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Evaluation And Treatment Of A Patient Diagnosed With Adhesive Capsulitis Classified As A Derangement Using The McKenzie Method: A Case Report

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The patient signed an informed consent allowing the use of medical information and photographs for this report and received information on the institution's policies regarding the Health Insurance Portability and Accountability Act.

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Abstract

Background/Purpose: The McKenzie Method of mechanical diagnosis and therapy (MDT) is supported in the literature as a valid and reliable approach to spine injuries. It can also be applied to the peripheral joints, but has not been explored through research to the same extent. This method sub-classifies an injury based on tissue response to mechanical loading and repeated motion testing with repeated motions identified during testing used to guide treatment. The purpose of this report is to demonstrate the assessment, intervention, and clinical outcomes of a patient classified as having a shoulder derangement using MDT methodology.

Case Description: The patient was a 52-year-old female who presented with a four-week history of insidious onset left shoulder pain and a medical diagnosis of adhesive capsulitis. She presented with pain (4-7/10 on the visual analog scale (VAS)) and decreased range of motion that limited her activities of daily living and work capabilities (Upper Extremity Functional Index (UEFI) score: 55/80). Active and Passive range of motion (A/PROM) were limited in all planes. Repeated motion testing revealed her MDT classification to be derangement. Following repeated shoulder extension, immediate improvement was noted in all shoulder motions, as well as, decreased pain. Treatment involved specific exercises, primarily repeated motions, identified as symptom alleviating during the evaluation process.

Outcomes: The patient demonstrated significant improvements in the UEFI (66/80), VAS (0-2/10), and ROM within 6 visits over 8 weeks. A/PROM was observed to be equal to the R shoulder without pain.

Discussion: This patient demonstrated improved symptoms and functional abilities following evaluation and treatment using MDT methodology. The use of MDT techniques can be effective in the treatment of extremity pathology.

Background/Purpose

Research shows that the number of patients with peripheral joint injuries far exceed those that require treatment for the spine.[1] Of these peripheral joint injuries prevalence ranges from 6.7 to 46.7% per year in the general population, demonstrating the importance of finding effective evaluation and treatment methods.[2] The literature reveals that therapists commonly use specialized orthopedic testing procedures and a pathoanatomic model as a way to diagnose shoulder injuries.[3] However, specific pathoanotomic diagnosis is challenging due to questionable reliability and validity of specialized orthopedic testing.[(4-18)] This is heavily supported in the research; a previous study reported that in the diagnosis of different shoulder injuries, including adhesive capsulitis, the kappa value for correct diagnosis was 0.45 (95% confidence interval 0.37,0.54), which demonstrates only moderate agreement.[10] Failure to correlate the exact anatomical structure with the patient's presentation can complicate the diagnosis and treatment process.

Traditional treatments delivered for adhesive capsulitis based on pathoanatomic findings include corticosteroid injections, NSAIDs, manipulations, and therapeutic exercise. The literature supports that exercise is much more effective than either modalities or medications.[1, 19, 20, 21] However, 40% of patients treated with traditional therapies continue to experience pain after discharge, suggesting that other current treatment is suboptimal.[1] Assigning a sub-classification based on the tissue's mechanical response to loading, and estimating the stage of tissue healing is useful for assessment and treatment methods as an alternative to traditional approaches, and may present a treatment approach to deal with the continued deficits.[22, 23, 24]

Application of the McKenzie method (MDT) has become widely accepted as a valid form of evaluation and treatment for the spine, and has demonstrated a high degree of reliability and prognostic validity. Trained clinicians have demonstrated approximately 92% agreement on classification.[25] When these classifications were used to guide treatment, chronic pain and disability were improved in patients with spine injuries that received interventions based on directional preference.[22, 24] It has been suggested that MDT assessment methodology could also be applied effectively to peripheral joints by classifying them into posture, dysfunction, or derangement syndromes.[1] The McKenzie method is a mechanical sub-classification system based on the patient history, and the response to repeated motions and positioning rather than attempting to identify the exact pathoanatomic structure.[1] An MDT trained therapist uses the assessment to classify the patient based on their responses during movement, with repeated motion testing used to determine the patient's mechanical classification and treatment.[25]

