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The Effect of an Accelerated Protocol on Patients Receiving Rotator Cuff Repair: an Outcome Study

Jerret Hopstad

University of North Dakota

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THE EFFECT OF AN ACCELERATED PROTOCOL ON PATIENTS RECEIVING ROTATOR CUFF REPAIR: AN OUTCOME STUDY

by

Jerret Hopstad
Bachelor of Science in Physical Therapy
University of North Dakota, 1997

An Independent Study
Submitted to the Graduate Faculty of the Department of Physical Therapy School of Medicine University of North Dakota in partial fulfillment of the requirements for the degree of Master of Physical Therapy

Grand Forks, North Dakota
May 1998
This independent Study, submitted by Jerret Hopstad in partial fulfillment of the requirements for the Degree of Master of Physical Therapy from the University of North Dakota, has been read by the Faculty Preceptor, Advisor, and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

(Beverly Johnson
(Faculty Preceptor)

(Beverly Johnson
(Graduate-School Advisor)

(Chairperson, Physical Therapy)
PERMISSION

Title               The Effect of an Accelerated Protocol on Patients Receiving Rotator Cuff Repair: An Outcome Study

Department         Physical Therapy

Degree             Master of Physical Therapy

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ABSTRACT

The purpose of this study is to establish the outcome of rotator cuff repair and rehabilitation for St. Alexius Medical/Bone and Joint Center, Bismarck ND, using standardized measurement which both third-party payers and providers can utilize. Thirty-seven rotator cuff repairs (36 patients) performed between September 1995 and December 1996 were reviewed retrospectively. One subject was excluded because therapy was completed outside of St. Alexius Physical Therapy. There were 22 males (61 percent of cases) and 13 females (14 shoulders) included in the study. The average age patient was 62.06 years, ranging from 38-80 years, with a median age of 60.5. The mean number of outpatient visits needed for rehabilitation was 7.51 with standard deviation of 3.28 and a median of six visits. Twenty-four of the 32 (75 percent) patients analyzed achieved good-to-excellent results, while requiring an average of 6.75 physical therapy visits. Eleven subjects reported an average of 96.32 percent satisfaction with their functional level one year after surgery. From the above results, it can be concluded for this health care facility, the combination of surgical repair and rehabilitation of rotator cuff tears has produced excellent clinical outcomes.
CHAPTER I

INTRODUCTION

Health care is one issue that affects everyone. Rarely a day goes by without some reference to our Nation’s health care in the media. There are obvious reasons why health care is a common worry for many Americans. Health care costs in the United States have increased from $12 billion in 1950 to an estimated $800 billion in 1992, and projected to reach $1.5 trillion by the year 2000.¹ Per capita health care costs in the U.S. are higher than in any other industrialized country in the world. Although we are considered to be the richest country in the world, close to 60 million people are either uninsured or marginally insured.¹ Some 20 to 30 percent of all medical procedures performed in this country, costing close to $125 billion per year, may not even be necessary.¹ Unfortunately, there is a paucity of research to determine the effectiveness and efficacy of our clinical interventions. In short, large dollars are being diverted towards our health care, while the quality of treatments by our health care providers is not being measured.

To no surprise, those held accountable for paying these outrageous medical costs, the third-party payers, have begun limiting the amount of reimbursement paid or even refusing to pay for some treatments and procedures. The cost escalation of health care is forcing the third-party payers to push more of the tab towards the government, employers, and the patients themselves. This cost explosion in health care is the reason for the
conception of the current managed care reimbursement system. Costs need to be controlled, and capitation of the health care dollar is one solution some third-party payers are turning to. The third-party payers have taken control of the over-stretched health care dollar.

Like other clinical disciplines, rehabilitation tends to assess its impact on patients by looking at the outcomes following treatment. Successful treatments are judged by how well the patient performs in the controlled environment of the clinic. This method doesn't accurately address how the patient will do in the unstructured, natural environment of real life. Third-party payers want evidence that their client is not only benefiting from impairment reduction, but also and more importantly, they want to see that the client's ability to function in everyday life is improving from therapy. Rehabilitation must be aimed toward allowing the patient to function in an uncontrolled environment. The outcomes of therapy will need to be measured with some component proving the patient can function effectively outside of the clinic.

As dollars for health care become less available, third-party payers in the delivery system will need to rely on those outcomes from specific diagnoses that prove to the payers that the services they are paying for are "reasonable and necessary." The measuring of functional outcomes resulting from treatments is becoming a standard method reimbursers are using when determining if payment for services are justified.

The profession of physical therapy is currently lacking outcome studies needed to justify clinical effectiveness. Outcome data is needed for every diagnostic group in which physical therapy services are used. One common patient population that is seen frequently by physical therapists is that of patients suffering from rotator cuff tears. Rotator cuff
tears are a debilitating injury to the shoulder and are becoming more and more common.\textsuperscript{4}

As a result of the incidence of injury in all ages\textsuperscript{5} and the anatomical and functional importance of the rotator cuff in shoulder movement, the outcome of surgical intervention to repair cuff tears is clinically important.

Outcome studies have proven to be an essential tool for assessing and describing how patients have responded after having rotator cuff surgery. Packer et al\textsuperscript{6} was one of the pioneers in reporting rotator cuff outcomes. They analyzed the results of 63 operative repairs of chronic tears over an average time span of 32.7 months. Packer suggested and demonstrated that subacromial decompression should be included when repairing rotator cuff tears due to the relief of pain this procedure provides. These authors also concluded that complete healing of the rotator cuff is not needed to obtain a satisfactory subjective improvement in pain, function, and patient satisfaction.

Hawkins et al\textsuperscript{7} also added to the understanding of results after rotator cuff repair. This study, reviewed 100 cases over four years, all having open tendon repair and acromioplasty. The investigators found no statistical difference in the pain level between patients with larger tears and smaller tears. However, they did find that the small tears correlated higher with full strength recovery than the large tears. The Hawkin’s study also showed that patients receiving Workers’ Compensation required twice as much time to return to work than non-compensated patients. Only two of fourteen patients receiving Workers’ Compensation who were not working preoperatively returned to their jobs postoperatively. Hawkins concluded that improvement in function was found to be primarily related to the postoperative relief of pain.
Another study which adds to possible results following rotator cuff repair was done by Ellman et al. They reviewed the results in 50 patients longitudinally for 3.5 years after their operations. All 50 were directly repaired with sutures, trough attachment, or graft placement. Forty-eight patients also had an anterior acromioplasty performed. Ellman et al found that preoperative impairment in strength and range of motion can put the patient at greater risk for poorer outcomes. They also found the amount of acromiohumeral distance (≤ 7 mm.) correlated with function, range of motion, and strength. Ellman concluded that repair of the rotator cuff can restore overall muscle strength.

In yet another study, Harryman et al found integrity of the rotator cuff to influence outcome. They evaluated the results of 105 rotator cuff repairs an average of five years postoperatively. Eighty percent of the repairs of a tear only involving the supraspinatus tendon were intact at the time of follow-up, while only 50 percent of the tears involving more than the supraspinatus tendon had a recurrent defect. Harryman and coworkers found a significant, positive correlation between size of the tear and age of the patient. They also reported that if the cuff remained intact at follow-up, the repair of large tears yielded comparable functional results to that of small tears. These authors concluded that the integrity of the rotator cuff at the time of follow-up, not the size of the tear preoperatively, is the major determinant of the outcome of repair.

In a unique study comparing rotator cuff surgical procedures, Baker and Liu analyzed the results of 37 rotator cuff repairs. Twenty patients were treated with the standard open rotator cuff repair, which also included an open acromioplasty. The other 17 repairs were done using the arthroscopically assisted mini-open approach with
subacromial decompression. Although the small sample size severely hindered this study, trends were introduced involving the benefits of each procedure. Less hospitalization and earlier return to full function was accomplished in the arthroscopically assisted group. Baker and Liu also found moderate-sized tears (<3 cm) had better functional outcome with the arthroscopically assisted repair, but larger tears (>3 cm) showed better results with the open repair. They concluded that the arthroscopically assisted procedure is as effective as the standard open procedure in repairing full-thickness, complete rotator cuff tears.

Although there has been an increased number of published works in the area of outcomes from rotator cuff repair, the literature continues to be limited. Additional study is needed for establishing standardized measurement of outcomes using terminology to which both payers and providers can relate. Literature is also lacking normative values from results of physical therapy treatment. Therefore, the purposes of this study is to establish the outcome of rotator cuff repair and rehabilitation for St. Alexius Medical/Bone and Joint Center using standardized measurement which both reimbursors and providers can relate. The research questions this study attempts to answer are (1) to determine outcomes of rotator cuff repair and rehabilitation by finding the descriptive values for the number of visits needed for each patient to reach favorable outcome measures by discharge from physical therapy; (2) to establish normative values for impairment measurements at various phases of rehabilitation and for long term functional levels; and (3) to investigate the influence of demographic variables in achieving favorable outcomes. These outcome results were analyzed retrospectively by reviewing charted
treatment information of patients who underwent rotator cuff repair surgery from September 1995 to December 1996.
CHAPTER II
OUTCOMES LITERATURE REVIEW

Introduction

The foremost reason why persons enter the physical therapy profession is to help others who are suffering from a physical ailment or disease. Since the conception of managed care, increasing limitations have been thrust upon our profession. Today's physical therapist is not only required to be a master clinician, but he or she holds the responsibility for justifying his or her treatment choices. The time of unlimited treatments and number of visits is now prehistoric. The ability to prognosticate is becoming essential. Today's physical therapist is expected to be involved in the political and economic processes that influence the policy which directs health care planning. Economic concepts must be learned to demonstrate to interested parties that these services of patient care are being practiced in the most effective and efficient ways. As the health care dollar is sliced thinner and thinner, competition for that thin dollar will be severe. Physical Therapy as a profession has turned toward outcome research to give it the competitive edge in fighting for the sought after health care dollar.

Why Managed Care?

Over the past 50 years we have witnessed a health care explosion, which has provided benefits to everyone. Along with these improvements in medicine, also came
excessive health care costs. Three basic factors have contributed to these expenditures: higher population, increased access to service, and expanded technology. According to Stewart et al, there are two other contributors to the cost explosion: the aging of the U.S. population and the tendency of consumers and providers to over-utilize services in the health care system. But probably the primary culprit for this current cost escalation has been the method of reimbursement that our health care system has used during the second half of this century, fee-for-service. This form of payment to the provider is done retrospectively, after the service has been completed. Historically, fee-for-service payment plans have had no utilization controls built into the reimbursement guides, causing little success in controlling costs. Essentially, all treatments administered were reimbursed regardless of whether they were needed or not. This encourages the provider to treat all ailments “thoroughly and completely” as long as they are getting paid for their services. In reality the fee-for-service reimbursement system rewards the practice of inefficient medicine. As the health care dollar dwindled, a change was needed. It was then suggested that changing the method of reimbursement to a fixed, pre-paid sum, would eliminate excess expenditures and encourage more efficient health care. This form of payment was termed managed care and is the basis for current and future reimbursement plans.

With these health care changes, managed care has taken the ball away from the providers and put the ball in the control of the payers. Naturally the payers (private insurance and federal and state government) prefer to pay as little as possible for patient care, but at the same time they want to satisfy the customer with high quality medical care. This trend of funding has undoubtedly increased competition in the health care provider
sector. In managing this financial burden, providers are forced to continuously explain to
the policy makers and insurers that “all patient care is medically necessary.”¹ Not only
must the provider justify that the deemed intervention is necessary, but also provide
documentation supporting the accountability of the treatment given.

What are Outcomes?

Outcomes of treatment are considered to be the ultimate contributor of quality in
health care.¹¹ The increasing need for outcome data in physical therapy and other allied
health professions has stemmed from the requirements of today’s health care insurers and
policy makers, ranging from managed care organizations (MCO) and payers to the
different accreditation agencies. Today’s health care providers have shown evident
concern that health care cost capitation policies, either at the governmental or private
sector level, could have a negative effect on the quality of patient care.¹²

With today’s payers wanting the most value for their dollar invested, physical
therapists must abandon the old ways of practicing and adapt to today’s requirements of
showing treatment outcomes. For starters, physical therapists are now needed to
differentiate the terms impairment and functional disability and apply them into their
clinical practice. According to the World Health Organization¹³, impairments refer to
abnormalities of anatomic, physiologic, or psychologic origin within specific organs or
systems of the body. In physical therapy terms, impairments are measured by a decrease
in range of motion, decrease in muscle strength, or altered sensation. Functional disability,
on the other hand, refers to restriction of or inability to perform Activities for Daily Living
(ADLs) normally. Examples of functional disabilities physical therapists might encounter
in their practice are ambulation difficulty or the inability to drive an automobile.
Physical therapists can no longer solely rely on documenting objective, impairment data alone to show patient progress. Clinical measurements of impairments no longer hold their value with third party payers. Payers want documentation proving their customer can function better in everyday activities than before therapy was initiated. According to Jette\textsuperscript{14}, successful physical therapy interventions are usually not reflected in simply better movement, but in improvements in daily functioning or what has been termed \textit{health-related quality of life}. In the past, physical therapists assumed that if the patient’s physical impairment status was improving (e.g. shoulder ROM) there would also be a similar improvement in the patient’s ability to function (e.g. ability to comb hair). As of now, there is relatively little scientific basis for this assumption.\textsuperscript{1,15,16} Therefore, as clinicians, we need to utilize impairment data as a tool for clinical assessment and re-assessment, but always remember that the patient’s functional disability is the basis behind documenting progress toward treatment outcomes.

