Setting Patients’ Expectations for Range of Motion After Arthroscopic Rotator Cuff Repair

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abstract

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Arthroscopic rotator cuff repair is a reliable option for symptomatic patients who have failed conservative treatments. Limited evidence exists regarding early rehabilitation time points (less than 1 year) and the influence of tear size. The authors sought to determine whether a difference exists in pre- and postoperative range of motion among small, medium, and large isolated rotator cuff tears treated arthroscopically.

Patient- and tear-specific demographics were analyzed in a retrospective series of patients who had undergone arthroscopic rotator cuff repair. Two hundred seventy-four patients (153 [56%] men and 121 [44%] women; mean age, 53 years) were analyzed. Small tears (n = 158 [58%]) were more common than medium (n = 70 [25%]) and large (n = 46 [17%]) tears. Shoulder range of motion was measured preoperatively and at 2 and 6 weeks, 3 and 6 months, and 1 year postoperatively. At nearly all time points pre- and postoperatively, large tears were significantly stiffer than small tears in external rotation and forward elevation (P < .05). It takes 1 year to fully regain external rotation after small and medium tears, whereas mild residual stiffness remains after large tears. Full forward elevation is restored by 3 months for small tears vs 6 months for medium and large tears.

Significant tear size–dependent differences exist in shoulder range of motion after arthroscopic repair of isolated rotator cuff tears. These data can be used to manage patients’ expectations for range of motion after arthroscopic rotator cuff repair to improve patient satisfaction.

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Rotator cuff tears are a common source of shoulder pain, and arthroscopic surgical repair is a reliable option for patients who fail non-operative treatments. Recovery of range of motion (ROM) and improvements in pain and function after repair can be an arduous process for patients and surgeons. Effectively managing patients’ expectations preoperatively may improve the patient’s experience, increase patient’s satisfaction, and improve the surgeon’s experience.

Several studies have examined the effect of patient expectations on the outcomes of various orthopedic procedures. After rotator cuff repair, patients’ preoperative expectations are positively associated with self-assessed outcomes. Patients’ expectations and satisfaction may also have economic implications. Patient satisfaction rates are increasingly used to determine physician reimbursement, a trend that is likely to continue in the current health care environment. Appropriate patient expectations may help reduce cost and unnecessary imaging postoperatively.

After arthroscopic rotator cuff repair, the incidence of stiffness reported in the literature ranges from 2.7% to 15%. Factors such as preoperative stiffness, workers’ compensation claims, younger age, and concomitant procedures (eg, superior labral repair) have been identified as independent predictors of postoperative stiffness. Despite variability in the definition of stiffness, most studies have consistently shown that ROM is restored by 1 year postoperatively and agree that patient dissatisfaction with ROM at any time point correlates with poor outcomes. However, limited evidence exists in the literature regarding early postoperative ROM (less than 1 year). Also, the influence of tear size is inconclusive, with some studies demonstrating greater stiffness in small tears and others demonstrating no relationship.

The primary purpose of this study was to determine whether a difference existed in pre- and postoperative ROM among small, medium, and large isolated rotator cuff tears treated with arthroscopic repair. A secondary purpose was to determine whether early stiffness resolved after repair and at what time point postoperative ROM was restored. This information may be used to advise and reassure patients on what is normal and to promote realistic patient expectations preoperatively and at frequent postoperative time points.

**MATERIALS AND METHODS**

A retrospective series of patients who underwent arthroscopic rotator cuff repair by sports medicine and shoulder and elbow fellowship-trained surgeons (G.L.J., R.B.B., J.Y.B.) between September 2006 and July 2010 were studied. Institutional review board approval was obtained prior to patient analysis. Informed consent was obtained prior to treatment in all cases. All patients were evaluated preoperatively and at 2 and 6 weeks, 3 and 6 months, and 1 year postoperatively by both senior authors (G.L.J., J.Y.B.).

