All-Arthroscopic Versus Mini-Open Rotator Cuff Repair: A Retrospective Review With Minimum 2-Year Follow-up

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Purpose: To compare the clinical outcomes of patients undergoing all-arthroscopic versus mini-open rotator cuff repair. In addition, ultrasound was used to assess the integrity of the repair. **Methods:** A total of 38 patients who had undergone all-arthroscopic repair and 33 patients who had undergone mini-open repair with minimum 2-year follow-up were evaluated. All patients completed the American Shoulder and Elbow Surgeons' Scoring Survey (ASES), the Simple Shoulder Test, the L'Insalata Scoring Survey, and visual analog scales for pain. Physical examination, including strength testing and ultrasound evaluation to determine the integrity of the rotator cuff, was performed. **Results:** No statistical difference in ASES scores was noted between patients who had all-arthroscopic repair versus mini-open repair, and 24% of all-arthroscopic repairs and 27% of mini-open repairs showed recurrent defects on ultrasound at follow-up. This difference was not statistically significant. Patients with an original tear larger than 3 cm were 7 times more likely to have a recurrent defect at follow-up. Patients with persistent defects had statistically significant deficits in strength on forward elevation and external rotation when compared with those with a normal shoulder. However, no difference was observed with regard to pain or outcome scores between patients with intact repairs and those with persistent defects. **Conclusions:** No difference in clinical outcomes was found between patients with rotator cuffs repaired arthroscopically and those repaired with use of a mini-open technique. **Level of Evidence:** Level III, retrospective comparative study. **Key Words:** Rotator cuff—Arthroscopic repair—Shoulder.

With recent advances in shoulder arthroscopy, techniques for performing a successful rotator cuff repair have evolved from full open procedures to arthroscopically assisted mini-open techniques to an all-arthroscopic technique.[1-3] Advantages of all-arthroscopic techniques over mini-open techniques include preservation of the deltoid attachment, less postoperative pain, and decreased postoperative morbidity with earlier return of motion.[3,4]

The results of arthroscopically assisted mini-open repair procedures are well documented and compare favorably with those of open repair techniques. Blevins et al. reported 89% patient satisfaction, with predictable improvement in function and decreased pain at 29 months' follow-up.[5] Liu and Baker reported 88% good or excellent results with use of the University of California, Los Angeles (UCLA), scoring scale in 36 cases at 38 months' follow-up.[6] Posada et al. described 80% good or excellent results using the same scoring system at 21 and 62 months' follow-up, with no change observed over time.[7] However, another report has noted an increase in the rate of postoperative stiffness following mini-open repair compared with traditional open techniques, which the authors hypothesized was related to excess stretch

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placed on the deltoid when the surgeon worked through a small incision.[8]

Despite increasing enthusiasm for all-arthroscopic techniques, reports on results of this technique remain limited. To date, reports on outcomes following arthroscopic repair that used only outcome measures have compared favorably with those for open and mini-open techniques.[3,4,9] Severud et al. reported 91% good and excellent results with the UCLA scoring scale at an average of 44 months' follow-up in a group of 35 all-arthroscopic repairs, compared with 93% good and excellent results in a group of 29 mini-open repairs.[10] Bennett reported 100% overall satisfaction in a group of 24 patients who underwent all-arthroscopic repair of the supraspinatus tendon at a minimum of 2 years' follow-up.[11] Furthermore, only a limited number of studies have involved use of postoperative imaging to assess the integrity of the repaired cuff after all-arthroscopic repair, with results correlated to functional outcomes.[12] These studies have suggested persistent defects in a large percentage of repaired cuffs after both open and arthroscopic techniques, independent of functional outcomes. Further, the rates of recurrent defects after open versus arthroscopic repair techniques have not been clearly defined.

The purpose of this study was to compare the clinical outcomes of patients who underwent all-arthroscopic or mini-open rotator cuff repair at a minimum of 2 years' follow-up. The hypothesis was that no difference would be seen in clinical outcomes between rotator cuffs repaired arthroscopically and those repaired by means of a mini-open technique.

METHODS

All patients who underwent surgery for rotator cuff repair between January of 2000 and May of 2002 were identified from the personal database of 5 surgeons who performed both arthroscopic and mini-open repairs at a single institution. Patient charts and operative reports were then reviewed for inclusion of patients in the study. Patients were included in the study if they had undergone arthroscopic or mini-open rotator cuff repair, with a minimum of 2 years' follow-up. The decision to perform mini-open versus arthroscopic repair was based on the primary surgeon's preference. The time period of this study corresponds to the surgeons' transition from mini-open to all-arthroscopic repairs. Exclusion criteria included revision procedures, subscapularis tears, partial or irreparable tears, and open repairs (involving the deltoid detachment). Approval was obtained from the hospital's institutional review board.