Derangement syndrome is a classification not utilized by any other evaluation and treatment approach.[1] It is an internal disruption or displacement of tissue that mechanically deforms outer innervated structures .[26, 3, 1] Pain is referred depending on the degree of internal displacement. When the tissue is displaced to a lesser degree pain is intermittent; however, larger displacements may cause constant pain. Patients with this syndrome can experience quick changes in symptoms and mechanical presentation as a result of repeated motions. A directional preference is found when movement(s) in a certain direction reduces the patient's report of pain. It must then be determined if this reduction is maintained overtime, or if it will continue to re-occur. Conversely, motions that open the joint space may temporarily decrease pain, but may displace the tissue even further.[1] Outcomes with this type of treatment have been very successful when applied to the spine. However, there are currently only two case reports that demonstrate the effects on the shoulder, revealing limited evidence on the application of MDT to the extremities.[26, 3]

The purpose of this case report is to detail the use of MDT principles in the assessment and treatment of a patient with shoulder pain. This report demonstrates the process used to identify directional preference during evaluation with treatment based on this response causing a rapid improvement in symptoms and functional level.

Patient History and Review of Systems

The patient was a 52-year-old female who reported pain and decreased ROM after striking her left shoulder on a refrigerator four weeks prior to the initial evaluation. X-rays were negative, and her physician provided a diagnosis of adhesive capsulitis. She was subsequently referred to physical therapy for ROM and strengthening. The patient reported intermittent symptoms, made worse with overhead motions, twisting doorknobs, and opening jars. The patient reported significant functional limitations, including: limited ability to perform her usual work hanging wallpaper, limited ability to perform volunteer work due to pain with lifting, and limited ability to care for her grandchildren.

A thorough systems review was conducted (Table 1).

Overall, the patient reported good health, and denied any previous orthopedic injuries. Her main goal for therapy was to return to work, complete ADLs, and complete volunteer work without aggravating symptoms or needing assistance.

The patient provided written informed consent for participation in this case report, and for any photography or videography associated with this report.

Clinical Impression 1

Following the subjective history and systems review, it was hypothesized that the patient presented with left shoulder adhesive capsulitis (MDT dysfunction classification). This was based upon her restricted left shoulder ROM in all directions with pain. However, pain with elbow motions indicated possible involvement of the long head of the biceps

tendon. Further tests/measures to confirm the hypotheses included the Crank test, Empty-Can Test, Hawkins-Kennedy Test, and Speed's Test.

It was also planned to evaluate the patient using McKenzie methodology. This would involve identifying the body area involved, pain levels, how long the pain had been present, whether the symptoms were constant or intermittent, and if there were any positions or motions that changed the symptoms. After special testing, palpation, and observation of posture, repeated motion testing would commence. First a concordant sign would be found, defined as a movement or position that increases the patient's symptoms consistently, would be identified. The patient's report of how repeated motions in various shoulder motions affected the concordant sign would determine the mechanical classification syndrome, which would in turn guide treatment.

Examination

The patient completed the Upper Extremity Functional Index (UEFI), and received a score of 55/80, indicating moderate disability. She reported pain that ranged from 4-7/10 on the VAS. After observational analysis and palpation was conducted, a gross AROM and strength assessment was performed. Deficits were noted in AROM and strength of the left upper extremity (pain produced), leading to goniometric measurements of PROM and evaluation for end-feel and restrictions. PROM measurements were 178°(right)/ 152° (left) abduction, 180°(right)/155°(left) flexion, 101°(right)/ 70°(left) ER, and 56°(right)/ 62°(left) IR. All motions on the left presented with firm end feel and pain. The following orthopedic tests were performed to evaluate for impingement, and labral or muscular pathology: Crank Test (negative), Empty Can Test (positive) [sensitivity 0.69-

0.78, specificity 0.52-0.62[11]], Speed's Test (positive) [sensitivity 0.48, specificity 0.55[29]] and Hawkins-Kennedy Test (positive) [sensitivity 0.79, specificity 0.59[4]]. These values demonstrate the moderate specificity and sensitivity of specialized testing. This is also evidenced by research, which demonstrated that structures other than rotator cuff tendons are impinged during impingement testing.[8]

Repeated motion testing was performed as per MDT methodology. The patient performed 2 sets of 20 repetitions in shoulder flexion, shoulder ER, and shoulder extension, and scapular retraction. The patient reported how the motions affected her symptoms during and after the test, with particular interest in an effect on her concordant signs (Table 2). The patient showed rapid improvements in ROM, pain, and her concordant signs with scapular retractions and shoulder extension.