Inclusion criteria were patients aged between 18 and 100 years and magnetic resonance imaging (MRI) showing a full-thickness or partial-thickness tear involving more than 50% of tendon thickness or a footprint surface area that required tear completion and subsequent repair. Traumatic and atraumatic tears were eligible for study inclusion. Although single- and double-row repairs were potentially inclusive, all cases were double-row, transosseous-equivalent, suture-bridge, arthroscopic rotator cuff repairs. The following concomitant procedures were permitted for study inclusion: subacromial decompression, biceps tenotomy, subpectoral biceps tenodesis (distal in groove), labral debridement, and distal clavicle excision.

Patients younger than 18 years or older than 100 years were excluded. In addition, irreparable tears, partial repairs, mini-open repairs, and open repairs were excluded; no patients underwent these procedures during the analyzed enrollment period. Patients with adhesive capsulitis; glenohumeral osteoarthritis; cuff tear arthropathy; associated superior labrum anterior–posterior repairs; associated fractures of the proximal humerus, clavicle, or scapula; cervical spine pathology; and prior shoulder surgery were also excluded. Figure 1 illustrates application of the exclusion criteria.

Two hundred seventy-four patients were analyzed. Mean patient age was 53 years. One hundred fifty-three men (56%) and 121 (44%) women were included. Small tears were more common (n=115 [58%]) than medium (n=70 [25%]) and large (n=46 [17%]) tears (Table 1).

Shoulder ROM was measured preoperatively and at 2 and 6 weeks, 3 and 6 months, and 1 year postoperatively. Active and passive forward elevation and external rotation with arms adducted at the side were measured visually at each pre- and postoperative visit. Prior to 6 weeks postoperatively, only passive motion was allowed, measured, and reported. After 6 weeks, active motion was initiated, measured, and reported. The index shoulder ROM was compared with the contralateral shoulder as a standard defined “normal” for that individual patient.

Intraoperative tear-specific variables of interest were tear size (as defined by DeOrio and Cofield, degree of retraction, and location. In addition, the number and location (medial vs lateral row) of suture anchors used was recorded. Tear size was defined as small (1 cm or less), medium (between 1 and 3 cm), and large (between 3 and 5 cm). This was measured on the preoperative MRI and correlated with intraoperative measurement with a calibrated probe. Multiple tendon tears were defined in patients with more than 1 tendon torn in a single shoulder (eg, supraspinatus and infraspi-
natus; supraspinatus and subscapularis; or supraspinatus, infraspinatus, and subscapularis). A 2-tailed Student’s t test was used to compare ROM at each time point pre- and postoperatively. Continuous data were reported as mean±SD. Categorical data were reported as frequencies with percentages. A P value less than .05 was considered significant.

Preoperative clinical physical examination included a shoulder and cervical physical examination, incorporating the traditional special testing for the shoulder, including shoulder inspection, palpation, active and passive motion, strength, and special testing (eg, instability, rotator cuff, biceps, scapular dyskinesis). Special testing evaluating the rotator cuff includes Neer and Hawkins impingement signs, impingement test, strength testing of the supraspinatus (eg, Jobe supraspinatus test, empty can test, and Codman drop arm sign), infraspinatus and teres minor (eg, external rotation lag test and hornblower’s sign), and subscapularis (eg, belly press, lift-off, and bear-hug test). However, for this study, only the passive and active motion of both shoulders was reported. Preoperative radiographic examination consisted of plain shoulder radiographs and MRI. Postoperative examination consisted of clinical physical assessment without imaging unless clinically indicated.

