the employee's condition. Over time the physical therapist and safety manager developed an informal panel of specialists who were willing to see cases sent from the plant on a preferential basis.

## OUTCOMES

Figures 3 and 4 illustrate the results of the GPC MSD prevention and management program. Based on GPC OSHA 300 log and other internal safety statistics provide to by GPC there was a 75% reduction in MSD the year following the implementation of the ergonomics program and this reduction has been maintained to this date. Figure 5 illustrates the outcomes of the onsite physical therapist first-aid interventions on worker compensation claims for MSD. Over the period of 6 years, 90% of all cases seen by the physical therapist were resolved through first-aid level interventions.

## DISCUSSION

Prevention and management of MSD in the workplace has been given much attention over the past 20 years. Many approaches have been implemented by employers in an effort to control the costs associated with MSD. Over a period of 7 years, GPC was successful in preventing and managing MSD by using a physical therapist to develop and implement an ergonomics and first-aid program. Numerous factors were important in the success of this program.

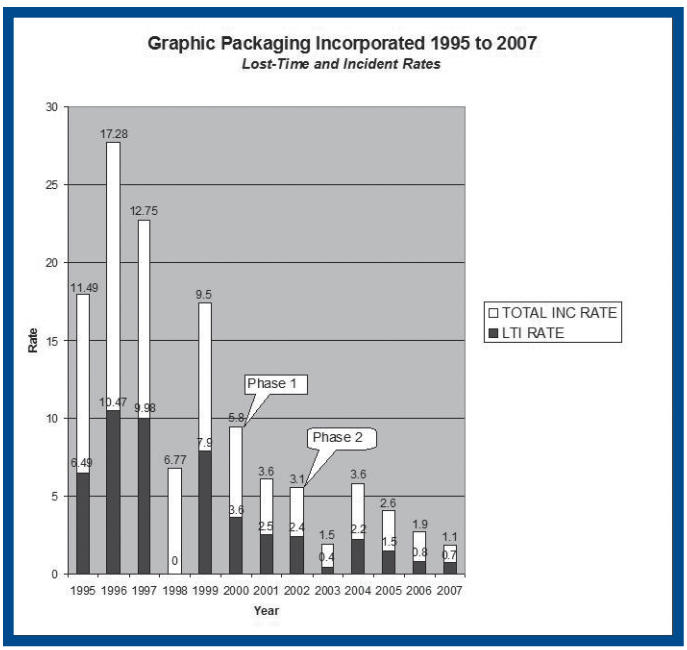



**Figure 3.**

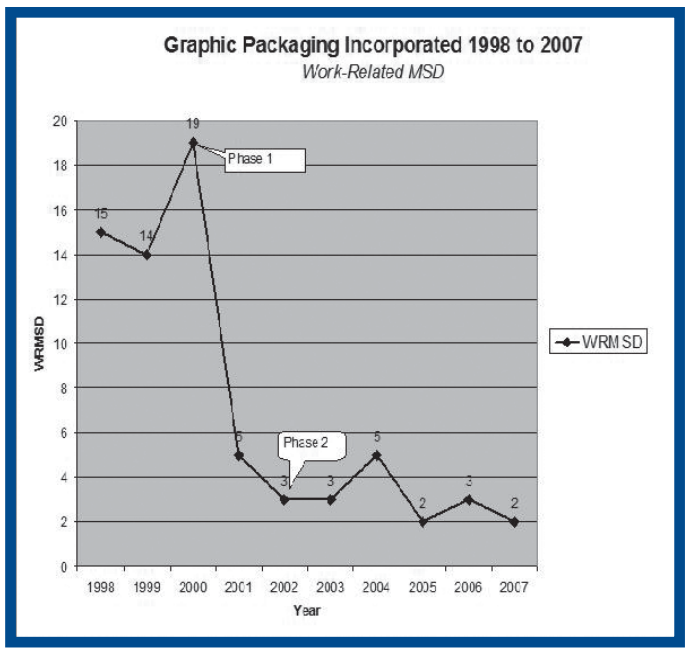



**Figure 4.**

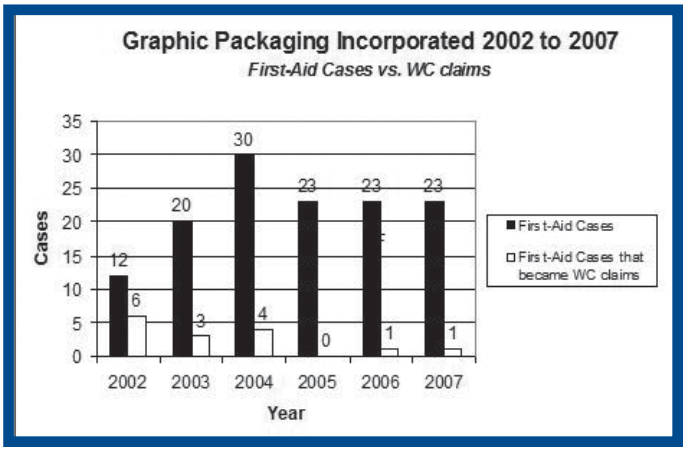



**Figure 5.**

## Trickle Down Ergonomics

In any workplace there is a culture that is pervasive. This is a direct function of the management that exists in the workplace. It determines what actually gets priority and what does not. When the question of ergonomics comes forward, the culture of the workplace becomes a huge factor. More importantly the culture and priorities of the management team determines the success of injury prevention programs. If there is not commitment at this level, the efforts of a safety manager, ergonomist, engineers, and employees usually do not produce results. The vast majority of people are reactive in nature, no matter how much sense prevention makes it often comes with many unknowns. There is a "leap of faith" involved on the part of the employer and the management team. This is especially important when you are preaching that the employer encourage the reporting of even minor aches and pains. When the entire management team is not committed to the program from top to bottom, the success of the program is virtually dead before it has a chance to start. In our program we spent considerable effort to create commitment in the management team. This was done through formal classroom education and frequent interaction as the program began. We addressed questions and concerns and helped them understand why we made various recommendations. When management became truly committed to the process, there was a noticeable change in the employee's involvement in the program. Employees began coming forward earlier with MSD complaints than in the past would have been ignored until the problem had became more significant.