Clinical Impression 2

The patient's primary problems were body function/structural issues in the left shoulder that prevented participation in volunteer activities, work, and self-care activities. At this point in the examination the differential diagnosis consisted of adhesive capsulitis, impingement, or a rotator cuff tear. Differential diagnosis for MDT classification included trauma/inflammatory, healing, postural, articular dysfunction, contractile dysfunction, derangement, and chronic pain state.

She had tenderness to palpation, and presented with poor posture. A positive Empty Can test, Hawkins-Kennedy test, and Speed's test indicated possible supraspinatus tear, shoulder impingement, or biceps tendinitis. A gross strength assessment revealed full

strength for all shoulder motions with pain in all shoulder/elbow motions, indicating possible muscular pathology. PROM was decreased and painful with firm-end feel demonstrating probable articular pathology. When the patient performed scapular retractions and shoulder extension during repeated motion testing her ROM and pain levels for all shoulder motions demonstrated immediate improvement. The mechanical diagnosis of a derangement was assigned to the patient because of the rapid change in her symptoms during repeated movements; however, her medical diagnosis remained adhesive capsulitis. The mechanical classification system used in the McKenzie method helps to guide treatment will be performed, but does not change the medical diagnosis given by the physician.

The patient's diagnosis was determined to be ICD 9 726.0 adhesive capsulitis of the shoulder; Preferred Practice Pattern 4E: Impaired Joint Mobility, Motor function, Muscle Performance and ROM Associated with Localized Inflammation. Given the patient's few co-morbidities, intermittent symptoms, and excellent response to repetitive motion testing, she was an excellent candidate for physical therapy. Her mechanical presentation was derangement syndrome, reported to generally demonstrate a very quick response to therapy.[3, 23, 1] She was very motivated, which indicated that she would be very compliant with her HEP. Therefore, it was expected that she would make a full recovery in a short period of time.

Based on the mechanical diagnosis (derangement), the patient was sent home with scapular retractions and shoulder extension exercises to continue treatment. It was

agreed that the patient would attend therapy once per week, with the overall goals of therapy to increase A/PROM to be equal bilaterally and decreasing pain.

Interventions

The patient was provided with a thorough explanation of her condition (adhesive capsulitis), and mechanical classification (derangement), and then goals were established for physical therapy. Given her positive reaction to therapy it was decided that she did not require referral for further intervention.

Using the MDT model described above, shoulder extension and scapular retractions decreased the concordant signs, increased A/PROM, and decreased pain levels to 1/10 during the initial evaluation. Therefore, interventions were designed to favor these movements. The upper body ergometer (Cybex, Bayshore, NY) was performed as a warm up to increase synovial fluid and blood flow, and the patient then completed standing scapular retractions followed by shoulder extension with a dowel (appendix 1). Standing rows with red tubing (Theraband, Akron, OH) was added for inter-scapular strengthening and postural re-education (appendix 1). [30] It was expected that improved activation and strength of the inter$^{\xi}$-scapular musculature and postural re-education would improve scapula-humeral rhythm, shoulder biomechanics, and posture.[31] Finally, the patient was given pictures and demonstrations to convey therapy and HEP exercises, as this was her preference. This included the patient performing the given stretches 4-5 times throughout the day. She was also advised to avoid all other shoulder motions.

Due to continued improvements in ROM, pain, and function over the following sessions, it was determined that the correct directional preference had been identified. Treatment was then progressed according to the MDT model for treatment of derangements. Once the patient could perform challenging activities without aggravating symptoms, exercises were progressed to include all motions while continuing her previous exercise program (shoulder extensions, scapular retractions). The patient was instructed to continue these stretches even after discharge to prevent the derangement from re-occurring.

Outcomes

At discharge the patient had met or exceeded all PT goals, with the exception of the UEFI score. However, she did show a clinically significant improvement of 11 points the UEFI [MCID 9-10 points].[32] PROM on the involved side was equal to the unaffected side with firm end feel and no pain. VAS scores revealed that the patient experienced only mild pain (2/10) during overhead activities. All special tests were negative, demonstrating resolution of her symptoms throughout the treatment process. Since pain was infrequent, and continued to diminish, the patient was advised to continue therapy stretches at home. Table 3 compares initial and final examination findings, and charts 1-3 detail changes in ROM and pain that occurred at each visit.