Outcomes were first defined by Donabedian\textsuperscript{11} as “the end result of medical care.” Ellwood,\textsuperscript{17} adds in his definition of outcome management that outcomes are “technology of patient experience designed to help patients, payers, and providers make rational medical care related choices based on better insight into the effect of these choices on the patient’s life.” Outcome research and management is a tool used to study a large range of outcomes which include patient reported perceptions of their health, functional status, quality of life, and satisfaction of care as a result of the provider’s intervention.\textsuperscript{18} The results from this data can be used to assist in managing the provision of health care, with the ultimate goal of delivering efficient, effective service. In other words, the outcome movement has the purpose of measuring the effectiveness and efficiency of treatments.
used. With these results, providers can justify the appropriateness of their clinical care, estimate the costs and prognosticate the number of therapy visits needed, and compare the treatment results with other providers promoting competition for quality, efficient health care.

In assessing today’s treatment outcomes, patient satisfaction has become increasingly important. Payers are no longer listening to only the providers for descriptions of how therapy is helping the patient. Payers are now moving toward the concept of patient-centered outcomes. Ideally, payers want both the provider and especially the patient to be satisfied with the treatments administered and the benefits received. In addition, payers understand the language the patient uses when describing his or her condition, as opposed to the discipline-specific, medical terminology physical therapists and other allied health professionals use in their notes and descriptions. As described by the World Health Organization’s definition, health is "a complete state of physical, mental, and social well-being and not merely the absence of disease." Patient-centered outcomes add to this multi-dimensional concept.

**Why are Outcomes Important?**

This cost containment movement of today’s health care world has put tremendous pressure on health care providers to demonstrate how effective their treatment interventions are. With reimbursement shrinking and costs of medical care escalating, the necessity and/or appropriateness of many services and procedures is being questioned. Today more than ever, the definition of “medically necessary” is being reevaluated. Thus, the providers of health care have turned to outcome research and management to gather data, justifying accountability and effectiveness of care.
Not only are today's health care providers required to show treatment effectiveness, but they are also held responsible to prove treatment efficiency, due to the increasing competition among providers. According to Reeves,¹⁰ “a provider must be able to demonstrate proof of treatment efficiency, which means having access to utilization and outcome studies.” Employers, MCOs, and other payers now have access to different utilization data, providing normative treatment outcome results. For example, one APTA survey reported that, on average, low back pain patients require five weeks treatment and 11 therapy visits, with an average charge of $766.²¹ Providers who can show that they consistently fall below those numbers are more likely to be chosen by payers to treat their clients. Essentially, outcome data has evolved to become a marketing tool for today’s generation of health care providers.

Outcome research is commonly thought of as effectiveness research, as opposed to research that studies only the efficacy of treatment. Although these two terms, effectiveness and efficacy, are often interchangeably used, they have different meanings. According to Lohr,² efficacy, is “the level of benefit expected when health care services are applied under 'ideal' conditions.” Effectiveness, on the other hand, is defined as “the level of benefit when services are rendered under ordinary circumstances by average practitioners for typical patients.”

Efficacy studies focus on a narrow range of clinical endpoints, seeking objective clinical values. The goal of efficacy research is to study the impact a specific treatment has on specific symptoms under controlled randomized trials.¹⁸ The outcomes found, therefore are only related to short-term effects. This type of research evaluates what a treatment could do, not what it does in usual practice.²²
Outcome studies are better described as effectiveness research because they are directed toward a different set of questions. Effectiveness studies are not focused on a narrow range of clinical measurements, but rather on patient assessment of the outcomes of their care. Outcome research is not designed to be performed under tightly controlled clinical treatment protocols. The effort, instead, is geared toward evaluating existing clinical practice patterns with results studied retrospectively. Outcome research is nearly always in a quasi-experimental setting rather than a pure experimental setting. The patient population is not highly randomized or exclusive, but simply representative of the population who is most likely to receive clinical services. Thus, the purpose of an effectiveness/outcome study is to illuminate practice tendencies and show how these tendencies effect patient satisfaction and cost effectiveness of treatments.

The benefits of outcome research are deeper in depth than simply obtaining the outcome result of a clinical treatment. Outcome research can be used as the foundation for measuring continuous quality improvement of clinical therapy practices. According to Barr, there are three basic ways outcomes aid in developing and maintaining continuous quality improvement: 1) developing baseline measurements of a patient’s condition and developing treatment plans; 2) monitoring patient’s status over time to determine when and what changes occurs in health status and assessing the effectiveness of the clinical intervention; 3) formulating plans for improved management of future patients including allocation of limited economic resources, based upon evaluation of past patient outcomes.

Outcome studies are performed with the purpose of understanding patient-oriented results and to allow for comparability of reports. Currently, there is lack of concrete
outcome studies directly related to rotator cuff repair in the literature. One huge reason for this is because of the lack of a standardized method of reporting postoperative results, making it difficult to judge which surgical or clinical factor is affecting the surgical outcome. In addition there is no universally accepted terminology used to define outcomes. For a shoulder outcome study to be effective, impairment data must be collected in a standardized manner and correlated to the patient's disability. Along with standardization of objective measures, a patient self-assessment tool should be utilized, describing the patient's pain, satisfaction, and functional abilities.

In this study, the number of total physical therapy consultations (visits) needed to rehabilitate the patient to a favorable outcome level is used as the major determinant of surgical and rehabilitation results. One goal of this study is to establish normative values for number of visits required to achieve treatment goals involving favorable impairment and disability measurements. With today's reimbursement constraints and visit limitations, therapists will need to utilize patient care more efficiently. Using fewer visits to obtain favorable, long-term results is becoming a necessity for today's physical therapists. The number of visits utilized is one common denominator each reimbursement payer, physician, and physical therapist can gauge the outcome of treatment.
CHAPTER III

ROTATOR CUFF LITERATURE REVIEW

Introduction

Rotator cuff tears are probably the most debilitating injury the shoulder can suffer. Rotator cuff injuries are also becoming more and more common. Tears of the rotator cuff most commonly occur in middle-aged or older patients after years of overuse and inflammation have weakened and predisposed these tendons to failure. Because our population is aging, it is no surprise physicians and physical therapists are seeing a record number of patients with rotator cuff tears.

Although acute, traumatic tears do occur, especially in overhand athletes, 90 percent of all rotator cuff injuries seen are of the chronic variety. A huge contributor in these chronic tears is the well documented avascular zone in the rotator cuff, which is located close to the insertion of the supraspinatus tendon, near the greater tubercle of the humerus. This avascularity is commonly thought to contribute to the increased incidence of degenerative tears in elderly patients. Consequently, this portion of the supraspinatus tendon is at great risk, and according to Mosely et al tears of the rotator cuff are most commonly found in this area. For chronic tears, a specific progression of rotator cuff
dysfunction is described by Neer. The cuff lesion begins with an impingement syndrome, followed by the development of tendonitis, and finally a rotator cuff tear.

Anatomy

The rotator cuff is a network of four muscles: supraspinatus, infraspinatus, teres minor, and subscapularis. These muscles originate from the scapula and insert onto the tuberosities of the humerus and the interior capsule, which blends with these tendons near their insertion, and functions to stabilize the glenohumeral joint. The supraspinatus and infraspinatus arise from their respective areas on the posterior aspect of the scapula. The supraspinatus passes underneath the acromion and inserts on the greater tuberosity. The infraspinatus attaches more posterolaterally on the greater tuberosity. Both muscles are innervated by the suprascapular nerve.

The subscapularis originates from the anterior portion of the scapula and inserts on the lesser tuberosity; it is innervated by the upper and lower subscapular nerves. The teres minor arises from the inferior posterolateral aspect of the scapula and inserts on the lower portion of the greater tuberosity. The teres minor is innervated by the axillary nerve.

Not only do the cuff muscles act to keep the humeral head in the glenoid fossa and control movement of the humeral head, but each muscle aids in various motions of the shoulder. The supraspinatus assists with abduction and forward elevation of the arm, while the infraspinatus and teres minor externally rotate the humerus, and the subscapularis aids in internal rotation.

Along with the dynamic stabilizers of the glenohumeral joint, static stabilizers are also needed for support at rest. Included in the group of static stabilizers are the glenoid labrum, glenohumeral ligaments, joint capsule, coracohumeral ligament, and
coracoacromial ligaments. The latter two ligaments are often excised during rotator cuff repair to allow for more space under the acromion during forward flexion, abduction, and external rotation of the humerus.

**Rotator Cuff Injuries**

The functional arc of motion for the shoulder is forward flexion. Impingement of the cuff occurs when the superior surface of the greater tuberosity comes in contact with the inferior surface of the acromion thus pinching intervening structures, most commonly the supraspinatus tendon near its insertion. Normal aging of tissue combining with continuous repetitive microtrauma as proposed by Neer, lowers the physiologic tolerance of this viable tissue, predisposing the cuff to rupture.

Patients with rotator cuff tears usually complain of pain, weakness, and limited motion, while having a history of bursitis and/or tendonitis. Pain is usually located in the anterior, lateral, and superior aspects of the shoulder and is often referred to the area of the deltoid insertion. Elevating the arm and participating in overhead activities are usually hindered and if attempted elicit pain. These patients often complain of pain at night and find sleeping in a recliner more comfortable.

Upon physical exam, there is usually minimal point tenderness, but pain is present with active resistive movement. Subacromial crepitus is usually both palpable and audible when the shoulder is rotated in the adducted position. Weakness is common in forward flexion, abduction, and external rotation of the humerus. Positive special tests including the drop arm test, supraspinatus test, Hawkins-Kennedy impingement test, and the subscapularis lift off test can all indicate rotator cuff damage. There also may be wasting of the supraspinatus, the infraspinatus, and the deltoid muscles.
Radiographs and magnetic resonance imaging should be taken when patient has not responded to conservative treatment. Radiographic exams can reveal the degree of cuff pathology near the acromiohumeral interval. Additional information regarding tear size and the quality of the remaining tissue can be obtained by a MR imaging of the affected area.\textsuperscript{37}

Classification of tear size can determine not only the severity of the injury, but can influence the surgeon in deciding which repair procedure to use. Most authors agree that favorable outcomes after rotator cuff repair are directly related to the size of the tear repaired.\textsuperscript{4,7-9,24,39} Rotator cuff tears of less than 3 cm are considered small and medium tears, and usually involve the supraspinatus alone. Tears ranging from three to five cm are considered large size tears, and tears over five cm are thought as massive. These larger lesions are usually extensively involved, full-thickness tears and affecting multiple areas of the cuff. Both small-and medium-size tears are commonly treated by arthroscopic subacromial decompression and if needed the mini-open rotator cuff tear approach. Larger tears are more easily and predictably treated with the standard open techniques of rotator cuff repair as these tears require more extensive tissue mobilization and transposition.\textsuperscript{38}

**Rotator Cuff Repair**

Most physicians advocate a conservative rehabilitation approach for rotator cuff tear initially and reserve surgery as a secondary treatment.\textsuperscript{4,25-27,29-32,35-50} Conservative treatment usually consists of rest, modification of home activities, anti-inflammatory medication, and physical therapy.\textsuperscript{32} If conservative treatment is unsuccessful at eliminating the patients symptoms, namely pain, a more severe rotator cuff disability is suspected with
surgery usually indicated. The two most commonly used procedures by today’s surgeons for repairing rotator cuffs are the standard open repair and the arthroscopically assisted mini-open repair with subacromial decompression, with tear size being the predominant factor in the surgeon’s choice.

**Standard Open Repair**

Since the consummation and acceptance of the arthroscopic technique, most surgeons use the standard open repair for rotator cuffs far less than they have in the past. Outcome studies have favored the arthroscopic and mini-approach technique over the standard open technique in the treatment of small and medium sized full thickness tears. For patients with large or massive tears (>3 cm), the standard open technique continues to be the treatment of choice for today’s surgeons. The open repair of rotator cuff tears is usually divided into three phases: the approach, the decompression, the mobilization and repair.