## Earlier is Better

A second key for success related to how early employees who were experiencing MSD signs and/or symptoms would report their problems and seek intervention. Prior to the program employees typically would not report MSD's until well into their development. This led to more costly care, increased disability, and unnecessary suffering. The typical North American culture values a certain amount of stoic behavior. This can be very much a part of the management and employee mindset leading to dismissing the earliest warning signs of MSD. Often employees who are suffering from MSD feel foolish, hesitant, or even guilty reporting the MSD. They delay reporting symptoms they feel may be related to their job often until the disease process is well developed and difficult to treat. Changing this attitude was a very important goal of the prevention program. The message of "earlier is better" was repeated and emphasized throughout the program. Employees participated in training directed at reducing work fatigue through personal ergonomics at work and home. In addition, they were taught how to recognize the early warning signs of MSD and appropriate self-care and reporting. Over time the culture changed and employees began to report earlier and more frequently.

## Direct Access to Onsite Physical Therapist

When working with employers to reduce MSD, accessibility to treatment services is paramount. In the traditional medical model the worker leaves the workplace to be seen by a physician at a clinic or ER. Sometimes this is an occupational medicine clinic, sometimes a family practitioner, sometimes in an emergency department. There may be a great amount of variability in the accessibility to these services from distance, timeliness, or experience. In our model the worker was seen by the physical therapist onsite at the workplace in a direct access model. This provided many advantages over the traditional medical model. First, the physical therapist was able to essentially perform 2 evaluations, the person and the job. This is a huge missing piece in the typical care of an injured worker with MSD. The practitioner usually only has one piece of the equation, the clinical presentation of the patient. Many assumptions are made based on the presentation of the patient and their report of the causes of the complaints. This can lead to care that is more costly than need be both in dollars and human suffering. We found that if we evaluated the persons MSD and then evaluate their interaction with the job that the ability to resolve their complaints was greatly enhanced. We often found counseling the employee in alternative work procedures or techniques was extremely helpful in resolving his/her complaints without requiring interventions beyond first aid.

Second, the physical therapist is the ideal practitioner to address MSD complaints. The skill set of the physical therapist allows them to make an accurate diagnosis of the complaints and their etiology as it relates to work tasks. In most cases we were able to make recommendations that fell within OSHA's definition of first-aid to resolve the workers complaints.

Third, an additional benefit of onsite intervention is psychological. Often the individual just wanted to know what his/her problems were and to what extent it had developed. They were relieved when they were educated on the pathology and etiology and how they could manage their symptoms on their own. When an employee is sent to a clinic, the severity of the injury in the mind of the employee appears to be greater. After having medical testing, being prescribed medications and/or physical therapy the severity of the problem has now become greater in the mind of the patient. Contrast this with the person with the same complaints seeing a physical therapist onsite who identifies the causes of their complaints, educates them of the typical recovery process, and assures them that the majority of these conditions are self-limiting. The physical therapist then helps them modify their risk factors and provides them with self-care tactics. This approach is consistent with current best

practices for treating acute low back pain and can be applied to most MSDs. In our experience this is the best model for addressing the majority of work-related MSD.

### Understanding Federal and State Laws

A number of federal and state laws and agencies directly affect what type of interventions the PT can provide, at what point they can be provided, and under what type of supervision. OSHA defines what interventions are first aid and what is deemed medical treatment (**Figure 1**). When an injury or illness requires treatment beyond first aid, it must be recorded on the OSHA 300 log. Many companies use the information on this log as their metric for safety. The 300 log contains information of the type of injury, date of injury, where it occurred, how it occurred, whether it required restricted duty or time away from work. When an injury is treated by first aid, it does not need to be recorded on the 300 log and may not need to be reported to the employers state regulatory agency and/or to their workers compensation provider. This can have huge implications in costs considering many work comp insurances and third party administrators charge a fee up front to open a claim.

A state may adopt OSHA's definitions of first aid or the state may have there own definition. This will dictate when the company must report an injury to the state and whether or not they need to report a claim to their insurance company. Understanding these laws and regulations can have a significant effect on the success of these types of programs. For example, OSHA states that anyone can administer first-aid level services regardless of medical training. However a state may define first aid services provided by a medically trained individual as medical treatment and require reporting to the state as well as to the insurance carrier. This injury would not need to be reported on the 300 log but it would need to be reported to the state and a claim may need to be opened with the insurance company. A number of scenarios of this type may exist depending of which state the company is operating in.

The state physical therapy practice act will determine what level of direct access the physical therapist can have and therefore how the program may be structured. The program would potentially be much more effective in a state with full direct access vs. partial or no direct access. Understanding these laws is pivotal to implementing this type of a program. Understanding these issues can help the physical therapist develop a program that meets the need of the employer to reduce MSD cases and the associated costs.