Discussion:

Given the questionable reliability and validity of pathoanatomic models for diagnosis and treatment of shoulder pathology, a model based upon patient response may allow for more accurate treatment of individual patients. The MDT method utilizes sub-

classifications based on patient response to repeated mechanical loading. [1, 4-18] Literature shows that there is good inter-rater reliability among trained clinicians with 85.5% diagnosis categories remaining consistent throughout treatment.[1, 25, 27, 28] This allows the therapist to determine treatments that demonstrate symptom provocation and alleviation, eliminating the need for determination of a specific affected anatomical structure. This may be particularly beneficial when treating adhesive capsulitis, as this is a commonly misdiagnosed condition.[10] With the application of MDT methodology, this patient was classified as having a shoulder derangement rather than a dysfunction such as adhesive capsulitis, based upon her rapid symptomatic improvement following repeated movements.

There is conjecture about the pathoanatomic basis of obstructed movement in peripheral joints. In a cadaveric study, it was revealed that intra-articular intrusions (deformable space fillers composed of fat pads and fibroadipose meniscoids) could proliferate within joints.[33] It is thought that cartilage fragments, joint capsule, a portion of the labrum, or any other component of the joint can become interposed between the joint surfaces causing blocked movement and abnormal stress on peri-articular structures.[1] Pain is derived from deformation of the joint capsule and supporting ligaments when the normal resting position is disturbed. These have been suggested as a potential cause for derangement in the extremities, but this still requires much investigation.[3, 33] Therefore, it is proposed that due to the nature of derangements, performing exercises that go against the identified directional preference can prevent the tissue from re-aligning itself, or can cause the tissue to become displaced even further.[1, 23, 26]

The patient made excellent improvements in all areas, and was able to return to work and all ADLs during the six weeks of outpatient therapy. It was felt that primarily focusing on stretches and performing therapy exercises that favored the directional preference identified during repeated motion testing was appropriate given the patient's positive response throughout the course of treatment. She demonstrated dramatic improvements in shoulder A/PROM (reveled through goniometric measurements), pain levels (VAS scores), and functional capacity (UEFI scores). This allowed the patient to return to her work hanging wallpaper, and complete the required activities involved in taking care of her grandchildren. She was even able to return to volunteer work that required heavy lifting and overhead motions. Notably, the patient was very happy with her progress, and felt that she had met all personal goals. Other factors that may have positively influenced her outcomes included a short duration of symptoms since onset, high levels of self-motivation, and overall good medical health.

The patient was only seen for six times over eight weeks due to her personal schedule; it is unclear if outcomes would have been affected by seeing the patient more often during the course of treatment. Another issue was the nature of the patient's work, where she continued to perform flexion-based activities to hang wallpaper often throughout the day, which would aggravate her symptoms. While alleviated by the stretches given, this may have prolonged the treatment process. Stretches incorporating ER were also added prematurely on visit four with aggravating affects, which may have also interfered with

patient outcomes at discharge, although the patient's symptoms returned to baseline rapidly after discontinuing ER on visit 5 (Figures 4-6).

These outcomes suggest that the use of MDT techniques can be effective in the treatment of extremity pathology. The ability to establish a cause-and-effect relationship is limited as this is a report of a single case, and there is no long-term follow-up available. However, the rapid improvements that were observed suggest that the use of MDT methodology to classify shoulder pain based on directional preference may be a useful approach to managing adhesive capsulitis. More research is required comparing the outcomes of patients treated with MDT methodology compared to traditional therapy methods, and to determine if this is a valid approach for treatment of the extremities. Overall, this method offers another approach to treating extremities when the pathoanatomic structure affected is unclear.

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Tables, Figures, Appendices:

Table 1.