**Phase I: Approach**

The patient is placed in the modified beach chair position with the chest angle approximately 60 degrees from the horizontal plane. A five to seven cm superficial incision is made on the anterosuperior aspect of the shoulder in the skin flexion creases (perpendicular to the fibers of the deltoid). The incision extends from the lateral aspect of the anterior third of the acromion toward the lateral tip of the coracoid. The deltoid is then split with the fibers from just anterior to the acromioclavicular joint extending directly laterally past the corner of the acromion. This leaves a healthy cuff of deltoid tissue attached to its origin. A stay suture is placed at the distal end of the split to avoid injury to the axillary nerve.
**Phase II: Decompression**

Subacromial impingement can occur at the anerolateral aspect of the coracoacromial ligament, the anteroinferior acromion, and the acromioclavicular joint. An effective subacromial decompression done openly has similar goals and procedures as when it is done arthroscopically. It generally includes the excision of the subacromial bursa, a coracoacromial ligament release, anterior acromioplasty, and sometimes a modified acromioclavicular ligament arthroplasty if indicated.37

The decompression is begun with resection of the coracoacromial ligament and excision of the subacromial bursa. Next, the acromion should be beveled as part of the acromioplasty. The wedge of bone excised should consist of a full width of the acromion from the medial to lateral border. A complete acromioclavicular arthroplasty or distal clavicle resection is reserved for patients with preoperative acromioclavicular joint tenderness and clinical findings, such as pain with horizontal adduction or internal rotation.37

**Phase III: Rotator Cuff Repair**

Before the repair begins, the size of the rotator cuff tear and the quality of the remaining tissue should be thoroughly assessed. Humeral extension and internal rotation can aid in better visualizing the infraspinatus and teres minor, while flexion and external rotation reveal the subscapularis. Multiple nonabsorbable sutures are placed into the leading edge of the torn tendon(s) in preparation for mobilization. Any adhesions located on the undersurface of the cuff should then be released to avoid inadvertent extension of the tear in the cuff. To ensure a successful repair, the edges of the torn tendon should reach the anatomic neck of the humerus with the arm in a functional position of 10 to 15
degrees of flexion and 10 degrees of abduction. Once the rotator cuff has been completely mobilized, repair is started with preparation of the greater tuberosity. Multiple drill holes are placed into the greater tuberosity developing a trough for sutures, depending on the size of the tear. The holes begin medially at the anatomic neck and extend laterally through the tuberosity for a distance of one to 1.5 cm. The sutures are passed through the drilled holes and anchored or tied. Before securing the tendon to bone sutures, the anterior and posterior aspects of the repair should be performed to re-establish the intratendinous relationships of the rotator cuff. Once the tendon-to-tendon repair is secured, the rotator cuff tendon-to-bone sutures are then tied superiorly over the bone trough. The deltoid and subcutaneous tissue are then closed with nonabsorbable and absorbable sutures respectively.

**Mini-Open Repair**

The technique of arthroscopically assisted, mini-open repair of the rotator cuff combines arthroscopic subacromial decompression with the open tendon repair through a small deltoid split. This procedure preserves the deltoid origin during the repair of the torn cuff because the acromioplasty is performed arthroscopically. Before the mini-open procedure was established, the surgeon had to choose between an arthroscopic subacromial decompression alone or performing the traditional open tendon repair with anterior acromioplasty. Along with preservation of the deltoid origin, other benefits and advantages the mini-open repair offers include better cosmesis, lower morbidity and shorter hospital stays, a more complete examination (allows inspection of entire glenohumeral joint), an earlier return to work, a more aggressive early rehabilitation, and high patient satisfaction.
The mini-open technique combines an arthroscopic subacromial decompression followed with a modified tendon repair through an incision of around three cm. The decompression, similar to the acromioplasty performed in the traditional open approach, reduces the mechanical source of attrition cuff wear and improves arthroscopic visualization of the superior rotator cuff surfaces. Three arthroscope portals are used during this procedure. The posterior arthroscope (primarily used in visualizing the cuff) is vertically placed two cm inferior and two cm medial of the posterior side of the acromion. Just lateral to the coracoid process is where the vertical anterosuperior scope is placed for the function of vision and labrum resection if needed. The lateral portal is two cm distal to the lateral border of the acromion and midway between the anterior and midpostion of the acromion. Through this hole, an arthroscopic cutting instrument (resector, electrocautery, burr) is used and is held in a horizontal direction. To accomplish this goal of increasing space around the impinged cuff area, the subacromial decompression consists of an extensive subacromial bursectomy, coracoacromial ligament resection, anterior acromioplasty, and removal of impinging acromioclavicular osteophytes.

After the arthroscopic subacromial decompression has been completed and the tear localized, an incision used by the anterior arthroscope is extended to a length of three cm located horizontally or parallel to the lateral border of the acromion. This yields a more cosmetically pleasing scar in comparison with vertically oriented incisions. The subcutaneous tissue is then undermined and the deltoid split parallel and in line with its fibers exposing the torn tendon.

Once the torn tendon is exposed, repair of the rotator cuff is then performed as a standard open procedure. Sutures are placed into the tendon along the perimeter of the
tendon to assist with mobilization of the torn cuff. The affected tendon is then mobilized
until it reaches its insertion on the greater tuberosity without undue tension. Depending
on the size of the tear, bone tunnels are made in the region of the greater tuberosity
(usually one or two for small- to medium-sized tears) to allow tendon-to-bone repair. A
sharp curved awl is used to create the tunnels for the sutures’ insertions. A curved hook is
then used to pass the sutures through the tunnels. Through each tunnel, braided
nonabsorbable sutures are placed and then passed through the entire perimeter of the torn
tendon, thus dispersing the stresses evenly. The tendon is then grasped with a simple
stitch, as opposed to metallic implants, which may be contraindicated for older, often
osteoporotic patients because of failure of implants to hold. Finally, once the tendon
repair is finished, the deltid split is repaired and the skin is closed with a subarticular
stitch.\textsuperscript{38}

**Postoperative Rehabilitation**

The rehabilitation treatments of choice for patients with rotator cuff repairs are
highly dependent on the specifics of the surgery, and the direct orders given by the
surgeon. Generally the rehabilitation program is separated into phases:

- the initial phase emphasizes passive range of motion, pain relief, and functional scar
  formation
- the next phase concentrates on promotion of active range of motion, light isometric
  strengthening and pain relief
- final phase(s) consists of resistive strengthening, full active range of motion, and
  preparation for reacquisition of sports or work-specific skills.\textsuperscript{42}

**Outcome Factors**

Many demographic, surgical, and clinical factors have influence on the outcome of
surgical repair and rehabilitation of rotator cuff tears. However, because of the quasi-
experimental/clinical research design of most outcome research, including rotator cuff studies, it is impossible to single out one variable as the single determinant of the outcome. Many factors such as the patient’s age, gender, surgical procedure used, surgeon, tear size, time between injury and surgery, physical therapist, and rehabilitation use all have bearing on the therapeutic outcomes. By addressing and analyzing these factors, clinical practice trends may be illuminated. The knowledge of these trends can only benefit today’s health care provider, allowing for more effective, yet efficient plan of treatment. For example, if we can determine that larger cuff tears generally tend to take longer to rehabilitate, and the surgeon communicates with the therapy staff that this particular patient had a large tear repaired, the therapist will have some justification why this patient might not be achieving the prognosticated therapeutic goal on time. These treatment variables pave the way for establishing practice patterns. One purpose of this study is to find which variables have the most influence on long-term outcome measures including shoulder range of motion, strength, pain level, and functional ability.

**Demographic Factors**

Age of the patient is generally considered a significant factor when predicting a successful outcome. It is well documented that there is an increase in incidence and significance of rotator cuff tears as age increases, which can make rehabilitation more lengthy.\(^9,^{24,27,29,44}\) Hattrup reported a poorer result or a poorer prognosis with increasing age.\(^{44}\) Normal aging of the rotator cuff tissue combined with continuous repetitive micro-trauma can lower the tolerance of the tissue predisposing the cuff to injury.\(^{31}\) Harryman et al\(^9\) found a significant correlation between the size of the tear and the age of the patient. However, it has been found that older patients who have had rotator cuff repair may be
expected to attain a level of strength similar to, or exceeding that of the non-surgical shoulder.\textsuperscript{46} It is difficult to distinguish that age itself has an independent effect on the outcome. Age then can be thought of as a cofactor, which may increase the amount of rehabilitation needed, but is commonly not found to hinder final outcomes.

Other demographic cofactors that can be considered influential to rotator cuff repair and especially rehabilitation are gender of the patient and whether the dominant or non-dominant shoulder was repaired. Generally, men are documented as more commonly suffering from cuff tears than women.\textsuperscript{4,6,8,39,47} However, the literature supports little, if any prognosis difference between genders following rotator cuff repair.\textsuperscript{48} The dominant shoulder has been found to be more commonly inflicted with rotator cuff tears.\textsuperscript{4,6,8,47} Not surprisingly, the dominant shoulder is predisposed to injury because it is generally used more frequently than the non-dominant side. Interestingly, little evidence thus far has supported a significant correlation difference between rotator cuff repair outcomes and the handedness of the individual.

**Surgical Factors**

Widely considered as the most important and influential factor affecting rotator cuff repair outcome is the size of the tear. Often times, the size of the tear has been difficult to quantify consistently due to varying amounts of tendon retraction and the shape of the tear.\textsuperscript{24} Rotator cuff lesions can be classified according to the number of tendons involved, the amount of retraction of the tendon, the surface of the tear, and the largest linear dimension of the tear.\textsuperscript{49} Measuring the largest linear dimension is thought as the simplest of the methods and was used by the surgeons in this study.\textsuperscript{49}
Recent studies have shown correlation of the tear size and surgical result. Gore et al\textsuperscript{39} reported that patients with tears less than 2.5 cm had greater strength of abduction and ROM than those with larger tears. In another study, Hawkins\textsuperscript{7} reported the amount of shoulder abduction was found to be directly proportional to the size of the tear.

Another surgical factor which has shown influence on rotator cuff outcome is that of the surgical type. As described earlier the two most common used procedures are that of an open repair of the tear with an open acromioplasty for decompression, and the arthroscopically performed subacromial decompression followed with a mini-open repair of the tear. Other procedures that are used combine different aspects from the two above procedures. For smaller tears, sometimes debridement alone is the choice of treatment. If the patient is experiencing excess pain with a small tear, debridement with arthroscopic subacromial decompression may be used. If the tear is of small to medium length, the patient is active, and the surgeon has the skill and experience to complete the procedure, an open or arthroscopic repair with decompression may be the procedure of choice.

Several factors influence the decision on surgical procedure including the established diagnosis, degree of pathology, the patient's age and activity level, the response to conservative treatment, and the surgeon's preference and skill level. Baker et al\textsuperscript{4} compared the outcomes of the standard open repair and the arthroscopically assisted rotator cuff repair with a minimum follow up of two years. Overall, the open repair group had 80 percent good-to-excellent results and 88 percent patient satisfaction. The arthroscopically assisted repair group had 85 percent good-to-excellent results and 92 percent patient satisfaction. Most subjective and objective ratings did not differ between the two procedure groups. Only range of motion in forward flexion and abduction
strength and were greater in the arthroscopically assisted repair group. The arthroscopic group did require less hospitalization and earlier return to full function than the open repair group. The result of this study suggest that full-thickness rotator cuff tears less than five cm. in length are best indicated for the arthroscopically assisted mini-open repair, but tears over five cm. are best repaired with the standard open approach. Although literature is limited, others support these findings.\textsuperscript{37,38}

Clinical Factors

The timing of surgery is one variable that appears to have influence on surgical outcome of rotator cuff tears, but is difficult to measure how much of an effect it has on outcome. Few studies have isolated this variable as it pertains to surgical outcome, mainly because most rotator cuff tears are not the result of single-event trauma.\textsuperscript{35} Most patients diagnosed with rotator cuff tears have a history of long-standing shoulder pain.\textsuperscript{51} One study compared patients who underwent surgery three weeks or six to 12 weeks after injury.\textsuperscript{43} Pain relief was found satisfactory in both groups. However, the patients who underwent surgery earlier achieved a greater range of active motion at seven-year follow up than the patients who waited a longer period of time, 168 degrees and 129 degrees, respectively. Whether the timing of surgery has long-term effects on the patients function remains to be seen.

The post surgical treatment protocol is another clinical factor that can influence outcome of rotator cuff repairs. However, as with other factors, rehabilitation is difficult to definitively examine as an isolated variable for surgical outcome. Commonly, the only time rehabilitation is mentioned affecting surgical outcome is when something goes wrong during therapy, or the patients gets injured. The postoperative treatment for rotator cuff
repairs will vary depending on the type of repair that was performed. Patients with large and massive tears will have a slower and more conservative rehabilitation program, while patients with small to medium tears have fewer restrictions during initial healing phase. Differences that exist between larger tear and smaller tear treatments mainly exist during the initial six weeks post-surgery for larger repairs, which usually limited to only three passive-assistive exercises that may be performed. In contrast, most protocols for smaller tears allow sub-maximal isometric exercises and active-assistive range of motion by week three after surgery. In order for the post-surgical treatment protocol to be effective, the lines of communication between the surgeon and the physical therapist need to always be open. The physician needs to explain the extent of the repair to the physical therapist, ensuring proper treatments are being administered. Also, the physical therapist must update the physician on the progression of rehabilitation and how the patient is responding to treatment.
CHAPTER IV
METHODODOLOGY

Subjects

Thirty-seven rotator cuff repairs (36 patients) performed between September 1995 and December 1996 were reviewed retrospectively. One subject was excluded because therapy was not completed at this regional medical center. There were 22 males (61 percent of cases) and 13 females (14 shoulders) included in the study. The average age of the patients was 62.06 years, ranging from 38-80 years, with a median age of 60.5. The repairs were done on the dominant shoulder in 62 percent (21 of 34) of cases (three cases unknown).