### Visibility and Trust

For any prevention program to be successful those that it targets to must be continually reminded of the program and its benefits. The old adage "out of sight, out of mind" definitely applies to a program like ours. This relates to the effort of addressing complaints earlier in the development. The employer should regularly remind their employees of ergonomic principles, work toward ergonomic improvements, and encourage the use of the onsite physical therapist for minor symptoms the program will not realize its full potential. The employer needs to have someone accountable to do this. This often is a safety or human resources professional. One of the best things the PT can do to help with this effort is to perform plant walk-through on a regular basis to make sure they interact with employees at their jobs. We found that our presence was a trigger for additional requests for a consultation with the physical therapist. Often these were for personal issues or very minor symptoms. We feel that this was a huge part of our success; it built trust and acceptance. When employees are more comfortable with the process and the practitioner, they are more willing to get involved which results in better outcomes.

## CONCLUSION

Many companies are suffering from the effects of unnecessary MSD problems. These disorders are very preventable. This article reports on the experience of one program that was successful in reducing MSD in a packaging manufacturing facility. It illustrates how a combination of ergonomics and improved injury management tactics reduced our clients MSDs by 75% and has maintained this reduction to the current date. In the future, work-related MSD management will occur earlier and be more job specific. The physical therapist is the practitioner of choice to provide the answers to work-related MSD. This is an area that numerous competing professions are targeting including athletic trainers, massage therapists, and chiropractors. As physical therapists now is the time to aggressively capture this important practice niche and provide the needed answers for employers and their employees.

# painmanagement

SPECIAL INTEREST GROUP

## PRESIDENTS MESSAGE

*John Garizione, PT, DPT, DAAPM*

Hope all of you enjoyed the wonderful fall and winter holidays.

The Practice Analysis Task Force is working on questions to determine what techniques our members employ to treat pain patients. The information gained will help the SIG guide physical therapists in the appropriate direction to attain advanced information in pain management practices through continuing education and clinical fellowships. My goal is to have the final draft completed by CSM 2009.

This year's CSM educational program, sponsored by the PMSIG, will be "Fear Avoidance Behavior: State of the Art Review" presented by James Thomas, PhD; Christopher France, PhD; and Steven George PhD. The purpose of this session is to provide the clinician with a comprehensive examination of the role of fear avoidance behavior in somatic dysfunction and disability. Dr. France will present underlying constructs of fear avoidance behavior from the perspective of health psychology. Dr Thomas will examine how fear avoidance behavior influences motor behavior in clinical populations. Dr. George will describe how to identify and address fear avoidance in clinical settings with a goal to maximize rehabilitation potential for patients with low back pain. This 3-hour presentation will give all physical therapists insight into the psychological constructs, movement patterns in low back populations, as well as strengths and limitations of the various instruments used to assess fear avoidance in patients with low back pain. Thank you again to Marie Hoeger Bement for her work in getting this course on our schedule.

The SIG Business Meeting will be on Wednesday, February 11 from 7:00 AM until 8:00 AM. The educational program will be presented immediately following the business meeting on Wednesday, February 11 from 8:00 AM until 11:00 AM. Please try to roll out of bed one hour earlier to attend the business meeting. Remember to consult your program for room assignments and/or any last minute changes.

See you in Vegas.

### PMSIG OFFICERS

**President: John Garzione, PT, DPT, DAAPM (johngarzione@frontiernet.net)**

**Vice President/Program Chair: Marie Hoeger Bement, PT, PhD (mariehoeger.bement@marquette.edu)**

**Secretary: Anne Ingard, PT (PTmum76@aol.com)**

**Treasurer: Laura Frey Law, PT, PhD (laura-freylaw@uiowa.edu)**

Please feel free to contact any one of us with ideas, questions, or concerns about the Pain Management Special Interest Group.

# performingarts

SPECIAL INTEREST GROUP

## PRESIDENT'S LETTER

Winter Greetings! I hope that the New Year finds you well. This is a time of new beginnings and the PASIG is trying to do that for you.

Tara Jo Manal, Vice-President of the PASIG and myself, have been meeting this winter to refresh the direction of the PASIG. We will have more to report at CSM in Las Vegas, so stay tuned. We will be looking for people to help on committees and projects, so please consider volunteering.

You should have received an email in December with a link to the PASIG membership survey. If you did not, you can still participate by going to the Orthopaedic Section website at www.orthopt.org. Select the PASIG page and click on the "PASIG Membership Survey."

The PASIG is happy to announce that Brooke Winder, SPT, from the University of Southern California was selected to receive the PASIG Student Scholarship. The research is entitled "Lower Extremity Joint Kinetics During the Take-off Phase of a Grand Jeté Performed by Elite Dancers." Look for this groundbreaking research as a poster presentation at CSM 2009. The scholarship is awarded to a student who performs research that contributes to the Performing Arts body of literature. The award is $400 to help defray the cost of presenting your research at CSM. See the PASIG website or contact Amy Humphrey at AHumphrey@bodydynamicsinc.com for more details.

At CSM 2009, the PASIG programming will be on the Foot and Ankle. Plan to attend our programming on **Thursday, February 12 at 8am.** We have terrific presentations scheduled, so we look forward to seeing you there.

Besides the excellent programming, one of the most important things you can do at CSM is attend the PASIG Business Meeting. The meeting is open to all, members and nonmembers. Remember that membership in the PASIG is free to Orthopaedic Section members**. The PASIG Business Meeting will be held on Thursday, February 12 at 7am**. Breakfast and coffee will be provided!