Patient charts were reviewed for collection of data. Patient demographic information, including age at surgery, date of surgery, side of surgery, and arm dominance, was recorded. Operative reports on all patients were also reviewed. Data regarding surgical technique (mini-open or all-arthroscopic), size of rotator cuff tear (measured as the greatest width of the tear at the greater tuberosity) (cm), and additional surgical procedures were recorded. Finally, patients' charts were reviewed for documentation of complications or subsequent surgeries. At the time of follow-up, all patients were asked whether any additional procedures had been performed on their shoulder.

Once patients had been identified, they were contacted and scheduled for a follow-up visit. At the time of follow-up, informed consent was obtained. Patients were then asked to complete the Simple Shoulder Test (SST), the American Shoulder and Elbow Surgeons' Scoring Survey (ASES), and the L'Insalata Scoring Survey.[13,14] Patients were also asked to complete a visual analog pain scale (VAS) (0 to 10 cm) regarding shoulder pain experienced during an average week.

All physical examinations were performed by an unblinded sports medicine fellow. Active range of motion was recorded for affected and unaffected shoulders in forward flexion, external rotation with arm at the side, and internal rotation behind the back. Strength testing was performed with a handheld dynamometer (Lafayette Manual Muscle Test System; Lafayette Instrument Company, Lafayette, IN) for both forward flexion in the scapular plane and external rotation with the arm at the side in the affected and unaffected shoulders. Forward flexion was tested with the patient standing, the elbow extended, and the shoulder forward-flexed to 90° in the scapular plane. The patient was then asked to maximally elevate against the dynamometer and hold for 5 seconds. This measurement was repeated 3 times on each shoulder, and the average of the results was calculated. External rotation strength was tested with the arm at the side, the elbow flexed to 90°, and the shoulder in neutral rotation. The patient was then asked to maximally externally rotate against the dynamometer and hold for 5 seconds. Again, the average of 3 measurements was calculated for each shoulder. Finally, the lift-off test was performed to assess the integrity of the subscapularis.

Ultrasonographic evaluation was performed on all patients by a single radiologist who had 16 years' experience performing musculoskeletal ultrasound.

Targeted examination of the supraspinatus and infraspinatus tendons was performed with the patient seated and the arm placed in internal rotation and extension. Scans were performed with a Siemens Sonoline Elegra scanner (Siemens Medical, Mountainview, CA) with a 7.5-MHz linear transducer or an IU22 scanner (Philips Medical, Bothell, WA) with a 12.5-MHz linear transducer. Failure of repair was defined as any full-thickness rotator cuff defect (Fig 1). Defects were measured for size in 2 dimensions. To maintain consistency with preoperative tear size measurements, recurrent defects were measured with regard to transverse diameter at the greater tuberosity. Recurrent tears were categorized as the same size as the original defect if they were within 0.5 cm in size, smaller if they were more than 0.5 cm smaller than the original defect, and larger if they were more than 0.5 cm larger than the original defect. The radiologist was blinded as to the results of the physical examination.

In both groups, all patients underwent arthroscopic glenohumeral evaluation, arthroscopic subacromial decompression, arthroscopic takedown of the coracoacromial (CA) ligament, and arthroscopic acromioplasty. In addition, in the mini-open group, 4 patients underwent arthroscopic distal clavicle excision, 6 underwent arthroscopic debridement of a type I degenerative SLAP lesion, 3 underwent arthroscopic repair of a type II SLAP lesion, 1 underwent biceps tenotomy, and 2 underwent biceps tenodesis. In the all-arthroscopic group, 4 patients underwent distal clavicle excision, 5 underwent debridement of a type I SLAP lesion, 1 underwent repair of a type II SLAP lesion, and 3 underwent biceps tenotomy.

For mini-open repair, an incision was made at the lateral edge of the acromion, and subcutaneous exposure of the deltoid was carried out. The deltoid was then split in line with its fibers for a maximum of 5 cm, with no detachment from the acromial edge. Tendon repair was then carried out with the use of anchors, bone tunnels, or a combination of both. Arthroscopic rotator cuff repair was carried out in all patients with the use of suture anchors and a suture-passing device or by shuttle relay technique. Given that operative data were obtained only from a review of the operative report, no consistent data on anchor configuration (single or double row) or on suture configuration (simple, mattress, etc.) could be obtained.

As with the operative technique, rehabilitation protocols varied with different attending surgeons. In general, all patients were placed in a sling and were permitted to perform only passive range of motion during the first 6 postoperative weeks. During weeks 6 to 12, passive range of motion was increased and active range of motion was begun. Cuff strengthening was initiated at week 12, with unlimited return to activity at 6 months postoperatively. Rehab protocols were not changed on the basis of the technique used (mini-open or all-arthroscopic).

