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Outpatient Physical Therapy Management of a Patient Following Rotator Cuff Repair

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by

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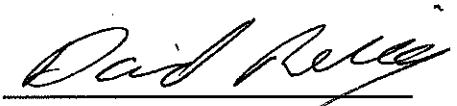
This Scholarly Project, submitted by Brianna Erickson in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

(Graduate School Advisor)



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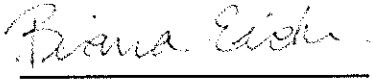
Signature 

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ABSTRACT

This case report describes a 12-week physical therapy treatment of a patient that arrived to physical therapy following a rotator cuff repair of the right shoulder. The patient was a 43-year-old male who had a torn rotator cuff of the right shoulder following a farming accident. The purpose of this report is to describe the presentation, intervention, and outcomes of the 12-week treatment. **Description:** Treatment for this patient included soft tissue mobilizations, joint mobilizations, stretching, and strengthening. **Outcomes.** Following treatment, the patient gained strength and range of motion, but he was unable to reach full range of motion and had moderate deltoid and upper trapezius compensation. **Discussion:** Treatment focused on manual therapy and therapeutic exercise to increase patient range of motion, strength, and decrease pain, as well as the use of different verbal, visual, and tactile cuing do activate the proper musculature.

Key Words: rotator cuff repair, shoulder pain, decreased range of motion, decreased strength

CHAPTER I

Literature Review

Rotator cuff pathologies are the most common cause of disability within the shoulder. Attempting to determine the prevalence of full-thickness tears, involving the entire thickness of the tendon, and partial thickness tears, incomplete tears of the tendon, investigators used cadaver specimens as well as imaging techniques in both asymptomatic and symptomatic patients.[1] They found that full-thickness tears were prevalent in less than 5% of 500 cadaver specimens. However, another cadaver study showed full thickness tears in 17% of their 235 cadavers, finding that 6% of the full-thickness tears were found in specimens less than 60 years old and 30% in older than 60 years old. Using MRI and ultrasound imaging, investigators looked at shoulders of asymptomatic patients. They found approximately 34% prevalence using MRI; ~15% were full thickness and ~20% were partial thickness. It was found that the prevalence of full thickness and partial thickness tears in patients over 60 years old were 28% and 26%, respectively, and in patients between the ages of 40 years old and 60 years old were 4% and 24%, respectively. They had found that none of the individuals less than 40 years old had full thickness tears, but 4% of individuals had partial thickness tears. Using ultrasound imaging, Tempelhof[1] and colleagues found the prevalence of full thickness tears in 23% of asymptomatic patients, and 50% of those individuals were over the age of 80 years old.

Several risk factors are involved in predisposing individuals to developing a rotator cuff tear, with increasing age being the most important.[1] Other risk factors include smoking, hypercholesterolemia, and family history. Nicotine vasoconstricts and decreases the delivery of oxygen to the tissues, resulting in lower oxygen to the critical zone, a zone with decreased blood supply in the supraspinatus and infraspinatus tendons, and increasing the risk of tearing. Smoking has also been shown to be associated with increased tear size, decreasing the healing ability after repair, and decreasing clinical outcomes. Hypercholesterolemia has shown to decrease the elastic properties within the tendon, causing a detrimental effect on the baseline biomechanical properties of the tendon. Family predisposition has shown to increase the risk of rotator cuff tears. They conducted a sibling study were 129 siblings were evaluated in a cohort of 205 individuals diagnosed with a full thickness tears. They found that the relative risk of full thickness tears in siblings compared with controls (spouses of the patients) was 2.42. When evaluated 5 years later, siblings were more likely to show a progression of tear size (62.9%) vs controls (22.1%).[1]

Rotator cuff tears may be caused by acute traumatic injury or degenerative changes due to decreased tissue vascularity, and impingement syndrome, where the tendon is being compressed against the acromion. Patients usually will have primary complaints of shoulder pain aggravated by overhead activities, localized in the anterolateral region of the shoulder, and pain worse at night, along with difficulty sleeping.[2] Provocative physical exam tests can also be used to determine rotator cuff pathologies, but specific special tests have been found more reliable in determining rotator cuff pathologies.