Hope to see you at CSM in Las Vegas.
Until then, *yours in the arts.*

***Leigh A. Roberts, PT, DPT, OCS***

# APTA Performing Arts Special Interest Group

## CSM 2009- Las Vegas

## Thursday, February 12th, 2009

**8:00 AM - 8:40 AM**
Evaluation of the foot and ankle in performing artists- Measurement reliability and Ability Measures
*RobRoy L. Martin, Ph.D., PT, CSCS*

**8:40 AM - 9:00 AM**
Clinical Case- The Influence of Boots in Figure Skating
*Eric Greenberg, PT, DPT*

**9:00 AM - 9:40 AM**
Rehabilitation and Manual Therapy for the foot and ankle of Performing Artists
*The Kleven Institute*

**9:40 AM - 10:40 AM**
Clinical Cases- Flexor Hallicus Longus tendonitis, MTP plantar plate tear, Sesmoid Fx, Cuboid Subluxation and Laceration and Repair of Extensor Hallicus Longus and Brevis
*Sheyi Ojofeitimi, MPT*
*and Shaw Bronner PT, PhD, OCS*

**10:40 AM - 11:00 AM**
Clinical Case- Taping Procedures and Clinical Applications
*Jason Tonley PT, DPT, OCS*

## AAOMPT 2009 - CALL FOR ABSTRACTS

The 15th Annual Conference of the American Academy of Orthopaedic Manual Physical Therapists will be held **October 14-18 in Arlington, VA.** Interested individuals are invited to submit abstracts for presentation in slide or poster format. The AAOMPT research committee chairman must receive the abstract by **June 1, 2009**. Abstracts received after this date will be returned. You will be notified of the acceptance/rejection of your abstract in July. If you have any questions you can contact the research committee chairman, Jean-Michel Brismée at jm.brismee@ttuhsc.edu. For additional organization information, see our website, www.aaompt.org.

**CONTENT.** The Academy is soliciting all avenues of research inquiry from case-report and case-series up to clinical trials. The Academy is particularly interested in research evaluating intervention strategies including manipulative techniques using randomized-controlled clinical trials. The abstract should include 1) Purpose; 2) Subjects; 3) Methods; 4) Results; 5) Conclusions; 6) Clinical Relevance.

**PUBLICATION.** The accepted abstracts will be published in ***The Journal of Manual & Manipulative Therapy***, which has readership in over 40 countries.

**SUBMISSION FORMAT.** The format for the submitted abstracts is as follows:
The abstract must be submitted by email in MS Word format to the research committee chairman (**jm.brismee@ttuhsc.edu)** The abstract should fit on one page with a one-inch margin all around and be no longer than 300 words in length. The text should be typed as one continuous paragraph. Type the title of the research in ALL CAPS at the top of the page followed by the authors' names. Immediately following the names, type the institution, city, and state where the research was done. Please include a current email address where you can be contacted.

**PRESENTATION.** The presentation of the accepted research will be in either a platform or poster session. The slide session will be limited to 8 minutes followed by a 2-minute questions/discussion; this session will be primarily for research reports and randomized clinical trials. The poster session will include a viewing and question answer period and will be primarily for case report/series.

**PRESENTATION AWARDS.** The platform and poster presentations deemed of the highest quality of those presented at the Annual Conference will be awarded the AAOMPT Excellence in Research Award (platform), and the AAOMPT Outstanding Case Report (poster). The Awards include free tuition for the AAOMPT conference the following year.

**Jean-Michel Brismée, PT, ScD**
**Texas Tech University Health Science Center**
**jm.brismee@ttuhsc.edu**

# PRESIDENTS MESSAGE

*Amie Lamoreaux Hesbach, MSPT, CCRP, CCRT*

Hello and Happy Holidays to the Members of the Animal Rehabilitation Special Interest Group!

We look forward to seeing everyone at CSM 2009 for our Business Meeting and Devine Equine Educational Programming featuring Narelle Stubbs and Lin McGonagle. Of interest at our Business Meeting will be discussions on…

- Legislative update
- Strategic plan
- Practice analysis update
- Educational opportunities

We always need members willing to volunteer, whether as a committee chair, a committee member, a state liaison, or a special project coordinator. Our SIG is only as strong as its members! We look forward to hearing more from you in the near future.

**Till next time…**
**Amie**

## APTA Policy and Payment Forum Minutes September 20-23, 2008

**Day 1:** The opening session started with updates on changes at both the Federal and State level. In addition, the APTA's Advocacy Unit has been restructured somewhat, with 4 subdivisions to the unit: State Government Affairs, Grassroots Advocacy, Federal Government Affairs, and Payment Policy and Advocacy. This was done to help streamline some of the processes and make it easier for members to contact the right individuals with their questions and concerns.

On the Federal side, the big issue is Health Care Reform, which the APTA doesn't feel is going to happen soon, due to the upcoming Presidential and other governmental elections in November. Some type of reform will take place following the election, but in what manner is uncertain at this point, as several Congressional seats are up for election this year, so the structure and balance of Congress may change. What is known is that there may be a continued gridlock threat due to neither race having a clear majority in Congress. In order to get many of the issues that APTA wants passed, it will require bipartisan support. Another big area of concern is Medicare issues, most notably the Fee Schedule and the therapy cap/exception process. One model that is being examined as a long-term solution to the therapy cap is the "severity-intensity" model; this model is based on the severity of the patient's problems/co-morbidities, and the intensity of the therapist's interaction in setting up and implementing the treatment plan. In this case, the payment would be more focused on the work the therapist does, rather than on the outcomes that the patient demonstrates.