All patients included in this study underwent optional surgical repair of the rotator cuff at Bone and Joint Center, Bismarck, ND and were referred to St. Alexius Physical Therapy, Bismarck, ND, for outpatient physical therapy service. These participants read and signed the consent form for outcome analysis during their initial physical therapy visit (Appendix A). From this larger pool of outcome data, participants were selected for inclusion in this study if they met the following criteria:

1. underwent rotator cuff repair by an orthopedic surgeon at St. Alexius Medical/Bone and Joint Center, in Bismarck, ND
2. referred to St. Alexius Physical Therapy rehabilitative service
3. signed the consent form to be a participant in outcomes analysis
4. participated in follow-up consultation (after the patient has been discharged from physical therapy) at six months post-surgery and/or one year post-surgery.

This study was reviewed and accepted by the University of North Dakota Human Subjects Independent Board (Appendix B).

**Instrumentation**

This outcome project involving the reviewing of rotator cuff repairs, was developed through an internal committee consisting of physical therapists, occupational therapists, and orthopedic surgeons employed at St. Alexius Medical/Bone and Joint Center in Bismarck, ND. This committee also collaborated with George Davies of Lacrosse, WI, an expert in the field of orthopedic physical therapy, for the formation of the outcome data collection form (Appendix C).

Collection of the data began in early September of 1995 and is ongoing. The data collected for this study was documented once during each phase of rehabilitation. Phase I occurring at the second to third week post-operatively, phase II at week six, phase III at week 12. Data was also collected after the patient had been discharged from physical therapy occurring at six months and one year after surgery. The protocol used for treatment and evaluation of these patients with rotator cuff repairs was also developed through a collaboration of the surgeons, physical therapists, and occupational therapists, including an extensive review of the literature. This protocol (Appendix D) was last updated in January of 1997 and specifies the treatment selection used for rehabilitation, while the outcome form (Appendix C) contained the methods of data measurement used by the clinicians who treated the subjects in this study. Four different physical therapists collected the data included in this outcome study. Efforts were made toward training...
these individuals on recording this data to insure inter-rater reliability. All procedures performed were standard physical therapy procedures such as Manual Muscle Testing, and range of motion measurements.53

Procedure

Most of the data obtained for this study came primarily from the outcome form (Appendix C). Missing data on the outcome form included rotator cuff tear size and surgical procedure. Values for missing data were determined from review of each subject's operative report. Tear size classification was as follows: less than one cm were considered small tears; one to three cm classified as medium size tears; and tears greater than three cm were considered large or massive. The surgical procedures performed to repair the cuff were classified into three groups. The first group was the standard open repair without subacromial decompression or acromioplasty. The second group included all open repairs done in combination with an open acromioplasty. The final group consisted of patients who underwent open repair with arthroscopic decompression. In addition, information regarding normal range of motion values not found on the outcome form was obtained from the medical records of several subjects. All data that were recorded on data input sheets (Appendix E).

The first research question of this study was to determine outcomes of rotator cuff repair by finding the descriptive values for the number of visits needed for each patient to reach favorable outcome measures by discharge from physical therapy. The number of treatments was recorded only at the end of each phase of rehabilitation (see Appendix C). Since all patients were discontinued from physical therapy following phase III, favorable
outcome data was taken from this phase only. The patients could have conceivably achieved favorable results between phase II and III, but never after phase III.

The criterion values used to signify favorable outcomes were chosen based upon results of prior studies. 4,6-9,31,36,38,54

1. Active forward flexion and active external rotation were selected as important for functional use of the shoulder. The parameters used to distinguish favorable outcome were: (a) active forward flexion at or more than 140 degrees and/or 75 percent of the motion capable of the non-surgical shoulder forward flexion; (b) active external rotation at or more than 60 degrees and/or 75 percent of the motion capable of the non-surgical shoulder external rotation.

2. Favorable strength was found by measuring the strength of the external rotators. The clinicians who treated the patients in this study measured strength using the standard “break test” for manual muscle testing (MMT) as described by Kendall et al. 52 The patients were tested in standing with the humerus adducted and elbow flexed to 90 degrees. The criterion needed for functional strength was for the patient to demonstrate at least a grade 4 (good) rating during MMT.

3. Pain measurement was determined by a subjective rating of the patient’s perceived pain level, using zero value for no pain, 10 value for excruciation pain. Pain levels of two or less were considered favorable results.

The number of patients achieving these favorable outcomes was also computed. If the subject achieved a favorable rating on four out of the four outcomes measured,
(forward flexion, external rotation, strength, and pain) an “excellent” rating was given. A “good” rating was given if the subject achieved any three of the four outcomes. “Fair” describes those who achieved any two of the four measures. Finally, a “poor” rating was given to those who only achieved one of the four desired measures. These measures were all taken from the final visit of phase III (the last physical therapy visit before discharge).

Normative impairment values were also studied. Descriptive statistics were computed for all shoulder motions (active and passive), strength levels, and pain levels at each phase of rehabilitation and at two follow-up consultations (26 weeks and 52 weeks after surgery). Mean functional levels were also found, which were measured at one or both of the follow-up consultations. The functional assessment form used (see Appendix C), measured the patient’s perceived ability during Activities for Daily Living (ADLs), household duties, outdoor activities, and sporting activities. A numerical range, one through five, was used to objectively quantify functional level. A score of five meant the patient could accomplish the desired task in a “satisfactory” manner (a score of one described the task as “non-satisfactory”). Only those activities that pertained to the patient’s lifestyle were scored. A percent score was computed for the outcome results.

Multiple comparisons were made between different demographic variables (age, handedness, and tear size) to find whether or not these variables statistically influence selected outcomes of external rotation, pain, and visits.

Statistical Analysis

The data were entered into a computerized data base and analyzed using Statistical Package for the Social Science (SPSS). As stated above, descriptive statistics for mean, standard deviation, and range values were calculated in each of the following areas:
number of physical therapy visits by discharge; number of visits needed to achieve favorable impairment levels in shoulder external rotation, forward flexion, external rotation strength, and perceived pain levels; number of visits needed when desired impairment levels are not met; and passive and active range of motion and perceived pain levels throughout all phases of rehabilitation. The Scheffe test was also utilized in effort to find significant differences between phases.

Multiple regression statistics were also computed using SPSS. In this analysis, multiple comparisons were made between different demographic variables (age, handedness, and tear size) to find which variable, if any, has significant influence on the surgical and rehabilitation outcome.

**Reporting Results**

The results of this study will be used to partially fulfill the requirements for the Degree of Master of Physical Therapy from the University of North Dakota and will be published as an independent study report. The report will be readily available for the faculty and staff at the University of North Dakota Physical Therapy Department. In addition, the results will be shared with orthopedic surgeons and physical therapists at St. Alexius Medical/Bone and Joint Center and any other interested party from this facility as deemed appropriate.
CHAPTER V

RESULTS

1. *The number of visits needed to achieve favorable results by discharge of physical therapy*

    Of the 36 patients included in this study, only those who had complete data measurements regarding active shoulder external rotation and forward flexion, strength, and pain reports at phase III were included in the statistical results. Eighty-two percent and 76 percent of the subjects achieved favorable impairment results for external rotation and forward flexion, respectively. In the area of strength, 77 percent of the subjects who had their strength tested at phase III, exhibited strength levels of at least a four (good) grade during manual muscle testing. A subjective pain rating of two or less was achieved in nearly 76 percent of the subjects. The mean number of outpatient visits needed for rehabilitation was 7.51 with standard deviation of 3.28 and a median of six visits. Table 1 contains the remaining results regarding the number of visits needed to achieve favorable outcomes. Not surprisingly, the mean number of visits was higher for those who failed to reach the desired impairment levels than those who did reach the desired levels. Descriptive statistics involving these patients who failed to reach the desired favorable impairment levels are summarized in Table 2.
Table 1. The Number of Physical Therapy Visits Needed to Achieve Favorable Impairment Results by Discharge

<table>
<thead>
<tr>
<th>Impairment measure</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Range</th>
<th>% of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Ext. Rot</td>
<td>28</td>
<td>6.93</td>
<td>2.94</td>
<td>3.0 - 16.0</td>
<td>82.35</td>
</tr>
<tr>
<td>Active Flexion</td>
<td>26</td>
<td>6.54</td>
<td>2.37</td>
<td>3.0 - 13.0</td>
<td>76.47</td>
</tr>
<tr>
<td>Strength</td>
<td>24</td>
<td>6.91</td>
<td>6.91</td>
<td>3.0 - 17.0</td>
<td>77.42</td>
</tr>
<tr>
<td>Pain level</td>
<td>25</td>
<td>7.16</td>
<td>3.51</td>
<td>3.0 - 17.0</td>
<td>75.76</td>
</tr>
<tr>
<td>Total # of visits</td>
<td>35</td>
<td>7.51</td>
<td>3.48</td>
<td>3.0 - 17.0</td>
<td>75.76</td>
</tr>
</tbody>
</table>

Table 2. The Number of Physical Therapy Visits Involving those Impairments which did not Reach a Favorable Level

<table>
<thead>
<tr>
<th>Impairment measure</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Range</th>
<th>% of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Ext. Rot</td>
<td>6</td>
<td>10.0</td>
<td>5.10</td>
<td>6.0 - 17.0</td>
<td>17.65</td>
</tr>
<tr>
<td>Active Flexion</td>
<td>8</td>
<td>10.50</td>
<td>4.88</td>
<td>5.0 - 17.0</td>
<td>23.53</td>
</tr>
<tr>
<td>Strength</td>
<td>7</td>
<td>7.29</td>
<td>2.56</td>
<td>6.0 - 13.0</td>
<td>22.58</td>
</tr>
<tr>
<td>Pain level</td>
<td>8</td>
<td>7.38</td>
<td>2.39</td>
<td>6.0 - 13.0</td>
<td>22.58</td>
</tr>
<tr>
<td>Total # of visits</td>
<td>35</td>
<td>7.51</td>
<td>3.48</td>
<td>3.0 - 17.0</td>
<td>75.76</td>
</tr>
</tbody>
</table>

In effort to illuminate possible practice patterns, Table 3 reveals end-result outcome of repair rehabilitation. The four possible favorable outcomes are those that make up Table 1. An excellent rating was given to those patients who met all four of the desired outcomes. If any three of the four impairment levels were met, a good rating was given; two was described as fair; and if one of the four outcomes was reached, a poor rating was given. Twenty-four of the 32 (75 percent) patients analyzed achieved good-to-excellent results, while needing an average of 6.75 physical therapy visits with standard deviation of 2.9. Those patients who achieved poor-to-fair results (8 patients) needed an average of 8.75 visits for rehabilitation with standard deviation of 4.06.
Table 3. End Result Outcomes For Surgical Repair and Rehabilitation of Patients with Rotator Cuff Tears

<table>
<thead>
<tr>
<th>End-Result outcome</th>
<th>Number of patients</th>
<th>% of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent (4 of 4 outcomes reached)</td>
<td>15</td>
<td>46.88</td>
</tr>
<tr>
<td>Good (3 of 4 outcomes reached)</td>
<td>9</td>
<td>28.12</td>
</tr>
<tr>
<td>Fair (2 of 4 outcomes reached)</td>
<td>5</td>
<td>15.62</td>
</tr>
<tr>
<td>Poor (1 of 4 outcomes reached)</td>
<td>3</td>
<td>9.38</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>

2. Descriptive results regarding normative clinical measurement during rehabilitation phases

Tables 4 through 6 provide results regarding clinical measurements documented while in physical therapy. Passive and active range of motion measurements, along with pain and strength levels were found for each phase. Normative data collecting done by physical therapists during phases I and II of rehabilitation primarily involved measuring and documenting passive shoulder motion and pain levels. Data collection by clinicians in phase III and follow-up consultations entailed documenting active shoulder motion measurements, strength levels, and subjective pain reports.