Jain NB, et al.[3] conducted a cohort study using 208 patients to determine reliability of shoulder special tests in determining a rotator cuff tear, using MRI as the gold standard. Patients completed a standardized physical exam including a physician and an orthopedic physician assistant. Special tests that were performed included lift off test, passive lift off test, belly-press test, belly-off sign, bear hug, external rotation lag sign at 0°, external rotation lag sign at 90°, Hornblower's sign, full can test, drop arm test, Jobe's test, Neer's sign, Hawkin's sign, bicipital groove tenderness, and Speed's test. For tests of supraspinatus tears, it was determined that Jobe's test had a sensitivity of 88% and a specificity of 62%. The full can test had a sensitivity of 70% and specificity of 81%. For tests involving infraspinatus tears, it was determined that the external lag sign at 0° had a specificity of 98%; Hornblower's sign had a specificity of 96%. Overall, the study found a high sensitivity and specificity for Jobe's test and the full can test, making them the most reliable in testing for supraspinatus tears. The Lag sign and the Hornblower's sign had high specificity and low sensitivity, meaning they are useful if the test is positive, indicating a high likelihood of a rotator cuff tear, or if a test is negative to rule out the disorder.

There are variations in the post-operative rehabilitation protocol, especially in determining the length of immobilization in patients. Some surgeons prefer a protocol with little immobilization to improve early shoulder mobility, and some surgeons prefer longer periods of immobilization to protect tendon healing and decrease risk of re-tearing. Hsu JE, et al.[4] discuss the evidence for immobilization following rotator cuff repair. The tendon-bone junction is the primary area that is most affected in rotator cuff pathologies, and it is made up of 4 zones. Zone 1 is made up of primarily type I

collagen. The transition from zone 1 to 2 is made up primarily of type II and III collagen and a change in the composition of extracellular matrix. Zone 3 consists of collagen and extracellular matrix similar to cartilage, and finally, zone 4 is the final transition and is similar to bone.

Following a tendon repair, the healing follows 3 phases. Phase 1 (inflammatory phase), occurs during days 4-7, when the inflammatory cells remove tissue debris, and a callous is formed of types I and III collagen. In the second phase (proliferative/reparative phase), the collagen and extracellular matrix components are deposited. Finally, in the third phase (remodeling phase), there is increased order of collagen structure into a linear pattern. The third phase begins approximately 6-8 weeks following tendon repair. Tendon healing requires controlled loading, therefore, they found that early passive range of motion does not increase risk of re-tearing, as long as the protocol isn't too aggressive. Although they found early range of motion increases the short term range of motion, there was no evidence for long term benefit.

A systematic review conducted by Gallagher BP, et al.[5] reviewed early vs delayed range of motion following arthroscopic repair using PubMed, Cochrane Central Register of Controlled Trials, and EMBASE. The reviewed covered 6 articles, three reported a significant increase in functional score within the first 3-6 months with early mobilization, but only one showed a continued difference at the final follow-up at 15 months. Range of motion was significantly improved with early mobilization in four of the articles in the first 3-6 months, but only one showed a continued significant difference at the final follow-up. They concluded that while early mobilization protocols showed initial improvements, there was no significant difference between the groups at one year.

Though it was not significant, they saw a trend in increasing re-tear rates with patients who had larger rotator cuff tears.

Houck DA, et al.[6] conducted a systematic review of meta-analyses using Pubmed and Chocrane Library databases, looking at early versus delayed mobilization. They reviewed seven meta-analyses involving 5896 patients. There was no evidence that immobilization was better than early mobilization. Most of the studies found that early mobilization increased early range of motion and reduced recovery time. Overall, they found that the meta-analyses suggested early range of motion improves range of motion but increases the risk of re-tearing. There was evidence of tear size influencing the choice of immobilization protocol, suggesting that larger tear size required delayed mobilization to ensure adequate healing. Therefore, when considering rehabilitation protocol, it is necessary to take into consideration the size of the tear.