Cardiovascular/Pulmonary	
Unimpaired	Normal
Musculoskeletal	
Impaired	Gross range of motion (ROM) impairments in left shoulder with pain.
	5/5 Strength for all shoulder motions bilaterally; however, pain produced with abduction, internal rotation (IR), and external rotation (ER) on the left.
	5/5 Strength for all elbow motions bilaterally; pain with left elbow flexion, extension, pronation, and supination
Neuromuscular	
Unimpaired	Normal
Integumentary	
Unimpaired	Normal
Communication	
Unimpaired	Normal

Table 2.

Repeated Motion Testing	**Initial Evaluation Results**	**Final Evaluation Results**	**Psychometrics**
Scapular Retractions	During: pain decreased, ROM increased	Full ROM, no pain	Good inter-rater reliability among trained clinicians[1,]
	After: better		

	ROM/pain (1/10)		[26, 28, 29]
Shoulder Flexion	During: NE pain, ROM increased	Not tested	85.5% diagnosis categories remained consistent over the treatment episode[26]
	After: NE pain/ROM		
Shoulder ER	During: pain increased, NE ROM	Not tested	
	After: ROM/pain worse after		
Shoulder Extension	During: pain decreased, ROM increased	Full ROM, no pain	
	After: Better ROM/pain (1/10)		
Mechanical Diagnosis Hypothesis		**Confirmed/Rejected**	
Derangement Syndrome		Improvements in ROM/pain/functional status with repeated scapular retractions/shoulder extension confirm hypothesis	

***NE= no effect**

Table 3.

Outcome Measurements	**Initial Visit**	**Final Visit**	**Goals**
UEFI (function)	55/80	66/80	75/80 (improved but not met)
VAS (pain)	Current: 4/10	Current: 0/10	0/10 (goal met)
	24 hour max: 7/10	24 hour max: 2/10	No goal made specifically about this
Empty Can Test	Positive	Negative	Goal met
Hawkins-Kennedy Test	Positive	Negative	Goal met
Speed's Test	Positive	Negative	Goal met
Gross Strength Assessment	5/5 all shoulder motions (abduction, IR, ER painful)	5/5 all shoulder motions (mild pain only with ER)	No pain with resisted motions (goal met)
	5/5 all elbow motions (flexion, extension, pronation, supination painful)	5/5 all elbow motions	0/10 pain with resisted motions (goal met)
AROM	Gross limitations all shoulder motions with pain	AROM equal bilaterally with no pain	AROM on left equal to right with 0/10 pain (goal met)

PROM	Right: 178 abduction 180 flexion 101 ER 56 IR (firm end feel)	Right: 178 abduction 180 flexion 101 ER 56 IR (firm end feel)	No goal addressed this
	Left: 152 abduction 155 flexion 70 ER 62 IR (pain, firm end feel)	Left: 177 abduction 178 flexion 99 ER 62 IR (firm end feel, pain-free)	Full PROM (when compared to right) with 0/10 pain (goal met)

Figure 1.