The clinicians measured shoulder strength in external rotation at phase III using the standard “break test” maneuver while manual muscle testing. At follow-up phases (26 and 52 weeks after repair), the clinicians tested muscle strength using a hand held dynamometer (microfet) in external rotation. These two ways of assessing strength cannot be compared due to incongruent measurement scales and it is not possible to convert the strength scales into a uniform scale. Due to this discrepancy, strength results were only reported for phase III.
Tables 4. Normative Values for Passive Range of Motion Measurements in Degrees and Subjective Pain Levels

<table>
<thead>
<tr>
<th>Treatment phase</th>
<th>Flexion</th>
<th>External Rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>X</td>
</tr>
<tr>
<td>I (2\textsuperscript{nd} - 3\textsuperscript{rd} week)</td>
<td>35</td>
<td>106.11</td>
</tr>
<tr>
<td>II (6\textsuperscript{th} week)</td>
<td>34</td>
<td>141.82</td>
</tr>
<tr>
<td>III (12\textsuperscript{th} week)</td>
<td>32</td>
<td>153.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment phase</th>
<th>Internal Rotation</th>
<th>Pain level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>X</td>
</tr>
<tr>
<td>I (2\textsuperscript{nd} - 3\textsuperscript{rd} week)</td>
<td>33</td>
<td>54.88</td>
</tr>
<tr>
<td>II (6\textsuperscript{th} week)</td>
<td>32</td>
<td>1.66</td>
</tr>
<tr>
<td>III (12\textsuperscript{th} week)</td>
<td>31</td>
<td>67.74</td>
</tr>
</tbody>
</table>

Tables 5. Normative Values for Active Range of Motion Measurements in Degrees

<table>
<thead>
<tr>
<th>Treatment phase</th>
<th>Flexion</th>
<th>Abduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>X</td>
</tr>
<tr>
<td>III (12\textsuperscript{th} week)</td>
<td>34</td>
<td>138.38</td>
</tr>
<tr>
<td>26 weeks Post-Op</td>
<td>35</td>
<td>141.51</td>
</tr>
<tr>
<td>52 weeks Post-Op</td>
<td>30</td>
<td>150.25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Treatment phase</th>
<th>External Rotation</th>
<th>Internal Rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>X</td>
</tr>
<tr>
<td>III (12\textsuperscript{th} week)</td>
<td>34</td>
<td>67.44</td>
</tr>
<tr>
<td>26 weeks Post-Op</td>
<td>35</td>
<td>75.00</td>
</tr>
<tr>
<td>52 weeks Post-Op</td>
<td>20</td>
<td>77.30</td>
</tr>
</tbody>
</table>

Table 6. Descriptive Statistics Regarding Normative Values for Subjective Level of Pain and Strength Testing Measurements

<table>
<thead>
<tr>
<th>Treatment phase</th>
<th>Pain Level</th>
<th>Strength Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>X</td>
</tr>
<tr>
<td>III (12\textsuperscript{th} week)</td>
<td>34</td>
<td>1.38</td>
</tr>
<tr>
<td>26 weeks Post-Op</td>
<td>31</td>
<td>.98</td>
</tr>
<tr>
<td>52 weeks Post-Op</td>
<td>21</td>
<td>.61</td>
</tr>
</tbody>
</table>

38
On average, all clinical measurements improved as phases increased, of these increases, few were significant (P<.05). Those measures showing significant improvement were: active external rotation from phase III to the 52 week follow-up consultation (gained 9.86 degrees, p<.049); subjective pain reports at phase I (2.63) compared to phase III (1.38, p<.026), 26 week follow-up (.98, p<.01), and at 52 weeks follow up (.61, p<.00).

The clinicians conducting this study measured function during the follow-up visits at 26 weeks post-operative repair and at 52 post-operative repair. As stated earlier, function was measured by a “perceived level of function” questionnaire which was completed by the patient (Appendix C). Of the 36 patients included in this study, 12 had completed the functional assessment questionnaire at the 26 week consultation, while 11 subjects completed the questionnaire at the 52 week follow-up consultation. Both groups on average perceived their function to be satisfactory (Figure 1). Interestingly, those who completed the questionnaire at 52 weeks, on average, reported being more satisfied with their function (96.32 percent, standard deviation of 5.39) than at the 26 week consultation (86.27 percent with standard deviation of 8.19).
Follow-up phase

Figure 1. Results of perceived functional satisfaction by percent at follow-up consultation

3. The Influence of demographic variables have in predicting favorable outcomes

Surgical procedure type and tear size

Of the 36 repairs studied, all but two were repaired using the standard deltoid split, open repair with open acromioplasty (group 2). One repair was done with open repair only, and the other was repaired using the modified-open repair with arthroscopic subacromial decompression. Twenty tears (54.1 percent) were classified as large; 10 (27 percent) were medium tears; and 7 (18.8 percent) were small tears. Summary of the tear size and surgical types is found in Table 7.
Table 7. Crosstabulation Between Tear Size and Type of Surgery Procedure Performed

<table>
<thead>
<tr>
<th>Tear size</th>
<th>Type of Surgical Procedure</th>
<th>Total Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Open repair</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Open repair &amp; open</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>subacromial decompression</td>
<td>20</td>
</tr>
<tr>
<td>Small</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Medium</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Large</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Total Patients</td>
<td>1</td>
<td>36</td>
</tr>
</tbody>
</table>

The influence demographic variables have in predicting outcome

Multiple regression statistical analysis was used for finding the level of predictive influence demographic factors (age, tear size, and handedness of repair) have on results found at discharge of physical therapy. The outcomes included in analysis were the degree of shoulder external rotation, the level of perceived pain, and the number of visits utilized. The results of these regressions are found in Tables 8 through 14. It is apparent that these three demographic variables do not significantly influence the degree of shoulder external rotation, the level of perceived pain, or the number of visits utilized.

Table 8. Model Summary Describing Predictors for Shoulder External Rotation at Phase III

<table>
<thead>
<tr>
<th>Model Predictors</th>
<th>$R^2$</th>
<th>$R^2$ change</th>
<th>$F$ Change</th>
<th>df1</th>
<th>df2</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tear size, Age, injury to dominant hand</td>
<td>.067</td>
<td>.067</td>
<td>.646</td>
<td>3</td>
<td>27</td>
<td>.592</td>
</tr>
<tr>
<td>Tear size, injury to dominant hand</td>
<td>.063</td>
<td>-.004</td>
<td>.107</td>
<td>1</td>
<td>29</td>
<td>.746</td>
</tr>
<tr>
<td>Injury to dominant hand</td>
<td>.045</td>
<td>-.019</td>
<td>.554</td>
<td>1</td>
<td>30</td>
<td>.253</td>
</tr>
</tbody>
</table>
Table 9. ANOVA Analysis Regarding Significance that Predictors have on Shoulder External Rotation at Phase III

<table>
<thead>
<tr>
<th>Model Predictors</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Regression</td>
<td>502.891</td>
<td>3</td>
<td>167.630</td>
<td>.646</td>
<td>.592</td>
</tr>
<tr>
<td>Residual</td>
<td>7005.045</td>
<td>27</td>
<td>259.446</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7507.935</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Regression</td>
<td>475.112</td>
<td>2</td>
<td>237.556</td>
<td>.946</td>
<td>.400</td>
</tr>
<tr>
<td>Residual</td>
<td>7032.823</td>
<td>28</td>
<td>251.172</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7507.935</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Regression</td>
<td>335.914</td>
<td>1</td>
<td>335.914</td>
<td>1.358</td>
<td>.253</td>
</tr>
<tr>
<td>Residual</td>
<td>7172.021</td>
<td>29</td>
<td>247.311</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7507.935</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Model Predictors: tear size; age; injury to dominant hand
2. Model Predictors: tear size; injury to dominant hand
3. Model Predictors: injury to dominant hand

Table 10. Model Summary Describing Predictors for Perceived Pain Levels at Phase III

<table>
<thead>
<tr>
<th>Model Predictors</th>
<th>$R^2$</th>
<th>$R^2$ change</th>
<th>$F$ Change</th>
<th>df1</th>
<th>df2</th>
<th>Sig. $F$ Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tear size, Age, injury to dominant hand</td>
<td>.021</td>
<td>.021</td>
<td>.197</td>
<td>3</td>
<td>27</td>
<td>.898</td>
</tr>
<tr>
<td>Tear size, injury to dominant hand</td>
<td>.021</td>
<td>.000</td>
<td>.012</td>
<td>1</td>
<td>29</td>
<td>.914</td>
</tr>
<tr>
<td>Injury to dominant hand</td>
<td>.015</td>
<td>-.008</td>
<td>.169</td>
<td>1</td>
<td>30</td>
<td>.684</td>
</tr>
</tbody>
</table>
Table 11. ANOVA Analysis Regarding the Significance Predictors have on the Perceived Pain Level at Phase III

<table>
<thead>
<tr>
<th>Model Predictors</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>$F$</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Regression</td>
<td>1.216</td>
<td>3</td>
<td>.405</td>
<td>.646</td>
<td>.592</td>
</tr>
<tr>
<td>Residual</td>
<td>55.558</td>
<td>27</td>
<td>2.058</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>56.774</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Regression</td>
<td>1.192</td>
<td>2</td>
<td>.596</td>
<td>.300</td>
<td>.743</td>
</tr>
<tr>
<td>Residual</td>
<td>55.582</td>
<td>28</td>
<td>1.985</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>56.774</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Regression</td>
<td>.857</td>
<td>1</td>
<td>.857</td>
<td>.444</td>
<td>.510</td>
</tr>
<tr>
<td>Residual</td>
<td>55.917</td>
<td>29</td>
<td>1.928</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>56.774</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Model Predictors: tear size; age; injury to dominant hand
4. Model Predictors: age; injury to dominant hand
5. Model Predictors: age

Table 12. Model Summary Describing Predictors for the Total Number of Visits Utilized

<table>
<thead>
<tr>
<th>Model Predictors</th>
<th>$R^2$</th>
<th>$R^2_{\text{change}}$</th>
<th>$F_{\text{Change}}$</th>
<th>df</th>
<th>Df 2</th>
<th>Sig. $F_{\text{Change}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tear size, Age, injury to dominant hand</td>
<td>.120</td>
<td>.120</td>
<td>1.269</td>
<td>3</td>
<td>28</td>
<td>.304</td>
</tr>
<tr>
<td>Tear size, injury to dominant hand</td>
<td>.110</td>
<td>-.009</td>
<td>.300</td>
<td>1</td>
<td>30</td>
<td>.588</td>
</tr>
<tr>
<td>Injury to dominant hand</td>
<td>.100</td>
<td>-.010</td>
<td>.330</td>
<td>1</td>
<td>31</td>
<td>.570</td>
</tr>
</tbody>
</table>

Table 13. ANOVA Analysis Regarding the Significance Predictors have on the Total Number of Visits Utilized

<table>
<thead>
<tr>
<th>Model Predictors</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>$F$</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Regression</td>
<td>48.763</td>
<td>3</td>
<td>16.254</td>
<td>1.269</td>
<td>.304</td>
</tr>
<tr>
<td>Residual</td>
<td>358.737</td>
<td>28</td>
<td>12.812</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>407.500</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Regression</td>
<td>44.915</td>
<td>2</td>
<td>22.458</td>
<td>1.796</td>
<td>.184</td>
</tr>
<tr>
<td>Residual</td>
<td>362.585</td>
<td>29</td>
<td>12.503</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>407.500</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Regression</td>
<td>40.795</td>
<td>1</td>
<td>40.795</td>
<td>3.337</td>
<td>.078</td>
</tr>
<tr>
<td>Residual</td>
<td>366.705</td>
<td>30</td>
<td>12.224</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>407.500</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Model Predictors: tear size; age; injury to dominant hand
2. Model Predictors: age; injury to dominant hand
3. Model Predictors: age
CHAPTER VI

DISCUSSION

One goal of this study was to document, with the data given, outcome results of rotator cuff repair and rehabilitation secondary to the repair for St. Alexius Medical/Bone and Joint Center. The reasons this study were (1) to report objective results back to payers, (2) to establish a data base for Continuous Quality Improvement purposes and practice pattern facilitation, (3) to give this health care facility the ability to compare these results to other studies and facilities, and (4) most importantly, to document whether high quality care is being practiced efficiently.

Calculating the average number of physical therapy treatment visits utilized per surgical case was one way this study attempted to objectify clinical results. A practical way the health care provider can use this data may be for prognostication purposes. The average number of visits may be used as a patient progression goal, a number to strive for when forecasting treatment for the average patient. For the payer, the number of visits translates to dollars spent, while providing written evidence how, on average, this particular health care facility practices health care. Finally, to the patient, the number of visits ultimately defines the amount of care given. As the number of visits utilized decrease, the more challenging it becomes for the provider to deliver high quality,
effective care. Home treatment programs will have to be utilized and while patient compliance will need to be high if favorable outcomes are to be achieved and maintained.

When considering treatment utilization efficiency of this particular rehabilitation facility, one might consider the average number of visits as a determining factor. The ability to utilize the least number of resources possible without compromising quality is how efficiency is measured. According to Therapeutic Associates Inc., a west coast based rehabilitation provider and a leader in the area of physical therapy outcome management, an average of 10 visits are needed for outpatient rehabilitation of rotator cuff repairs. Currently many third-party payers are setting reimbursement-treatment guidelines, paying for a limited number of physical therapy visits, to ensure efficient care is being utilized. According to recently formulated reimbursement guidelines developed by the largest insurance carrier in the state of North Dakota, physical therapists receive up to 18 visits within 6 months for the rehabilitation of surgical patients.

In this study, St. Alexius Medical Center/Bone and Joint Center exhibited excellent efficiency by utilizing an average of 7.51 physical therapy visits for rehabilitation of patients with rotator cuff repairs. The rural setting of this health care facility may be a contributor in this efficiency. Patients are limited in the number of times they may be seen for outpatient therapy due to long distance commutes. Thus, more home exercise programs are utilized.

The quality of care being provided by St. Alexius Medical Center/Bone and Joint Center was quantified in this study by the percentage of patients possessing good-to-excellent end-results from surgery and therapy (Table 3). In this study 75 percent of the subjects were classified as having good-to-excellent results. This result was very
comparable to other studies, but slightly lower than Ellman et al reported. For this particular facility, results show both efficient and effective care is being provided.