Rehabilitation protocols following an arthroscopic rotator cuff repair vary greatly. Thigpen CA, et al.[7] formulated a consensus statement on rehabilitation created by the American Society of Shoulder and Elbow Therapists in hope of aiding clinical decision-making during rehabilitation. By reviewing various randomized control trials, they have developed a consensus statement suggesting a 2-week period of immobilization for tendon healing, followed by a staged introduction to passive range of motion starting at 2 weeks post-op. At 6 weeks, restoration of active range of motion may begin, with gradual strengthening beginning at week 12. Many surgeons support strict immobilization for 6 weeks.

Thigpen CA, et al.[7] believe a long period of immobilization will create a false sense of confidence with little evidence to support early vs delayed range of motion.

They feel it is unnecessary to immobilize for such a long period of time. It was found that 17.3% of patients became noncompliant between weeks 6-12 when limited to a sling and one range of motion exercise for an entire 6 weeks.[7] However, early range of motion protocols can strain tissue and increase the risk of failure. Failure rates were shown to increase in patients with a larger tear size, poorer quality tissue, older age, fatty infiltration and atrophy, smoking, high cholesterol, and diabetes. All these factors should be considered when developing a patient's range of motion protocol, and there should be adequate consultation between the physical therapist and the referring surgeon.

In conclusion, evidence shows that individuals are at an increased risk of rotator cuff tear later in life, as well as with other co-morbidities such as history of smoking, high cholesterol, and family history. Patients with rotator cuff pathologies will demonstrate pain with overhead activities, pain at night, and pain in the anterolateral aspect of the shoulder. Early mobilization was found to produce a significant increase in early range of motion, however, early mobilization didn't have a significant difference in the long term. Rehabilitation protocols should also consider the size of the tear, because larger tear size shows a higher risk of a re-tear.

CHAPTER II

CASE DESCRIPTION

The patient was a 43-year-old male who presented to physical therapy five days following a rotator cuff repair to the right shoulder on 7/31/19. He had injured his shoulder when he was driving a utility vehicle on his farm when he hit a pothole jerking the steering wheel. The jerk of the steering wheel requiring his shoulder to stabilize it caused the tear to his rotator cuff. The patient works on a farm with his father and is a volunteer firefighter, requiring high demand use of his shoulder, so it was important to the patient to regain strength and range of motion to be able to complete all farming and firefighting duties.

Examination, Evaluation and Diagnosis

During the initial examination, the patient reported his current pain at 7/10 on a visual analogue scale, 8/10 at its worst, and 4/10 at its best. He stated that he was using ice to decrease the pain, but any shoulder movement increased his pain. Upon observation, the patient was wearing a Breg slingshot shoulder brace, and he had four arthroscope holes with a waterproof dressing that had not been changed. He had bruising over the right chest and swelling that extended to the distal bicep. He exhibited a forward shoulder posture. His shoulder active and passive range of motion (Tables 1 and 2). Active range of motion on the right was not tested due to protocol.

Table 1. Left Shoulder AROM at initial examination.

	Left
Flexion	160 degrees
Extension	60 degrees
Abduction	160 degrees
Internal Rotation	70 degrees
External Rotation	90 degrees

Table 2. Shoulder PROM at initial examination.

	Right	Left
Flexion	30 degrees	160 degrees
Extension	All other motions not tested due to pain and recent surgery	60 degrees
Abduction		160 degrees
Internal Rotation		70 degrees
External Rotation		90 degrees

The patient's strength was graded as 4/5 in all shoulder motions in the left upper extremity, but strength testing on right extremity was deferred due to recent surgery and protocol restrictions. The patient had increased tenderness over his proximal humorous. Special testing was deferred due to his recent surgery. The patient completed Focus On Therapeutic Outcomes, a web-based outcome measure that is capable of reporting the patient's initial functional status, their predicted functional status, and their discharge functional status based on the patients other co-morbidities.[8] The patient scored 26 out of 100 and had a predicted score of 69 out of 100.