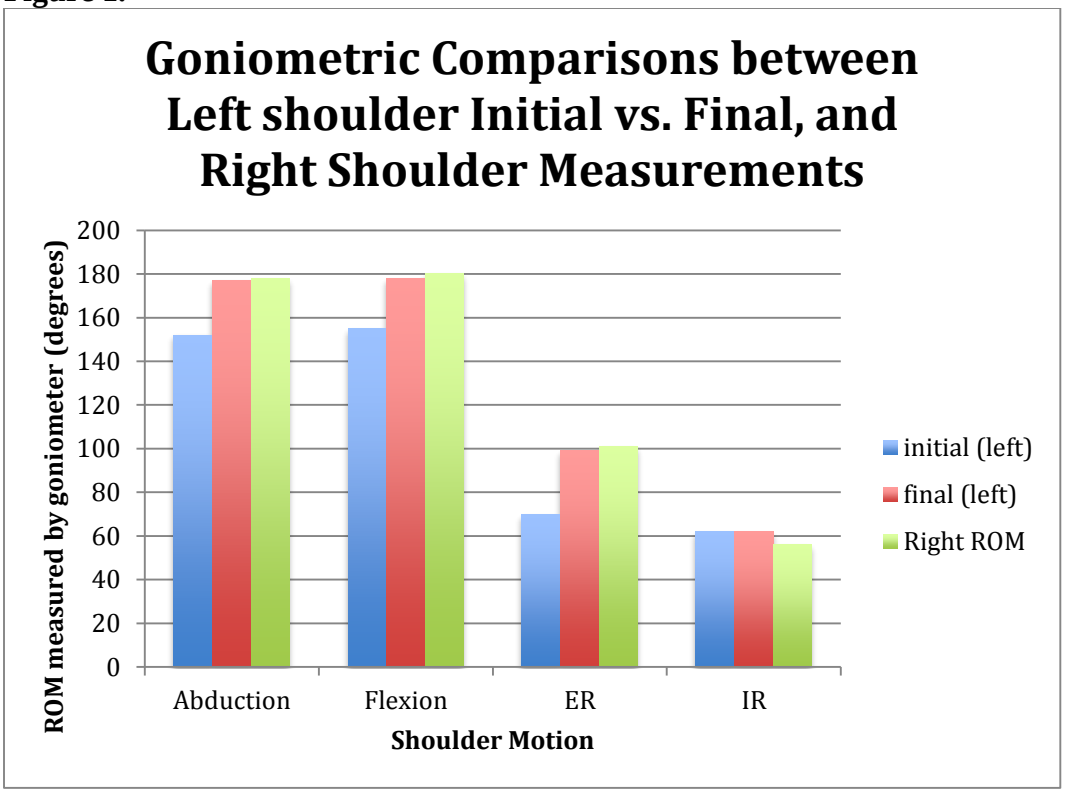


Figure 2.

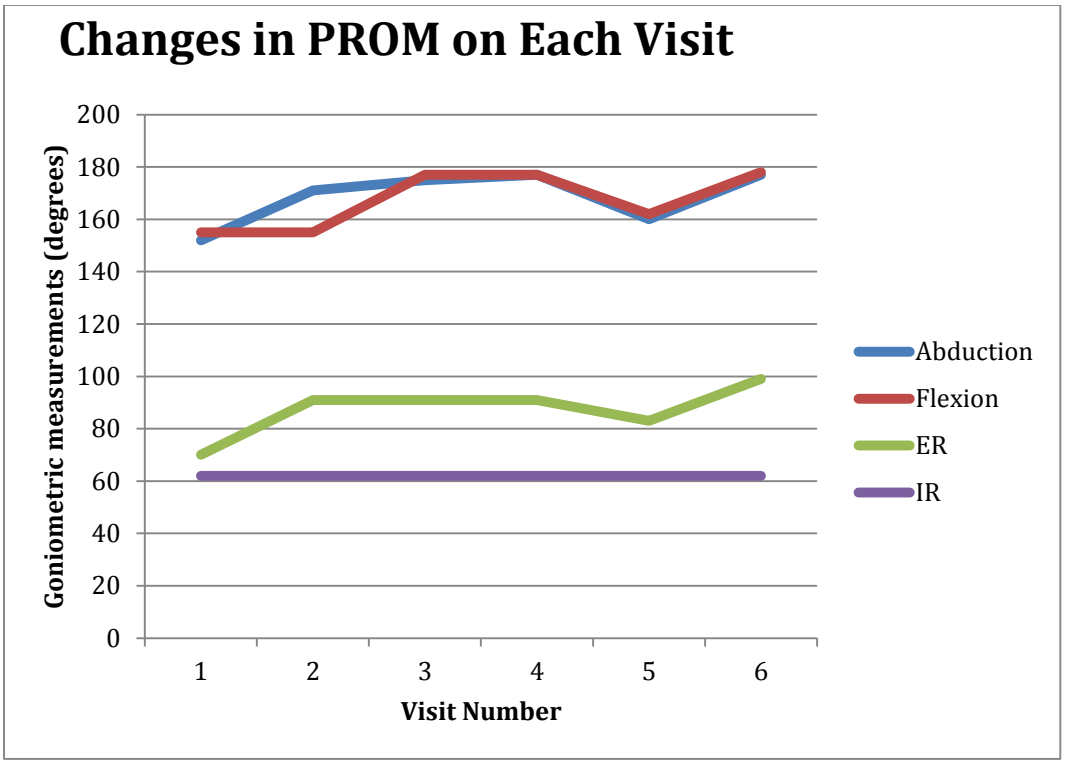
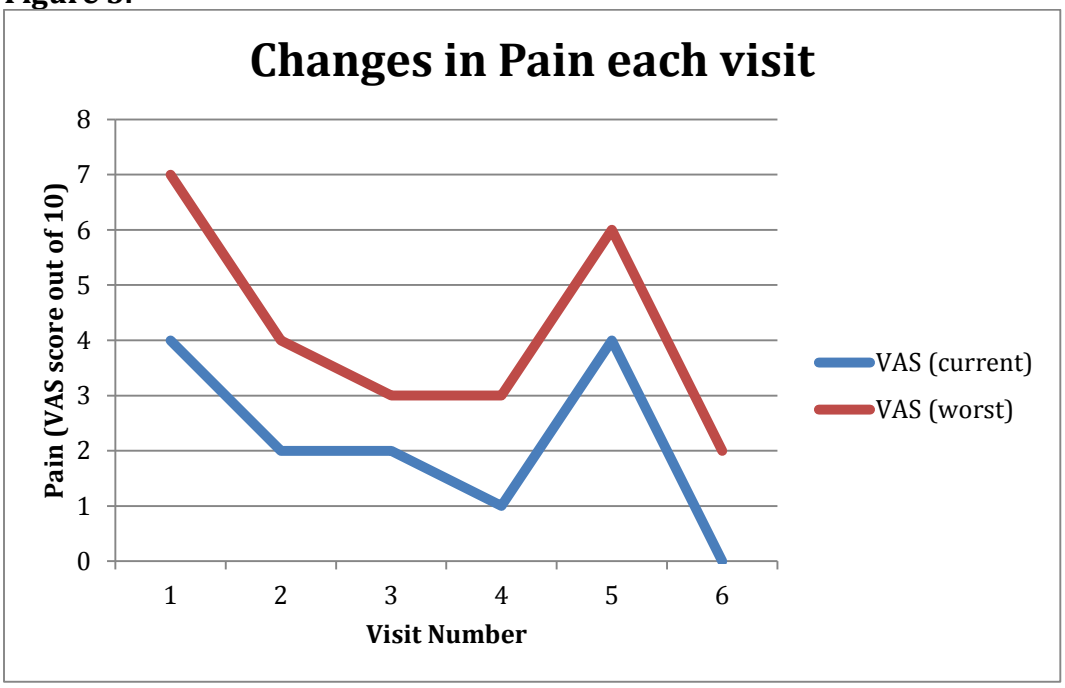