Favorable impairment results from this study are similar to other studies. Satisfactory range of motion percentages as found in this study were nearly identical to the study conducted by Bjorkenheim et al. They found 76 percent of patients who underwent rotator cuff repair showed satisfactory forward flexion and 82 percent favorable external rotation, while in this study 76 percent and 82 percent of the patients obtained satisfactory forward flexion and external rotation, respectively. Pain reduction results (76 percent) in this study were somewhat lower as compared to other studies. Bjorkenheim et al achieved an 84 percent satisfactory pain level in their study, while Hawkins et al and Gore et al found 86 and 85 percent satisfactory pain results respectively.

For those impairment levels in which the patients did not meet the desired objective results, the mean number of treatment visits utilized was higher (although not significantly) in all four impairments compared to those who met the desired outcome (see Tables 1 and 2). Although conclusions are limited from this data due to the small sample size, one trend is worth noting. According to the results printed in Table 2, the average number of visits utilized for active external rotation and forward flexion was 10.00 and 10.50 respectively, while strength and pain level were found to utilize 7.29 and 7.38 visits respectively. These results may indicate that the clinicians in this study emphasized achievement of favorable range of motion levels before discharge, and utilized more visits in attempt to reach the favorable levels. Future investigations would be necessary in this area to better delineate this relationship.
This study was successful in establishing normative data regarding impairment measures. Because 26 week and 52 week follow-up data was included (Tables 5 and 6), suggested trends could be looked upon as areas of further investigation. With the current data, there appears to be a small difference between phase III (time of discharge at 12 weeks) and the 26 week follow-up, while a larger difference is apparent between phase III and the 52 week follow-up. This reinforces the finding that suggest strength and range of motion measures can continue to increase up to 1 year post-operatively.\textsuperscript{39,37,51} Most studies analyze data at follow-up ranging from two years to six years after surgical repair, compared to this study which conducted the latest follow-up at one year.

In comparing this study’s results at 52 weeks to other studies, similar results were found. For forward shoulder flexion, Baker et al\textsuperscript{4}, Ellman et al\textsuperscript{8}, and Hawkins et al\textsuperscript{7} found measurements of 153, 153, and 148 degrees respectively, while active flexion in this study was found to be 150 degrees. Similar conclusions were found when comparing shoulder abduction and external rotation motions.\textsuperscript{15,7} Pain relief in this study also closely resembled results found in other studies.\textsuperscript{4,8} Using a pain rating scale which quantified no pain as 10 while terrible pain as zero, Baker et al\textsuperscript{1} and Ellman et al\textsuperscript{8} found follow-up pain to average 8.4 and 9.1 respectively. In this study, the average perceived pain level was .61 (zero being no pain, 10 being terrible pain). In reviewing past studies, one conducted by Heveron et al,\textsuperscript{31} had impairment measurements at both three months and six months following surgery. In this study, which had only 18 subjects, only forward flexion was measured in the same manner as in this study. At three months and at six months, forward flexion was measured at 133 and 147 degrees respectively, compared to 138 and 142 degrees found in this study.
The perceived functional level of the patient who completed the functional assessment questionnaire form (Appendix C) high for both the 26 week follow-up and 52 week follow-up groups (Figure 1). This trend showing functional improvement from the 26 week consultation to the 52 week consultation supports the findings that suggest the functional level may continue to increase up to one year after surgery. However, because the sample size for those who completed the questionnaire was small, accurate conclusions could not be made regarding the overall functional level of those included in this study. Furthermore, the pre-operative functional level was not documented, which inhibited the possibility for measuring the functional improvement gained from having rotator cuff repair surgery. Future research in this area is needed to determine functional outcome.

The results from multiple regression analyses revealed that the demographic variables of age, tear size, and handedness do not significantly influence the degree of shoulder external rotation, the level of perceived pain, or the number of visits utilized. These findings may suggest that standardized operative procedures used by surgeons for repairing the rotator cuff, along with consistently performed rehabilitation procedures have lowered demographic variability that exists between each patient. For instance, if a large tear is repaired successfully with limited complication or defects, it may possess near equal tensile strength potential that a smaller repaired tear contains. The influence tear size variability has on outcome is thus eliminated. This idea supports the findings found by Harryman et al which suggest the integrity of the rotator cuff at the time of follow-up, not the size of the tear preoperatively, is the major determinant for outcomes of operative repair.
One major limitation for quantifying the number of treatment visits needed to achieve favorable outcome measures, was that the last treatment given (at phase III) was the primary source for data collection. This treatment session was the only time when all active range of motion measurements and strength tests were documented. Treatment data were not collected between phase II and phase III. Thus, the patients included in this study may have conceivably achieved these levels of impairment prior to the final visit at phase III.

Another major limitation of this study was that of small sample size. This study potentially illuminates clinical practice trends but does not statistically determine cause and effect relationships. Future research is needed as the sample size increases to determine significance from statistical analyses.

Lack of standardization of the data collected was a definite limitation throughout this study. Strength comparisons were nearly impossible to compare from phase to phase due to inconsistent measuring techniques. During phase III, all strength measurements were completed using the standard "break" test with Manual Muscle Testing. However, during the follow-up visits, hand held dynamometers were used to test strength, measuring pound of pressure produced. Consequently, comparisons could not be accurately made between phase III strength and follow-up strength.

The length of the outcome form (Appendix C) may have influenced the amount of data that was collected. Because the form was quite long, clinicians may have opted not to record all of the impairment results due time constrains. This lack of documented data limited the number of subjects with could be included in this study. A more concise form, including pain rating, level of strength, functional level, shoulder range of motion levels
(forward flexion, abduction, and external rotation), and the patient's level of satisfaction would be optimal for documenting and measuring outcome.

Patient satisfaction data were not collected in this study, thus limiting the outcome measurement in the area of the patient's feedback on the rehabilitation received. According to Dobrzykowski,6 "the patient's perspective on the result of his or her health care experience and the measurement of this perception are essential to a valid outcomes management system." The patient's view of his or her condition is as important or more important than how the clinician views the condition. In addition, third-party payers are increasingly viewing patient satisfaction results as a vital continuum.

One suggestion for future investigators when conducting any outcome study, would be to incorporate a clinometric, objective tool to measure impairment and disability levels. This scale should be specific to the area of study, it should include measurements of pain, range of motion, strength, functional ability, and patient satisfaction. This assessment tool should standardize impairment data collection, while correlating these impairments with the patient's ability to perform life work and recreational activities. In other words, the scoring system must quantify the outcome of treatment. One such rating scale is the University of California Los Angeles End-Result Score (Appendix F). This 35-point scale was first use by Ellman et al8 and includes pain rating (10 points), function (10 points), active forward flexion (5 points), strength in forward flexion (5 points), and patient satisfaction (5 points). For this scale to show the best results it should be administered consistently by the same clinician, before surgery, at discharge of therapy (approximately three months) and at follow-up visits. Thus, the progression of therapeutic outcome is being monitored.
CHAPTER VII
CONCLUSION

Functional outcome data is a major tool many health care providers are using to accommodate to the ever changing realm of health care. By monitoring treatment procedures and results, outcomes serve as proof that high quality, cost effective health care is being provided and utilized. Since rotator cuff tears are one of the more frequent injuries causing disability to the shoulder, and often require surgical repair, outcome studies are needed in this area. In this study, therapeutic outcomes were quantified by (1) the number of visits needed to achieve favorable outcomes by discharge from physical therapy; (2) normative values for impairment measurements at various phases of rehabilitation and for long term functional levels; and (3) the influence demographic variables have on achieving favorable outcomes. When finding the mean number of visits needed for rehabilitation, the efficiency outcome is established. When finding the percentage of the patients who achieved desired impairment results, effectiveness of therapy is established for this particular health care facility. Both components, efficiency and effectiveness, are essential in order for outcome of rehabilitation to be considered satisfactory.

For this particular physical therapy facility, the mean number of visits needed for rehabilitation of the repaired rotator cuff was relatively low (7.51). In addition, 75 percent
of the participants in this study achieved good-to-excellent results. From the above results, it can be concluded that for this health care facility, the combination of surgical repair and rehabilitation of rotator cuff tears has produced excellent clinical outcomes. In effort to spot clinical trends and reveal possible practice patterns, this study established normative values for impairment measurements at certain phases of rehabilitation. These normative values were developed as baseline data, with the purpose of being added to with future clinical measures.

The data tabulated in this study can assist in the assurance that St. Alexius Medical/Bone and Joint Center is providing the most efficient, yet effective care to their patients. By monitoring outcomes, health care costs inevitably will decrease. These savings will be passed onto the third-party payers, providers, and ultimately the patient. This information will assist St. Alexius Medical/Bone and Joint Center in providing the best possible care, striving toward continuous quality improvement, which ultimately will lead toward benefiting the patient. With the need for outcome data becoming vital for survival as a health care provider, it is possible that St. Alexius Medical/Bone and Joint Center could be looked upon by other facilities as a model for outcome related data, thus helping to facilitate outcome research in other facilities. This could aid in the quality standards the physical therapy profession needs to compete in today's health care market.
LONGITUDINAL STUDY CONSENT FORM

THE RESULTS OF YOUR REHABILITATION PROCESS ARE BEING GATHERED AS PART OF A LONG TERM STUDY OF SURGICAL AND FUNCTIONAL OUTCOMES OF YOUR PARTICULAR DIAGNOSIS. ONCE YOU HAVE COMPLETED YOUR FORMALIZED PHYSICAL THERAPY TREATMENT AND HAVE BEEN DISCHARGED FROM ST. ALEXIUS MEDICAL CENTER, WE WOULD APPRECIATE THE OPPORTUNITY OF RETESTING YOUR STATUS AT 6 MONTHS, 12 MONTHS, AND 24 MONTHS POST DISCHARGE. THESE LAST THREE VISITS WOULD BE FREE OF CHARGE AND ALL RESULTS WOULD BE MADE READILY AVAILABLE TO YOU.

WHEN UNDERGOING THESE TESTS, THERE ARE CERTAIN INHERENT RISKS WHICH INCLUDE THE POSSIBILITY OF MUSCLE AND LIGAMENTOUS INJURY. YOU SHOULD EXERT YOUR BEST EFFORT THROUGHOUT THE EVALUATION BUT AT NO TIME ARE YOU EXPECTED TO EXPERIENCE ANY INCREASE IN PAIN OR DISCOMFORT BEYOND A LEVEL YOU FEEL YOU CAN COMFORTABLY TOLERATE. AT NO TIME WILL YOU BE FORCED TO PERFORM ANY TESTS WHICH YOU DO NOT WISH TO PERFORM AS YOU ARE IN CONTROL OF THE TESTING AND MAY STOP WHENVEVER YOU FEEL THAT YOU SHOULD NOT PROCEED. IF WE SEE YOU EXERTING EFFORTS, WHICH IN OUR OPINION MAY PLACE YOU IN DANGER, WE WILL STOP YOU.

BASED ON THE ABOVE INFORMATION THAT I HAVE READ AND UNDERSTAND, I AGREE TO PARTICIPATE IN THIS LONGITUDINAL STUDY.

DATE

PARTICIPANT SIGNATURE
REPORT OF ACTION: EXEMPT/EXPEDITED REVIEW
University of North Dakota Institutional Review Board

DATE: May 20, 1997  PROJECT NUMBER: IRB-9706-278

NAME: Jerret Hopstad  DEPARTMENT/COLLEGE: Physical Therapy

PROJECT TITLE: The Effect of an Accelerated Protocol on Patients Receiving Rotator Cuff Repair: An Outcome Study

The above referenced project was reviewed by a designated member for the University's Institutional Review Board on June 3, 1997 and the following action was taken:

☐ Project approved. EXPEDITED REVIEW NO. _____________________.
   Next scheduled review is on _________________________.

☐ Project approved. EXEMPT CATEGORY NO. <__________. No periodic review scheduled unless so stated in the Remarks Section.

☐ Project approved PENDING receipt of corrections/additions. These corrections/additions should be submitted to ORPD for review and approval. This study may NOT be started UNTIL final IRB approval has been received. (See Remarks Section for further information.)

☐ Project approval deferred. This study may not be started until final IRB approval has been received. (See Remarks Section for further information.)

☐ Project denied. (See Remarks Section for further information.)

REMARKS: Any changes in protocol or adverse occurrences in the course of the research project must be reported immediately to the IRB Chairperson or ORPD.

cc: B. Johnson, Adviser

[Signature]
UND's Institutional Review Board

6/3/97

If the proposed project (clinical medical) is to be part of a research activity funded by a Federal Agency, a special assurance statement or a completed 310 Form may be required. Contact ORPD to obtain the required documents.