Following the initial evaluation, it was found that the patient had decreased range of motion, decreased strength, and increased pain due to the recent rotator cuff repair. Because of this, the goals for this patient focused on increasing strength and range of motion, along with decreasing pain to improve the patient's functional mobility.

CHAPTER III

INTERVENTION

The patient was seen for one hour, three times a week for 18 weeks. The course of treatment followed an early ROM protocol written out by the patient's surgeon. The first three weeks focused only on passive range of motion below 90 degrees, scapular retraction, and pendulum exercises to decrease muscle tension and stiffness. Weeks 3-6 included AAROM using overhead pulleys and a wand, allowing the patient to begin to use his involved UE to move through his available range.

Rotator cuff muscle strengthening was introduced in week 7, starting with shoulder isometrics. Strengthening progressed slowly through weeks 7-18, including wall slides to improve shoulder ROM and learning to move his upper extremity against gravity. We also included upper body ergometer exercises, resisted shoulder AROM, body blade exercises, and TheraBand exercises. Strengthening exercises included AROM in both antigravity and gravity eliminated positions, using dumbbells and TheraBands, to increase strength and ROM for functional mobility. Scapular strengthening was included with resisted scapular rows, latissimus pull downs, serratus anterior punches in supine, and modified push ups with a plus on an elevated surface.

In week 11, ballistic exercises were used to increase strength and stability of the RTC musculature. Ballistic exercises included chest passes, first with an unweighted

ball and then progressing to a 4-pound medicine ball. They were progressed further by catching the ball laterally which put the shoulder at an unstable, vulnerable position.

Throughout the course of treatment, modalities such as ultrasound and H-wave were used to decrease pain. Ultrasound was given for 8 minutes at 1.2 W/cm2 as the intensity with a 50% duty cycle to decrease deep heat due to inflammation within the joint. H-wave is a device that stimulates smooth muscle fibers within the lymphatic system to reduce/eliminate chronic pain and inflammation. It is thought to work through interstitial fluid shifts that are produce by low frequency through direct stimulation of smooth muscles, and it is also achieved by producing an anesthetic/analgesic effects through high frequencies by affecting the sodium pumps within the nerve.[1] The H-wave set up included four electrodes connected to two different channels. The first channel was place on the anterior and posterior shoulder joint, and the second channel was placed over the upper trap and deltoid. Both channels were set to high frequency and 2.7 intensity for 10 minutes.

Once the patient began AROM exercise, he had notable upper trapezius muscle activity in an attempt to compensate for UE ROM especially in flexion, scaption, and abduction. Different techniques were used to try and decrease the upper trap activation, such as mirror therapy, kinesiotape to inhibit the upper trapezius, different positioning to eliminate gravity, and verbal and tactile cuing. The patient also presented with capsular tightness, so in week 11 we began grade III-IV glenohumeral posterior and inferior mobilization to decrease capsular tightness.

CHAPTER IV

Outcomes

The patient was discharged on 12/6/19 and his strength and ROM at discharge are shown in Tables 3 and 4.

Table 3. Shoulder AROM at discharge from physical therapy.

	Right	Left
Flexion	155 degrees	160 degrees
Extension	70 degrees	60 degrees
Abduction	150 degrees	160 degrees
Internal Rotation	50 degrees	70 degrees
External Rotation	40 degrees	90 degrees

Table 4. Shoulder Strength at discharge from physical therapy.

	Right	Left
Flexion	4+/5	5/5
Abduction	4+/5	5/5
Internal Rotation	5/5	5/5
External Rotation	4+/5	5/5

Following the 18 week treatment, the patient returned back to full firefighting and farming duties with no restriction, he was pain free, he had increased shoulder ROM, and increased shoulder strength. The patient had a final FOTO score of 96/100 which showed great functional improvements in comparison to his initial score. The patient was encouraged to maintain a gym program and was given scapular rows, shoulder

extension, flexion, abduction, external rotation, and internal rotation as suggested exercises to continue to further increase shoulder strength and ROM.