On the state level, there has been more progress in the health care reform area. As opposed to the federal budget, states must show a balanced budget, and so, need to look closely at health care costs, especially from Medicaid. Other areas that the states are working with include direct access, POPTS, protection from infringement by other health care practitioners (chiropractors, athletic trainers, etc), and payment issues. To assist state chapters in these areas, APTA has several resources, including information on setting up "fitness clinics/lobbying days" for marketing; direct access grants, legislative tracking and analysis, "take action" packets, and grassroots campaigns.

The next session was devoted to direct access and how to market effectively, both to physicians and the general public. Using the internet and sites such as Facebook and You Tube were discussed, as well as community programs, such as a health screening clinic, sponsoring a fun walk/run, or a booth at a local fair/event. In addition, it was discussed how important it was to talk with the payors also, to remove the blocks to payment for service without a physician referral.

The last morning session was devoted to the challenges being faced by PTs who perform EMG studies. A group of neurologists, the AANEM, has successfully lobbied to prevent anyone except neurologists from performing needle EMG's in Michigan, New Jersey, Nebraska, and Hawaii. However, PTs successfully defeated AANEM proposals in New York, Texas, Washington, and Wisconsin. Performing EMG studies is within the scope of practice for PTs, although additional training is highly recommended due to the more advanced nature of these studies.

In the afternoon, the conference broke into roundtable discussions on topics including Medicaid, Prompt Payment, Quality Measures Reporting, Worker's Comp, and Mandated Benefits. Successes, defeats, and trends in all these areas were discussed. Although there were unique challenges in several of the states, overall many of the states were facing common challenges in these areas, most of which related to fair payment for services rendered and access to services.

The last session of the day was devoted to the Stark Law (referral for profit) and the "loopholes" that physicians use for referring physical therapy in-house. Two exceptions that exist that allow physicians to refer to PT that is in their facility include "Incident-To", in which case services are billed under the physician's provider number and performed by a physical therapist supervised by the physician. The other exception is "reassignment of benefits", where a physical therapist performs the services under his/her provider number, then reassigns the payment back to the physician. This method doesn't require the direct supervision by the MD. The APTA is pushing to have physical therapy removed as an "ancillary service", in order to remove these loopholes for the physicians.

**Day 2:** The first session dealt with continued competence of physical therapists once licensed. Although most states require some form of continuing education for their licensees, the number of hours required and the way in which those credit hours are approved vary widely from state to state. The APTA and the Federation of State Boards of Physical Therapy are both examining this issue, and are discussing the idea of "continued competence" vs. "continuing education" and trying to come up with new metrics to assess the quality of continuing education courses. They also emphasized the importance of practice-based learning vs. a lecture-only format.

The rest of the morning was devoted to workshops regarding advocacy. The topics included "Organizing a Chapter Advocacy Academy", "ABC's of Hosting a Political Fundraiser", and "PT Power:Grassroots at the State Level". The workshops provided a framework for setting up an advocacy day at the state level, and provided some case studies of previous activities that states had hosted.

The afternoon session started out with infringement issues by chiropractors. In several states, chiropractors have challenged physical therapists in the use of the term "spinal manipulation," as well as skills required to perform these techniques. Chiropractors contend that they are the only practitioners skilled to perform manipulations. PTs have countered, citing their practice act does allow for spinal manipulation, continuing education courses available, and the level of the examination required for licensure.

The next session was devoted to revising your state practice act; a case study regarding Pennsylvania's recent practice act change was given, and the reasons for that change (primarily language changes to better reflect the scope of practice in today's world, such as PT's being allowed to accept referrals from physician assistants and nurse practitioners). They also outlined some of the potential hazards once the practice act has been opened and cautioned that the PT board must be alert for any other health care practitioners trying to insert unwanted language into the practice act.

The last session was devoted to infringement by athletic trainers. In Alabama and Vermont, athletic trainers sponsored bills trying to greatly increase the scope of their practice by redefining "athlete" to include persons in the industrial and educational fields as well as in the sporting arena; and how "athletic injury" was defined. After much politicking in Alabama, the legislative session adjourned in May without a vote on the bill.

**Day 3:** The final day of the conference (a half-day, actually) was dedicated to the topic of referral for profit, with physician-owned physical therapy practices being the most commonly recognized form in the area of physical therapy. One of the speakers talked about referral for profit being a specific type of conflict of interest, and the POPTS (physician-owned PT service) being a specific type of referral for profit. He also discussed strategies for campaigning against POPTS, including how to talk to those therapists who are working in that area.

Overall, this was a very informative conference and opened my eyes to several areas that I was aware of, but didn't realize just how much of an impact they can have on our profession. It behooves all of us to stay informed and be active in our state chapters, in order to understand any changes or threats that may be coming our way, so that we may educate others and hopefully protect our scope of practice.

**Respectfully submitted,**
***Lisa Bedenbaugh, PT, CCRP***

# CASE STUDY: PHYSICAL REHABILITATION OF A SHETLAND SHEEPDOG

# S/P SURGICAL REPAIR OF A CHRONIC GASTROCNEMIUS RUPTURE

# PART I

**Amie Lamoreaux Hesbach, MSPT, CCRP, CCRT**

## HISTORY OF THE CASE

Tucker is an 8-year-old, 46-pound, intact, male Shetland sheepdog who presented to the Mid-Atlantic Animal Specialty Hospital (MASH) of Huntingtown, Maryland on November 11, 2002.