Arthroscopic rotator cuff tear was performed in a consistent manner by both surgeons. Preoperative interscalene block was placed via ultrasound guidance by the anesthesiology staff. All repairs were performed in the beach-chair position. Standard posterior and anterior portals were used for complete diagnostic glenohumeral arthroscopic examination using a 3° arthroscope. Access to the subacromial space was obtained via a posterior portal. Tear characteristics were assessed and recorded via intra-articular and subacromial visualization. One lateral portal was consistently created in all patients, and often a second accessory anterolateral portal was used. The tear footprint was lightly debrided to a bleeding surface. Medial-row bioabsorbable anchors were placed at the articular margin. Secure arthroscopic knot fixation was obtained and the sutures tensioned to lateral-row anchors, a transosseous equivalent, suture-bridge, double-row repair.

All patients, regardless of tear size, were immobilized in a sling for 6 weeks. All patients had standard postoperative rehabilitation physical therapy, starting within 2 weeks postoperatively. Initially, all ROM was passive motion, and then motion advancement progressed in therapy and at home beyond 6 weeks to active-assisted and then active ROM. Strengthening began 3 months postoperatively. Cryotherapy was used postoperatively.

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<th>Table 1: Patient and Tear Demographics After Arthroscopic Rotator Cuff Repair</th>
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<td>Mean No. of anchors used</td>
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RESULTS

A total of 274 patients were included in this study (Figure 1). Patient- and tear-specific demographics are shown in the Table. After arthroscopic repair, physical therapy was initiated at a mean of less than 1 week for small and medium tears and a mean of 2.11 weeks for large tears. Ninety percent of the 274 included cases had follow-up through 3 months postoperatively. Sixty-five percent (n=178) of patients had 6 months of clinical follow-up and 50% (n=140) had 12 months (Figure 2).

Figure 3 shows mean ROM results in external rotation among small, medium, and large tears from preoperative through 1-year postoperative assessment. At all points pre- and postoperatively, large tears were significantly stiffer in external rotation than small tears ($P<.0055$ for all time points). The large tears were also significantly stiffer than the medium tears in external rotation preoperatively and at 3, 6, and 12 months postoperatively ($P<.05$).

In terms of restoration of external rotation postoperatively, small and medium tears did not regain full (preoperative) ROM until 1 year postoperatively, whereas large tears had slight residual stiffness ($P>.05$). At 3-month follow-up, small and medium tears regained 82% and 80% of external rotation, respectively. At the same time point, large tears regained 68% of normal external rotation.

Figure 4 shows the mean ROM results in forward elevation among all tears from preoperative to 1-year postoperative assessment. No significant difference in ROM existed among the tear sizes preoperatively or at 2 weeks postoperatively ($P>.05$). Large tears were significantly stiffer in forward elevation than small tears for all time points from 6 weeks through 1 year postoperatively ($P<.05$).

No significant difference in ROM existed between large and medium tears at any time point ($P>.05$). Full preoperative ROM in forward elevation was restored at 3 months for small tears and at 6 months for medium and large tears.

DISCUSSION

The primary purpose of this study was to determine whether a difference existed in pre- and postoperative ROM among small, medium, and large isolated rotator cuff tears treated with arthroscopic repair. The data demonstrate that patients with large tears were significantly stiffer than those with small tears in external rotation and forward elevation at nearly all time points pre- and postoperatively. Although no significant difference was demonstrated between large and medium tears in forward elevation, large tears were significantly stiffer than medium tears in external rotation preoperatively and at all time points postoperatively.
time points after 6 weeks postoperatively. Medium tears were significantly stiffer than small tears between 6 weeks and 6 months postoperatively, with resolution of the difference at 1 year follow-up.

A secondary purpose of this study was to determine whether early stiffness resolved after repair and at what time point postoperative ROM was restored (Figure 5). This information can be used to counsel patients on the normal postoperative course and to promote realistic patient expectations preoperatively and at frequent postoperative time points. The current authors generally tell patients that a rotator cuff repair takes 3 months to heal, and many patients equate this to full recovery at that time point. This translates to unrealistic expectations that they will be back to normal by 3 months postoperatively. The study data demonstrate that it takes 1 year to completely restore external rotation for small and medium tears, whereas large tears retain a small degree of residual stiffness. At 3-month follow-up, small and medium tears regained 82% and 80% of external rotation, respectively. At the same time point, large tears regained 68% of normal external rotation. This trend continued up to 1-year follow-up. Patients recovered full forward elevation much sooner than external rotation. Small tears had complete resolution by 3 months, whereas medium and large tears restored full elevation by 6 months.