CHAPTER V

DISCUSSION

The patient made progress in shoulder strength and ROM throughout the course of treatment. Though he didn't not achieve full shoulder ROM or strength, the patient had plateaued the last two weeks in both areas, and due to his return to full functional duties the last two weeks of treatment, it was decided to discharge the patient with a gym program that will allow the patient to continue to progress with strengthening. He is expected to return to full functional duties of both farming and firefighting.

Reflective Practice

Since I arrived at the clinic 9 weeks into the patient's 18-week treatment session, I wasn't able to conduct the initial evaluation myself. However, based on the patient's age and lifestyle, I would ask questions pertaining to what his job requirements are, the amount of weight he has to lift/positions he has to lift in, and the mechanism of injury. Because the patient's job was manual labor, I would want to know this information to design a plan of care that focuses on his day to day functional tasks, making sure he is safely able to return to work without increased risk of re-tearing.

In the first few weeks of treatment, I would like to have focused solely on scapular movements. When I arrived, the patient struggled with scapular muscle activation, specifically with scapular adduction. He relied heavily on his upper trapezius muscles to compensate with shoulder flexion and abduction, and I believe early

intervention of scapular movements, focusing on correct trapezius activation to adduct the scapulae, the patient would have increased proper shoulder movements without upper trapezius activation.

Along with focusing on scapular movements, I would have prioritized patient education to understand the importance of proper muscle activation for shoulder movements. While he was able to get close to full range of motion, the quality of motion was poor, and I think with patient education focused on the importance of quality of movement, i.e. proper shoulder range of motion will decrease the risk of impingement and tendon re-tear in the future, would have reinforced the focus on small, proper scapular movements early in the treatment plan.

At the time, neither my clinical instructor nor I were certified in dry needling. However, dry needling has shown to reduce muscle tension and activation, which I believe would have been an effective treatment in reducing the patient's upper trapezius activation with shoulder overhead elevation[9]. With early detection of upper trapezius activation, I would have liked to focus on other modalities as well, such as soft tissue massage, trigger point release, and a kinesiotape technique for muscle inhibition.

When I arrived at the clinic, I performed those modalities, however, I would have liked to perform them much earlier in the treatment session to focus on high quality movements as soon as possible, before habits were formed. Other techniques I would have liked to focus on early in the treatment plan would be strengthening in a gravity eliminated position, emphasizing each repetition on proper muscle activation. I believe if the patient was able to feel the proper muscle activation in a gravity eliminated position, the patient would have transitioned to an against gravity position much easier.

Areas for further evidence included the use of therapeutic ultrasound. When I arrived at the clinic, my clinical instructor was using therapeutic ultrasound to decrease pain in the patient's shoulder, and we continued to use it if the patient complained of pain or soreness. I would have liked to look into the research to determine whether or not it had an effect on decreasing pain or if there would be a more cost and time effective treatment of his pain.

Overall, the cost of treatment was high due the extensive time in physical therapy and high frequency of visits. The patient was seen for 18 weeks at 3 times per week, and I think the number of visits could have been significantly reduce by focusing on quality movements and proper muscle activation early in the plan of care. As stated early, the patient showed poor quality of movements later on in his plan of care, so a lot of time was spent trying to retrain his muscle activation, regressing to gravity eliminated movements and decreasing resistance. If adequate muscle activation would have been established early in the plan of care, the frequency of visits could have decreased, and the patient could have been discharged much earlier.

In the future, I will emphasize fundamental movements early in the plan of care, ensuring proper muscle activation and quality movements. Without a focus on proper muscle activation, the plan of care is affected closer to discharge and ultimately can cause a setback in the plan of care, as it did for this patient. This case has taught me to find the learning style that best fits each patient. The patient in this case struggled with body awareness which made it difficult for him to activate the appropriate muscles. I found that the patient learned and understood best with tactile stimulation. By understanding his learning style early in his plan of care could have led to appropriate

muscle activation and muscle memory to create high quality movement. I look forward to continuing my education in the use of different modalities, the treatment of various orthopedic conditions, and pain management to expand my knowledge to provide the best possible care for my future patients.

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