Tucker's past medical history includes a left gastrocnemius tendon tear with surgical debridement and tendon repair using a "loop and lock" suture pattern to reattach the adjacent segments of tendon on May 2, 2002. An extension splint was applied for 8 weeks, with bandage changes every 2 to 3 weeks. This was an "unsuccessful repair" according to the clients.

The results of the examination by the veterinary surgeon at MASH revealed plantigrade stance with collapse and hyperextension of the hock and no pain or crepitus with passive range of motion. A thin, flaccid, and atonic tendon in the left gastrocnemius was palpated approximately 3 centimeters proximal to its tendinous insertion at the tuber calcaneus. The surgical plan included exploratory surgery of the left gastrocnemius tendon.

## INTERVENTIONS

On November 12, 2002, tendon repair of the left gastrocnemius tendon was performed with a "locking loop" to the common calcaneal tendon and deep digital flexor tendon. Postsurgically, a bi-valve fiberglass cast was applied. Tucker was discharged home with instructions for the clients to administer Cephalexin (500mg twice daily for ten days) and Rimadyl (50mg every 12 hours for four days), to focus on a weight-reduction program (with a goal of a 15 to 20 pound weight loss in 4 to 6 months), and to restrict Tucker's activity. These activity restrictions included 6 to 8 weeks of cage confinement with 2 to 3 short leash walks daily for 5 minutes or less for urination and defecation purposes only.

An appointment with the veterinary surgeon occurred on POD 20 for suture removal and a bandage change. At this time, the surgeon noted weight bearing lameness, mild discomfort of

the hock during manipulation, and tension in the gastrocnemius muscle with passive stifle extension (Figure 1).

**Figure 1. Demonstration of the integrity of the Achilles' tendon with passive extension of the stifle and dorsiflexion of the hock.**

On POD 44, Tucker returned to MASH for transition of the hard bi-valve fiberglass cast to a soft bandage. At this time, the veterinary surgeon noted lameness of the left hind limb, however, with a symmetrical appearance when compared to the other hind limb.

On POD 51, Tucker returned for a bandage change. It was noted at this time that Tucker had "partial collapse of the hock." The soft bandage was reapplied and Tucker was referred to rehabilitation by the veterinary surgeon.

## PHYSICAL REHABILITATION EVALUATION

Tucker presented to MASH Physical Rehabilitation on January 8, 2003, POD 57. On evaluation, Tucker demonstrated independence with all functional mobility and transitions. His posture while sitting was with the left hind limb tucked under with hip external rotation and stifle extension. Tucker's standing posture was with the left hind limb adducted and with toe-touch weight bearing.

At a walk, Tucker tended to collapse into a plantigrade position with an abnormal amount of hock flexion on the left hind limb on weight bearing. Orthopedic lameness scores developed by Dr. Taylor were used to evaluate Tucker's degree of lameness (Table 1). The grading scheme is as follows: 0 Normal, 1 Slight lameness, 2 Obvious weight bearing lameness, 3 Semi-weight bearing lameness, 4 Intermittent nonweight bearing lameness, 5 Continuous nonweight bearing lameness.

**Table 1. Taylor Orthopaedic Lameness Scores on Evaluation**

| Stance | Walk | Trot |
|---|---|---|
| 3 | 2 | Not tested |

Base of support measurements were also recorded (Table 2). In a supported standing weight bearing position, base of support was measured in a straight line with a flexible tape measure from the most lateral aspect of the right hind limb paw to the most lateral aspect of the left hind limb paw, and similarly in the fore limb (Table 2). The difference between these two measurements is theorized to be directly related to functional recovery. Goals were not set using the base of support measurements, as standards per breed have not yet been defined.

**Table 2. Base of Support Measurements on Evaluation (cm)**

| Fore limb | Hind limb | Difference |
|---|---|---|
| 15 | 15 | 0 |

Objective measurements of thigh and calf girth were made in a supported standing position, without plantigrade and with an approximately symmetrical stance. As these may not be accurate measurements depending upon the muscle tone of the quadriceps, hamstrings, or gastrocnemius muscles, amount of flexion or extension of the hip, stifle, or hock, amount of edema, or weight shifting from right to left, the difference between the right and left thigh and calf girth measurements was considered to be the more meaningful measurement. As well, reproducibility and intertester reliability of the measurements is assumed to be poor. These measurements are reported in Table 3.

**Table 3. Girth Measurements on Evaluation (cm)**

| | Right | Left | Difference |
|---|---|---|---|
| Thigh | 22.8 | 20.7 | 2.1 |
| Calf | 9.2 | 8.8 | 0.4 |

Tucker did not demonstrate painful signs on palpation or with functional mobility. Fibrotic thickening was noted with palpation of the left hock and metatarsal-phalangeal (MTP) joints. The left gastrocnemius muscle also had palpable atrophy with a thickened fibrotic scar area approximately at the proximal third of the muscle belly. Tucker's surgical incision was closed with scabbing, but without apparent adhesions. Cracked pads and long nail length were noted in the left hind limb as well.

Passive range of motion measurements were recorded (Table 4). "Normal" range of motion measurements are those reported by Jaegger, Marcellin-Little, and Levine, however, these "normals" are of Labrador retrievers and may not correlate to "normals" in a Shetland sheepdog (Jaegger G, Marcellin-Little DJ, and Levine D. Reliability of goniometry in Labrador Retrievers. *Am J Vet Res*. 2002;63:979-986.). Decreased accessory motion of the left hock and metatarsal-phalangeal joints was noted as well in all planes.