(3/96)
EXPEDITED REVIEW REQUESTED UNDER ITEM ___ (NUMBER[S]) OF HHS REGULATIONS
X EXEMPT REVIEW REQUESTED UNDER ITEM ___ (NUMBER[S]) OF HHS REGULATIONS

UNIVERSITY OF NORTH DAKOTA
HUMAN SUBJECTS REVIEW FORM
FOR NEW PROJECTS OR PROCEDURAL REVISIONS TO APPROVED PROJECTS INVOLVING HUMAN SUBJECTS

PRINCIPAL INVESTIGATOR: Jerret Hopstad  TELEPHONE: (701) 775-4103  DATE: 4-15-97

ADDRESS TO WHICH NOTICE OF APPROVAL SHOULD BE SENT: University of North Dakota, Dept. of Physical Therapy, PO Box 9037, Grand Forks, ND, 58202-9037


PROJECT TITLE: The Effect of an Accelerated Protocol on Patients Receiving Rotator Cuff Repair: an Outcome Study

FUNDING AGENCIES (IF APPLICABLE):

TYPE OF PROJECT:
X NEW PROJECT  ____ CONTINUATION  ____ RENEWAL  ____ THESIS RESEARCH  ____ STUDENT RESEARCH PROJECT

CHANGE IN PROCEDURE FOR A PREVIOUSLY APPROVED PROJECT

DISSERTATION/Thesis Adviser, or Student Adviser: Beverly Johnson

PROPOSED PROJECT: ___ INVOLVES NEW DRUGS (IND)  ____ INVOLVES NON-APPROVED USE OF DRUG  X INSTITUTION

IF ANY OF YOUR SUBJECTS FALL IN ANY OF THE FOLLOWING CLASSIFICATIONS, PLEASE INDICATE THE CLASSIFICATION(S):

__ MINORS (<18 YEARS)  __ PREGNANT WOMEN  __ MENTALLY DISABLED  __ FETUSES  __ MENTALLY RETARDED
__ PRISONERS  __ ABORTUSES  __ UND STUDENTS (>18 YEARS)

IF YOUR PROJECT INVOLVES ANY HUMAN TISSUE, BODY FLUIDS, PATHOLOGICAL SPECIMENS, DONATED ORGANS, FETAL MATERIAL, OR PLACENTAL MATERIALS, CHECK HERE

1. ABSTRACT: (LIMIT TO 200 WORDS OR LESS AND INCLUDE JUSTIFICATION OR NECESSITY FOR USING HUMAN SUBJECTS.

Functional outcome data is an important tool for many health care providers. It is now being used to accommodate the ever changing realm of health care. Monitoring treatment procedures and results (number of visits, functional strength rating, pain level), outcomes serve as proof to the third party payers that efficient, cost effective, high quality health care is being provided and utilized. Physical therapists at St. Alexius Medical Center in Bismarck, ND have been interested in exploring patient outcomes of therapeutic intervention for a variety of medical conditions. Since rotator cuff tears are one of the more frequent injuries causing disability to the shoulder, and often, require surgical repair, it is only natural that these therapists would be interested in knowing therapeutic outcomes for such a common diagnosis. Therefore, the purpose of this study is to analyze this charted information to determine the average length of time (number of visits) needed to reach optimal functional ability, thus establishing outcome results for this particular clinic.

This project is a retrospective review of information collected on patients at St. Alexius Medical Center/Bone and Joint Center in Bismarck, ND, and will be performed. The patients included in this study underwent shoulder rotator cuff repair. Various physical test measurements and functional results were recorded at specific time intervals throughout their rehabilitation process. Descriptive statistics and multiple regression procedures will be utilized to determine the outcomes from the data collected. These results will be shared with St. Alexius Medical Center/Bone and Joint Center and the UND department of Physical Therapy for use in establishing protocol for future patient care, quality improvement and reimbursement.
PLEASE NOTE: Only information pertinent to your request to utilize human subjects in your project or activity should be included on this form. Where appropriate attach sections from your proposal (if seeking outside funding).

2. PROTOCOL: (Describe procedures to which humans will be subjected. Use additional pages if necessary.)

Purpose:
The purpose of this study is to determine physical therapy outcomes following rehabilitation of rotator cuff repair of the shoulder. The outcomes which will be investigated are: range of motion, muscle strength, pain level, and functional use of the surgically repaired shoulder. In addition, this study will investigate the influence of demographic variables (gender, age, size of tear, etc...) on range of motion, pain level, and functional use of the involved shoulder at one year post-operatively.

Subjects:
Participants included in this study were patients who underwent optional surgical repair of the rotator cuff (shoulder) and were referred to St. Alexius for physical therapy service. These participants read and signed the consent form for outcome analysis during their initial physical therapy visit. Outcome data was collected by St. Alexius physical therapy from 9/1/95 until 5/1/97 on a standardized form (appendix A). From this larger pool of outcome data, participants will be selected for inclusion in this study if they meet the following criteria:
1. underwent rotator cuff repair by an orthopedic surgeon in the Bismark area;
2. referred to St. Alexius for physical therapy service;
3. signed the consent form to be a participant in outcomes analysis; and
4. completed all outcome evaluations at 3 weeks, 6 weeks, 12 weeks, 6 months, and 1 year post-operatively.

Procedure and Instrumentation:
The procedure will entail reviewing 80-100 outcome forms along with the respective operative reports of participants who met inclusion criteria. A data sheet will be used to record various outcomes identified as important by the St. Alexius physical therapy staff (Appendix B). These outcomes were collectively defined as the:
1. Number of physical therapy visits needed until range of motion of the surgical shoulder is comparable to the involved shoulder;
2. Number of visits needed until muscle strength of the surgical shoulder is comparable to the involved shoulder;
3. Number of visits needed to achieve functional use of the surgically repaired shoulder as recorded on the Upper Extremity Functional Assessment Form (Jung, 1995). This assessment tool has high score of 90 and scores that range between 72 and 90 will be considered functional. This range of scores corresponds with a subjective rating of satisfactory when using the shoulder for activities of daily living, household duties, outdoor activities, and for sporting activities;
4. Number of visits needed to achieve a pain free surgical shoulder using a 0-10 pain scale, where a 0 score indicated no pain and a 10 score indicated pain which required emergency care.
5. Influence of demographic variables (gender, age, size of tear, etc...) on range of motion, functional use of the shoulder, and pain level at one year post-operatively.

Analysis:
Outcomes 1-4 will be investigated using descriptive statistics for measures of central tendency and variance. Multiple regression procedures will be used to examine outcome 5. All data will be collected and analyzed in a codified form to insure participant confidentiality.
3. BENEFITS: (Describe the benefits to the individual or society.)

By using this data to determine the most efficient method of providing patient care, costs to provide this care will be reduced. These savings will be passed onto the third party payers (insurance companies, Workers Compensation and Medicare/Medicaid), the providers, and ultimately the patients. St. Alexius will have information needed to provide the best possible care, striving toward continual quality improvement which ultimately will lead toward benefiting future patients. The data found in this study will also benefit UND Department of Physical Therapy. As needed, students and faculty will have unlimited access to this study to aid in the educational process. With the need for outcome data becoming vital to survive as a health care provider, it is possible St. Alexius could be looked upon by other facilities as a model for outcome related data, thus helping to facilitate outcome programs in other facilities. This could aid in establishing the quality and efficacy standard the physical therapy profession needs to compete in today's health care market. The knowledge gained from this study by UND will contribute to the understanding of how outcome studies can affect the profession of physical therapy, and it also will aid, in the form of literature, persons interested in research in related outcome studies.

4. RISKS: (Describe the risks to the subject and precautions that will be taken to minimize them. The concept of risk goes beyond physical risk and includes risks to the subject's dignity and self-respect, as well as psycho-logical, emotional or behavioral risk. If data are collected which could prove harmful or embarrassing to the subject if associated with him or her, then describe the methods to be used to insure the confidentiality of data obtained, including plans for final disposition or destruction, debriefing procedures, etc.)

Collection of the data by St. Alexius was done during the course of standard patient care involving no extraordinary risk to the patients. Risks for the patients as a result of analysis of the data include that of confidentiality which will be maintained as no individual names will be used, the results will be reported in aggregate, and codes will be used to input the data. The original forms will be maintained by St. Alexius Medical Center and copies will be kept in the Physical Therapy Department for a period of two years.
5. **CONSENT FORM:** A copy of the **CONSENT FORM** to be signed by the subject (if applicable) and/or any statement to be read to the subject should be attached to this form. If no **CONSENT FORM** is to be used, document the procedures to be used to assure that infringement upon the subject's rights will not occur.

Describe where signed consent forms will be kept and for what period of time.

Consent forms for inclusion in this outcome study were gathered by St. Alexius and are being maintained in their facility. No additional consent forms will be utilized for this chart review.

6. For **FULL IRB REVIEW** forward a signed original and thirteen (13) copies of this completed form, and where applicable, thirteen (13) copies of the proposed consent form, questionnaires, etc. and any supporting documentation to:

Office of Research & Program Development  
University of North Dakota  
Box 8138, University Station  
Grand Forks, North Dakota 58202

On campus, mail to: Office of Research & Program Development, Box 134, or drop it off at Room 101 Twamley Hall.

For **EXEMPT** or **EXPEDITED REVIEW** forward a signed original and a copy of the consent form, questionnaires, etc. and any supporting documentation to one of the addresses above.

The policies and procedures on Use of Human Subjects of the University of North Dakota apply to all activities involving use of Human Subjects performed by personnel conducting such activities under the auspices of the University. No activities are to be initiated without prior review and approval as prescribed by the University's policies and procedures governing the use of human subjects.

**SIGNATURES:**

Principal Investigator  
DATE:

Project Director or Student Adviser  
DATE:

Training or Center Grant Director  
DATE:
LONGITUDINAL OUTCOME STUDY
SURGICAL ROTATOR CUFF PROTOCOL

NAME OF PATIENT
__________________________

Doctor ___________________

Preoperative Diagnosis: ____________________________

Surgical Procedure: ____________________________

Surgical Complications:
Deltoid Detached: Y/N - Clavicular Resection: Y/N - Graft Used Y/N
Size of the Tear: ____________________________
Age of Patient: _______ Sex: _______ Involved Side: _______ Dominant Side: _______
Occupational Injury - Yes _______ No _______
Occupation: ____________________________
Sport Injury - Yes _______ No _______ Sport: ____________________________
Injury from other cause (please state): ____________________________

HOSPITAL DISCHARGE
Date _______ Protocol Title/Date ______________________

Check off if complete:
Pt. was given all protocol instructions prior to discharge.
Pt. achieved all discharge parameters satisfactorily.
Alterations from protocol: ____________________________

Period and Type of Immobilization: ____________________________

PHASE ONE: (2ND TO 3RD WEEK)
Check one: Clinical Care______ Home Program______
Date _______ Protocol Date _______

Pain Scale _______
Active Extension of Elbow______
Active Flexion of Elbow______
Active Extension of Wrist______
Active Flexion of Wrist______
Active Supination of Wrist______
Active Pronation of Wrist______
Adducted Passive External Rotation of Shoulder______
Passive Elevation or Flexion of the Shoulder______
Complications/Comments: ____________________________

Bilateral Movements Taken: _______ Yes _______ No
Data Logged: _______ Yes _______ No

# of Visits: _______
PHASE TWO: (6TH WEEK)
Check one: Clinical Care Home Program
Date Protocol Date
Pain Scale
Active Extension of Elbow
Active Flexion of Elbow
Active Extension of Wrist
Active Flexion of Wrist
Active Supination of Wrist
Active Pronation of Wrist
Active Assistive Flexion of the Shoulder
Active Assistive Abduction of the Shoulder
Active Assistive External Rotation of the Shoulder, (add max. ext. rot. allowed)
Passive External Rotation of Shoulder at 90 degrees Abduction, Supine
Passive Internal Rotation of Shoulder at 90 Abduction, Supine
Passive Elevation or Flexion of the Shoulder, Supine
Active Extension of the Shoulder, standing
Complication/Comments:
Data Logged: Yes No # of Visits:

PHASE THREE: (12TH WEEK)
Check one: Clinical Care Home Program
Date Protocol Date
Pain Scale
Active Flexion of the Shoulder
Active Abduction of the Shoulder
Active Adduction of the Shoulder
Active External Rotation of the Shoulder at 90 degrees Abduction
Active Internal Rotation of the Shoulder at 90 degrees Abduction
Active Extension of the Shoulder
Passive External Rotation of Shoulder at 90 degrees, Supine
Passive Internal Rotation of Shoulder at 90 degrees, Supine
Passive Flexion of the Shoulder, supine
Manual Muscle Testing (Internal Rotation "IR", External Rotation "ER" in Adducted Position)
_____ 5 Complete range of motion against gravity with maximum resistance
_____ 4 Complete range of motion against gravity with moderate resistance
_____ 3 Complete range of motion with gravity
_____ 2 Complete range of motion with gravity eliminated
_____ 1 Evidence of slight contraction, but no joint motion
_____ 0 No contraction palpated
Complications/Comments:
Data Logged: Yes No # of Visits:
SIX MONTHS POST SURGERY

Current Symptoms: (check each one that applies)
- Pain Scale____ Unusual Sounds____ Joint Going Back In____
- Swelling____ Joint Locking Up____ Inability To Move____
- Stiffness____ Joint Giving Way____

External Rotation of Shoulder, 90 Degrees Abduction____
Internal Rotation of Shoulder, 90 Degrees Abduction____
Flexion of the Shoulder____
Extension of the Shoulder____
Abduction of the Shoulder____
Adduction of the Shoulder____

Isokinetic Test/MMT** (Internal/External Rotation)
(include short form)
Joint Play (state concerns about hyper/hypomobility)
Complications/Comments: ____________________________

Functional Assessment: _____Yes _____No
Data Logged: ______Yes ______No

**Microfet Testing - (test involved and uninvolved)

ONE YEAR POST SURGERY

Current Symptoms: (check each one that applies)
- Pain Scale____ Unusual Sounds____ Joint Going Back In____
- Swelling____ Joint Locking Up____ Inability To Move____
- Stiffness____ Joint Giving Way____