Figure 3.



Appendix 1.

Intervention	Explanation	Frequency

Shoulder Extension 	-Standing position -Hold dowel with left arm posteriorly -Push dowel backwards to extend the left shoulder -2 sets, 20 repetitions	Performed 4-5 times per day (HEP), and throughout therapy sessions. Instructed to perform during times when shoulder felt stiff and sore (post-aggravating activities).
Scapular retractions 	-Standing position against wall (foam roll in between scapula against the wall) -Holding cervical spine in neutral alignment, perform scapular retractions against the foam roll -2 sets, 20 repetitions	Performed 4-5 times per day (HEP), and throughout therapy sessions. Instructed to perform when symptoms were aggravated or when sitting with poor posture for long periods.
Upper Body Ergometer (UBE)	-Sit in UBE chair, and hold onto handles -Switch between pedaling arms forward and backward every 2 minutes -Focus on good postural alignment throughout	Performed for 8 minutes at the beginning of every physical therapy session.
Standing Rows with scapular retractions (Theraband)	-Stand maintaining good postural alignment -Hold onto a Theraband that is hooked into the wall (progressed from red to green)	Performed 2-3 times per day at home, and once during the physical therapy session.

	-Bend elbows and pull back to stretch the Theraband keeping the arms close to the side of the body -Focus on scapular retraction at and range	

Equipment Information:

1. Upper body ergometer-Cybex
   Model number: BKCY-005
   Lumex, Inc.
   160 Spence Street
   Bay Shore, N.Y. 11706
2. Wooden dowel-Lowe's
   Model number: 436976
   Madison Mill 1.375 in x 72 in round poplar dowel
   4101 Charlotte Ave
   Nashville, TN 37209
3. Foam Roll
   Model number: 1507067
   CanDo
   Fabrication Enterprises
   PO box 1500
   White Plains, NY 10602
4. Theraband
   Model number: PO2883
   The hygienic corporation
   1245 Home Ave.
   Akron, OH 44310