The explanation for greater stiffness in external rotation vs forward elevation in the early postoperative period may involve the rotator interval. Small tears repaired with a suture location slightly too anterior could tighten the interval, causing a loss of external rotation with the arm adducted. This is especially important because this study’s data demonstrate that patients with small tears had normal external rotation preoperatively vs patients with large tears, who were stiff preoperatively. For large tears, the authors hypothesize that active external rotation is weak, so preoperative stiffness develops because of the loss of full excursion of external rotation. The authors also recognize that although tear size is the same between a 1-cm supraspinatus tear and a 1-cm subscapularis tear, the biomechanics of the tear (anterior vs superior vectors), its subsequent repair, and the postoperative rehabilitation restrictions (limitations in external rotation) may confound the postoperative ROM.

To the authors’ knowledge, this is the first study to analyze shoulder ROM and the effect of tear size in the early postoperative period after isolated arthroscopic cuff repair, without significant confounding intra-articular procedures. Prior studies have shown that ROM is restored by 1 year postoperatively after cuff repair,8,11 and the current data generally confirm these findings. However, the current data illustrates an earlier return of forward elevation vs external rotation and a tear size–dependent relationship influencing shoulder ROM after arthroscopic repair. Prior studies that examine shoulder stiffness after cuff repair have focused on identifying contributing factors.
The findings of the current study are an impetus to further study: Does rotator cuff tear size correlate with postoperative pain, and does postoperative pain correlate with stiffness? Furthermore, the role of intraoperative rotator interval management in early postoperative pain and ROM is a current focus of research.

Study limitations include the inherent limitations of any retrospective study, which are prone to selection, transfer, and detection bias. The number of patients in each tear size group was not similar, although the patient numbers were high enough to allow significant results. Although loss to follow-up was present at the later postoperative time points, this was acceptable given that the primary goal was to examine early stiffness. Furthermore, it can be speculated that asymptomatic patients with full return of ROM and function are less likely to follow up than those who are still recovering. Although follow-up was short, the purpose of this study was scrutiny of early postoperative ROM. Recent literature has demonstrated that if rotator cuff repair is to fail, it is likely to do so within the first 3 to 6 months. Therefore, the current early data are likely to capture and encompass patients with failure as a postoperative complication that could influence ROM.

Another limitation was the visual vs goniometric measurement of shoulder ROM. A potential source of selection bias is present in the definition of rotator cuff tear size because not all shoulder surgeons measure the same tear similarly. Khazzam et al reported the interobserver reliability of 7 fellowship-trained orthopedic surgeon shoulders and showed poor agreement in measurement of tear size (number of tendons and size) and retraction. Although the current study used the most commonly used size measurement classification system (DeOrio and Cofield), the authors recognize this as a potential source of bias. Performance bias was limited in that all cases were performed by 2 fellowship-trained surgeons using identical techniques. An additional source of bias is present in that the difference in postoperative physical therapy initiation may explain the reason that early stiffness was present to a greater degree in large vs small tears.

CONCLUSION

This study demonstrated significant tear size–dependent differences in shoulder ROM after arthroscopic repair of isolated rotator cuff tears. Large tears are stiffer than small tears at all time points in external rotation. It takes 1 year to restore external rotation for small and medium tears, whereas large tears have residual stiffness. Full forward elevation is restored earlier (3 months for small tears and 6 months for medium and large tears) than external rotation. These data can be used to manage patients’ expectations for ROM after arthroscopic rotator cuff repair to improve patient satisfaction.

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