External Rotation of Shoulder, 90 Degrees Abduction____
Internal Rotation of Shoulder, 90 Degrees Abduction____
Flexion of the Shoulder____
Extension of the Shoulder____
Abduction of the Shoulder____
Adduction of the Shoulder____

Isokinetic Test/MMT** (Internal/External Rotation)
(include short form)
Joint Play (state concerns about hyper/hypo mobility)
Complications/Comments: ____________________________

Functional Assessment: _____Yes _____No
Data Logged: ______Yes ______No

**Microfet Testing

TWO YEARS POST SURGERY

Current Symptoms: (check each one that applies)
- Pain Scale____ Unusual Sounds____ Joint Going Back In____
- Swelling____ Joint Locking Up____ Inability To Move____
- Stiffness____ Joint Giving Way____

External Rotation of Shoulder, 90 Degrees Abduction____
Internal Rotation of Shoulder, 90 Degrees abduction____
Flexion of the Shoulder
Extension of the Shoulder
Abduction of the Shoulder
Adduction of the Shoulder
Isokinetic Test/MMT** (Internal/External Rotation) (include short form)
Joint Play (state concerns about hyper/hypo mobility)
Complications/Comments: ____________________________________________________________

Functional Assessment: _____Yes _____No
Data Logged: _____Yes _____No

**Microfet Testing

KA/MC/alr
5/96
UPPER EXTREMITY RANGE OF MOTION MEASUREMENTS
NON-INVOLVED EXTREMITY

DATE: __________

(To be used on the first outpatient visit)

Active Flexion of the Wrist
Active Extension of the Wrist
Active Supination of the Forearm
Active Pronation of the Forearm
Active Flexion of the Elbow
Active Extension of the Elbow
Active Flexion of the Shoulder
Active Extension of the Shoulder
Active Abduction of the Shoulder
Active Horizontal Adduction of the Shoulder
Active Internal Rotation of the Shoulder
Active External Rotation of the Shoulder

REFERENCES:


UPPER EXTREMITY
FUNCTIONAL ASSESSMENT FORM

DATE: ____________

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KA/MC/alr
5/96
APPENDIX D
SURGICAL ROTATOR CUFF PROTOCOL
JANUARY 1997

A. PREOPERATIVE SCREENING/INSTRUCTION

1. Rehabilitation for the rotator cuff repair will vary in length depending on several factors such as:
   a. Age of the patient
   b. Acute versus chronic tear
   c. Size and/or location of tear
   d. Immobilization time (use of abduction splint)
   e. Preoperative strength/ROM status
   f. Associated injuries/surgeries
   g. Desired activity level

2. Teach exercise program (Day 1)

B. PRECAUTIONS

1. Portion of anterior deltoid muscle detached/split
   a. Avoid active forward flexion for a minimum of 4-6 weeks

2. Sling at side 3-6 weeks, or axillary bolster/abduction splint 4-8 weeks

3. Obtain operative report for nature of repair
   a. Phase I may take 3-4 weeks for those undergoing direct repair, versus 6-8 weeks for those who have had a large/massive tear or tenuous repair, or need an abduction brace postoperatively.
4. Usually takes 6-12 months for a full recovery, occasionally will improve for up to 2 years postop

C. GOALS

1. Painless shoulder

2. Functional active range of motion obtained by end of 3rd month
   a. Minimum functional shoulder range: Flexion to 100 degrees, abduction to 90 degrees, external rotation to 45 degrees.

3. Functional strength returns

REHABILITATION

Phases of program based on stages of soft tissue healing (Review)

I. Phase I - 0 to 3 Weeks Postop (May take up to 6 weeks before advancement) Physician initiates program depending on repair, usually begun postop 2-4 days

0 to 10 days: Inflammatory stage, work on pain relief
10 days to 3 weeks: Coincides with fibroplasia stage of soft tissue healing

A. Passive range of motion

1. Six times daily, immobilizer removed for exercises

2. Pendulum exercises

3. Passive external rotation to pain free tolerance
   a. Arm adducted with towel roll between arm and side

4. Pulleys
   a. Do in plane of scapula for elevation to tolerance (Avoid any type of shoulder hiking)
B. Active range of motion
1. Cervical spine AROM
2. Elbow (Precaution if biceps repaired)
3. Wrist and hand
   a. Watch for hand swelling
   b. Watch for possible ulnar nerve irritation or olecranon bursitis from leaning on elbow
C. Modalities for pain relief (ice, E-stim, etc.)
D. Goals for Phase I
1. Promote functional scar
2. Increase ROM; 30-45 degrees passive external rotation in neutral, 90 degrees passive elevation
3. Prevent neuro dissociation
   * Physician will notify if sling to be sent home upon discharge.

II. Phase II - Start at 3-4 To 8 Weeks Postop
Sling may be removed at this time (physician discretion)
Coincides with late fibroplasia stage.
A. Educate in anatomy, surgical technique and rehab phase
B. Continue passive range of motion
C. Continue with AROM of distal joints
D. Assisted PROM all motions to pain free tolerable range
   1. Supine assisted passive flexion with use of cane
2. Supine external rotation starting with 45 degrees of abduction and progressing to 90 degrees of abduction

3. Supine 135 degrees of abduction/external rotation with use of cane

E. Active internal/external rotation with elbow adducted

F. Active exercises
   1. Shoulder shrugs
   2. Prone rowing
   3. Biceps curl (observe any precautions)
   4. Triceps curl
   5. Active assisted/active flexion after 6-8 weeks to 90 degrees
   6. Shoulder abduction to 70 degrees active assisted/actively after 6 weeks observing scapulohumeral rhythm

G. Mobilization of capsule/clavicle/scapula p.r.n.

H. Modalities for pain relief
   1. Ice with arm supported slightly abducted

I. Proprioceptive activities

III. Phase III - Start at 8 to 12 Weeks Postop

Early maturation stage

Functional scar at 6 weeks postop

Full PROM by 9 weeks postop: flexion 140°-160°; external rotation 70°-80° at 90° abduction
A. Continue ROM
   1. Active ROM flexion to tolerance
   2. Active ROM abduction to 90 degrees

B. Stretches
   1. Posterior cuff stretch
   2. Inferior cuff stretch
   3. Internal rotation stretch

C. Continue mobilization p.r.n.

D. Gentle resistive exercises to individual rotator cuff muscles and scapular stabilizers after appropriate active motion achieved
   1. Shoulder shrugs
   2. Flexion resisted to 90 degrees.
   3. Scaption with external rotation
   4. Internal rotation in the adducted position to full with use of low resistance Theraband.
   5. External rotation adducted with low resistance Theraband (to neutral only if instability present)
   6. Prone rowing
   7. Biceps curl (observe any precautions)
   8. Triceps curl

E. UBE

F. Modalities for pain relief
IV. **Phase IV - 12 to 16 Weeks Postop**

**Maturation Stage**

A. Continue ROM activities p.r.n.

B. Continue mobilization p.r.n.

C. Resisted exercises

1. Progressive resistive exercises through available ROM.
   
   a. Keep arm in front and below shoulder level for strengthening exercises if progress is slow/painful
   
   b. Resisted abduction beyond 70 degrees as well as elevation beyond 90 degrees should be avoided until internal rotation/external rotation is 25% or less deficit compared to the uninvolved side

2. Additional strengthening for rotator cuff as well as scapular musculature.
   
   a. Flexion (full) - Must be able to elevate actively without shoulder hiking before advancing resistance.
   
   b. Scaption with external rotation
   
   c. Scaption internally rotated
   
   d. Rowing prone
   
   e. Horizontal abduction prone with ER
   
   f. Wall pushup with plus
   
   g. Resisted internal/external rotation in the adducted position progressing to more abducted positions depending on desired activity level to be returned

D. UBE
4. Cybex
   a. Avoid 0 degrees adducted or 90 degrees abducted initially (suggest internal rotation with 20 degrees of abduction or in plane of scapula, external rotation up to 90 degrees flexion or also do in plane of scapula).

D. Modalities for pain relief

V. Phase V - 16 Weeks Postop to Discharge
Coincides with maturation stage
A. Maintenance program for nonathletic patients
B. Functional progression for throwing athletes
   1. Discharge to Human Performance Center
      Throwing Program


CLINICAL REVIEWER  
MEDICAL REVIEWER

CLINICAL DIRECTOR  
MEDICAL DIRECTOR

KA/alr  
1/2/97
B I B L I O G R A P H Y

ROTATOR CUFF PROTOCOL
Conservative/Surgical Rotator Cuff and Partial Acromioplasty


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Shoulder Pain in the Overhand or Throwing Athlete: The Relationship of Anterior Instability and Rotator Cuff Impingement, Jobe, Kvitne, Kerlan-Jobe Orthopaedic Clinic.

Shoulder Rotator Cuff Repair Rehabilitation Program, Brewster, Seto, Lum, Kerlan-Jobe Orthopaedic Clinic.


KA/alr
Updated 3/20/95
BIBLIOGRAPHY
Conservative/Surgical Rotator Cuff and Partial Acromioplasty

UPDATED MAY 7, 1996


Leroux, Jean-Louis; Herbert, Mouillerone; Thomas, Bonnell; Blotman; "Postoperative Shoulder Rotator Strength in Stages II and III Impingement Syndrome", Clinical Orthopaedics and Related Research, No. 320, pp. 46-54, November 1995.


UPDATE JANUARY 1997


APPENDIX E
DATA SHEET

Demographic Variables

Participant #: 

Gender: M F 

Age: 

Days between injury and surgery: 

Tear Size: Small Medium Large 

Surgery procedure type: 

Handedness: D/ND 

Physical Therapist: 

Doctor: 

Phase: 

Pain: 

A_Flex: A_Abd: 

A_ER_90: A_IR_90: 

P_Flex: 

MMT: MF_Inv: MF_NInv: 

Visits: Function: 

A_niv_fl: A_niv_er: 

80
Phase:

Pain:

A_Flex: A_Abd:

A_ER_90: A_IR_90:

P_Flex:

MMT: MF_Inv: MF_NInv:

Visits: Function:

A_niv_fl: A_niv_er:

_________________________

Phase:

Pain:

A_Flex: A_Abd:

A_ER_90: A_IR_90:

P_Flex:

MMT: MF_Inv: MF_NInv:

Visits: Function:

A_niv_fl: A_niv_er:

_________________________
APPENDIX F
### University of California at Los Angeles End-Result Scores

<table>
<thead>
<tr>
<th><strong>PAIN</strong></th>
<th><strong>Points</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Present all of the time and unbearable; strong medication frequently</td>
<td>1</td>
</tr>
<tr>
<td>Present all of the time but bearable; strong medication occasionally</td>
<td>2</td>
</tr>
<tr>
<td>None or little at rest, present during light activities; salicylates frequently</td>
<td>4</td>
</tr>
<tr>
<td>Present during heavy or particular activities only; salicylates occasionally</td>
<td>6</td>
</tr>
<tr>
<td>Occasional and sight</td>
<td>8</td>
</tr>
<tr>
<td>None</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>FUNCTION</strong></th>
<th><strong>Points</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to use limb</td>
<td>1</td>
</tr>
<tr>
<td>Only light activities possible</td>
<td>2</td>
</tr>
<tr>
<td>Able to do light housework or most activities of daily living</td>
<td>4</td>
</tr>
<tr>
<td>Most housework, shopping, and driving possible; able to do hair and dress</td>
<td>6</td>
</tr>
<tr>
<td>And undress, including fastening brassiere</td>
<td>8</td>
</tr>
<tr>
<td>Slight restriction only; able to work above shoulder level</td>
<td>10</td>
</tr>
<tr>
<td>Normal activities</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ACTIVE FORWARD FLEXION</strong></th>
<th><strong>Points</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>150 degrees or more</td>
<td>5</td>
</tr>
<tr>
<td>120 to 150 degrees</td>
<td>4</td>
</tr>
<tr>
<td>90 to 120 degrees</td>
<td>3</td>
</tr>
<tr>
<td>45 to 90 degrees</td>
<td>2</td>
</tr>
<tr>
<td>30 to 45 degrees</td>
<td>1</td>
</tr>
<tr>
<td>Less than 30 degrees</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>STRENGTH OF FORWARD FLEXION</strong></th>
<th><strong>Points</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 5 (normal)</td>
<td>5</td>
</tr>
<tr>
<td>Grade 4 (good)</td>
<td>4</td>
</tr>
<tr>
<td>Grade 3 (fair)</td>
<td>3</td>
</tr>
<tr>
<td>Grade 2 (poor)</td>
<td>2</td>
</tr>
<tr>
<td>Grade 1 (trace)</td>
<td>1</td>
</tr>
<tr>
<td>Grade 0 (nothing)</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>SATISFACTION OF PATIENT</strong></th>
<th><strong>Points</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfied and better</td>
<td>5</td>
</tr>
<tr>
<td>Not satisfied and worse</td>
<td>0</td>
</tr>
</tbody>
</table>

| **MAXIMUM SCORE**                                                     | **35**     |
References