The data collected during the physical rehabilitation evaluation allowed for formation of a list of strengths and problems.

**Strengths included:**

1. Tucker has a supportive family willing to attend physical rehabilitation and to perform a home exercise program.

**Table 4. Range of Motion Measurements on Evaluation (degrees).**

| | Right | Left | Normal |
|---|---|---|---|
| MTP flexion | 65 | 30 | |
| MTP extension | 25 | 10 | |
| Hock flexion with stifle flexion | 105 | 105 | |
| Hock flexion with stifle extension | 30 | 40 | 39 |
| Hock extension | 105 | 110 | 164 |
| Stifle flexion | 50 | 40 | 42 |
| Stifle extension | 155 | 165 | 162 |

2. Tucker has a pleasant affect and participates in rehabilitation activities.
3. Tucker's passive range of motion of the left hock and stifle was nearly equal to the right.

**Problems included:**

1. Tucker had severe weakness and atrophy of the left gastrocnemius muscle and tendon.
2. Tucker was lame at stance and at a walk.
3. Tucker had reduced range of motion and reduced accessory motion of the left metatarsal-phalangeal joint.
4. Tucker's prior surgery had failed.
5. Tucker was overweight.

**Goals were created, which included:**

1. Tucker will have passive range of motion of the left metatarsal-phalangeal joint within 5° of the right in 4 weeks.
2. Tucker will demonstrate a symmetrical standing posture with even calcaneal heights without external splinting in 4 weeks.
3. Tucker will demonstrate a lameness score of 1, "slight lameness," at a walk in 4 weeks.

The rehabilitation plan was formulated and reviewed with the veterinary surgeon and the clients and included neuromuscular electrical stimulation (NMES), fitting and/or fabrication of an orthotic, icing and heating PRN, passive range of motion PRN, soft tissue, scar, and transverse friction mobilization, joint mobilization PRN, therapeutic exercises for increased strength and proprioception, gait training, and aquatic therapy with the Westcoast Water Walker underwater treadmill. The recommended duration and frequency of treatment was 2 times weekly for 4 to 8 weeks with re-evaluations on a monthly basis.

Watch for the remainder of this article in the April issue of *OP*.

# PES CAVUS DEFORMITIES

**Damon B. Combs, DPM**

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## INTRODUCTION

Pes cavus or cavovarus is described as a high arched foot, both in the weight bearing and nonweight bearing positions. During the gait cycle this deformity causes abnormal weight shifting to the lateral column. This abnormal weight shift can contribute to recurrent ankle sprains, peroneal tendon pathology, metatarsalgia, and fifth metatarsal stress fractures. Although the pes cavus deformity can result from Charcot-Marie-Tooth Disease (CMT) it can also be idiopathic in nature.

## ETIOLOGY

Soft tissue and muscle imbalances are thought to be the driving forces behind the pes cavus deformity. Initially weakness of the intrinsic musculature (lumbricals and interossei) occurs. The intrinsic muscles cause flexion the metatarsophalangeal (MTP) joint and extension of the interphalangeal joints. With weakness of the intrinsic muscles, the extrinsic flexors and extensors are unopposed. The long flexors cause flexion at the proximal interphalangeal (PIP) joint and distal interphalangeal (DIP) joint, while the long extensors cause hyperextension at the MTP joint. Prolonged unopposed flexion at the PIP and DIP joints will result in a retrograde buckling of the metatarsophalangeal MTP joint and further flexion of the metatarsal. Ultimately this deformity will lead to contractures, increased pressure under the metatarsal head, and the pain associated with metatarsalgia.

The next group of deformities occurs because of an imbalance in the agonist/antagonist relationship between 2 groups of muscles: (1) tibialis anterioranterior/peroneal longus and (2) peroneus brevis/ posterior tibialis. The tibialis anteriorand the peroneal longus tendons both insert on the base of the first metatarsal. The anterior tibial tendon inserts on the dorsomedial tubercle of the base of the first metatarsal and performs ankle dorsiflexion and inversion. The peroneus longus inserts on the plantar lateral tubercle of the base of the first metatarsal and plantarflexes the first metatarsal. Weakness of the tibialis anterior gives mechanical advantage to the peroneus longus, resulting in an unopposed plantarflexion force to the first metatarsal. Plantarflexion of the first ray causes a forefoot valgus and a compensatory hindfoot varus deformity. During the early stages of this forefoot driven deformity, the hindfoot varus can be flexible but become progressively more rigid over time.

The peroneus brevis primarily everts foot, while the posterior tibial tendon is the primary invertor of the foot. As the peroneus brevis muscle weakens, it gives mechanical advantage to the posterior tibialis, resulting in a dynamic hindfoot varus. The compensation to hindfoot varus is a forefoot valgus deformity. Forefoot valgus gives more mechanical advantage to the posterior tibialis, increasing the varus position of the hindfoot. Similar to as stated above, this hindfoot driven deformity will initially be flexible during the early stages but over time becomes progressively more rigid.

### Physical Examination

The foot should function so that weight bearing forces are transmitted fairly equally through the first metatarsal, fifth metatarsal, and calcaneus. However, this relationship is lost in an uncompensated cavus foot. A varus hindfoot position places increased stress on the lateral aspect of the foot and ankle. This stress can result in abnormal strain on the ligaments around the ankle and potentially contributing to lateral ankle instability. Continued strain on the lateral aspect of the ankle may eventually stretch the lateral collateral ligaments of the ankle beyond their physiologic tension, resulting in the inability of these ligaments to stabilize the ankle. Repetitive overload to the lateral aspect of the foot can also cause injury to the peroneal tendons, resulting in peroneal tendonitis, tears, or subluxation. Finally, cumulative lateral column overload can result in fifth metatarsal stress fractures.

An individual with pes cavus should have a complete lower extremity examination, with specific attention to assessing the strength of potentially contributing musculature, ankle stability, and areas of tenderness. An assessment of the deformity as to its rigidity should also be done. Being able to see the medial heel pad when the patient stands with the foot straight ahead ("peek-a-boo" sign) can be noted with a subtle cavus foot (Figure 1). A careful neurological examination needs to be performed to rule out more proximal causes of cavovarus feet such as spinal dysrhaphism or tumors.

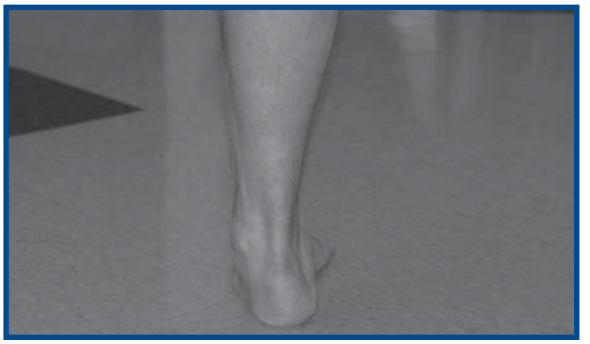

**Figure 1. A "peek-a-boo" sign occurring with a pes cavus deformity. Left foot**

**Figure 2. An anterior view of the Coleman block test.**

The deforming forces behind the cavus foot should be determined. Examination will help establish if the deformity is flexible or rigid and if the deformity is forefoot driven or hindfoot driven. The Coleman block test can be used to determine if the deformity is a flexible forefoot driven deformity or not. In this test, the first ray is placed off a one-inch the block, while the rest of the foot remains on the block (Figure 2). The observer looks at the patient from behind. When the deformity is flexible and forefoot driven the heel will get into a neutral or possibly a slight valgus position (Figure 3). When the deformity is hindfoot driven or rigid, the heel will remain in varus (Figure 4).

## SUMMARY

Subtle cavovarus deformity of the foot contributes to recurrent ankle sprains, peroneal tendon pathology, metatarsalgia, and stress fractures of the fifth metatarsal. Clinicians should especially consider this condition when evaluating patients with foot and ankle pathology that involves the lateral ankle and foot.

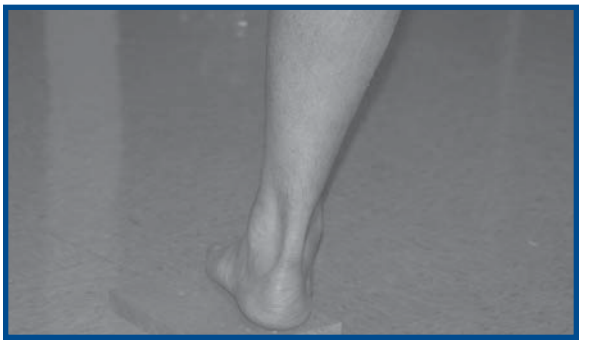

**Figure 3. The Coleman block test on the left foot demonstrating a neutral heel position that occurs with a flexible forefoot driven deformity.**

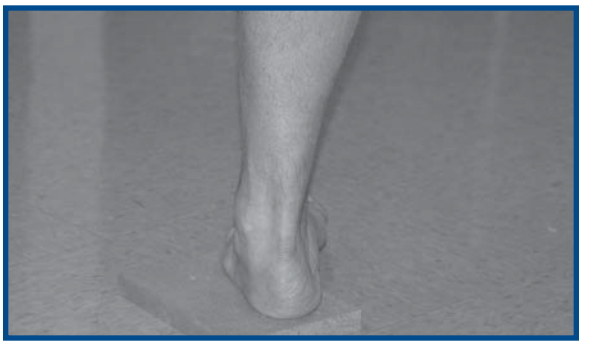

**Figure 4. The Coleman block test on the left foot demonstrating a varus heel position that occurs with a rigid or hindfoot driven deformity.**

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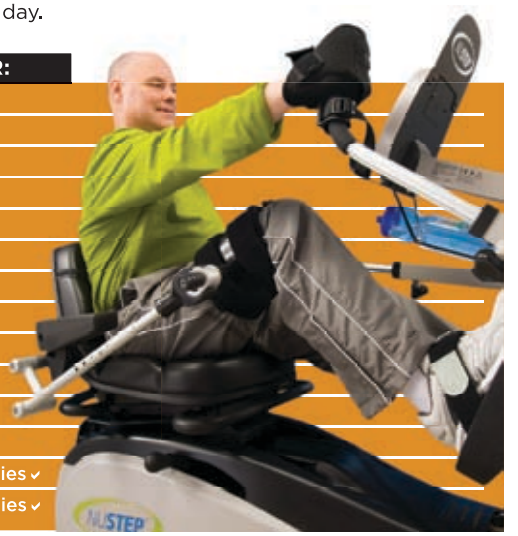

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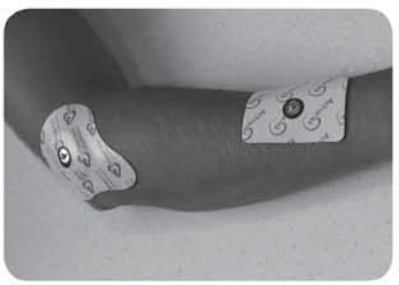


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