The primary end-point of this study was the ASES scoring survey. A power analysis was performed to determine the ability of the study to detect a significant difference in ASES scores between study groups. The minimal clinically important difference (MCID) used for this calculation was 7 ASES points.[15] With the numbers available, the study had 88% power for detecting an MCID between study groups at a significance level of .05.

For statistical analysis, the Mantel-Haenszel χ-Square and Fisher exact tests were used to compare proportions. Differences in mean values were com-

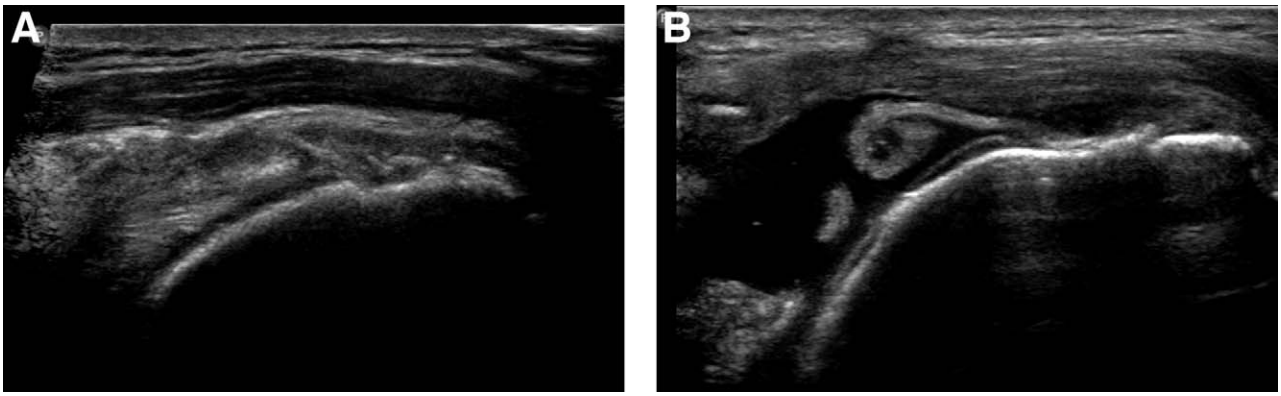

Figure 1. (A) Coronal ultrasound image demonstrating intact repair, with tissue extending to the greater tuberosity. (B) Coronal ultrasound image demonstrating recurrent defect, with tendon retraction.

pared with the use of an independent-samples *t* test. The assumption of equal variances was tested by means of the F test, and when this test was significant ($P < .05$), Satterthwaite's *t* value was used. Multivariable logistic regression was used to assess the influence of type of rotator cuff repair (all-arthroscopic *v* mini-open) on failure, with age, sex, handedness, and preoperative tear size used as independent variables. All analyses were performed with the use of SAS for Windows 9.0 (SAS Institute, Cary, NC).

RESULTS

During the study period, 127 patients who met the inclusionary criteria were identified. A total of 69 patients underwent all-arthroscopic rotator cuff repair, and 58 patients underwent mini-open rotator cuff repair. Overall, 71 patients were enrolled in the study—45 men and 26 women. Of the remaining patients, 3 had died and the remainder were lost to follow-up or were unable to return for ultrasound evaluation and physical examination. The average age of patients at the time of surgery was 60.0 years (range, 37.0 to 75.0 years), and average follow-up was 38.9 months (range, 24.0 to 97.0 months). In all, 47 right shoulders and 24 left shoulders were included, and the dominant extremity was involved in 65% (46 of 71) of cases. The average tear size was 2.7 cm (range, 1.0 to 5.0 cm). Patients were divided into 2 groups; group 1 included 38 patients who had undergone all-arthroscopic repairs, and group 2 included 33 patients who had undergone mini-open repairs. Demographic information for members of each group is provided in Table 1. No statistical difference was noted between groups with regard to age, sex, tear size, operative side, or handedness.

TABLE 1. *Baseline Demographics for Arthroscopic (Group 1) and Mini-Open (Group 2) Repairs*

	Group 1 (n = 38)	Group 2 (n = 33)	*P* Value
Mean age, y (SD)	59.45 (8.6)	60.73 (10.4)	.62
Mean size, cm (SD)	2.5 (1.0)	2.8 (1.0)	.23
Group size, n			.17
≤3 cm	32	23	
>3 cm	6	10	
Sex, n			.31
Male	22	23	
Female	16	10	
Side, n			.32
Right	23	24	
Left	15	9	
Handedness (dominant), n (%)	23/38 (60.5)	23/33 (69.7)	.46

Range of motion data, scoring scale values, VAS data, and patient satisfaction data are listed in Table 2. No significant difference was observed between the arthroscopic and mini-open groups at final follow-up for all scoring scales (ASES, L'Insalata, SST) and range of motion values.

In the mini-open group, recurrent defects were noted in 9 shoulders (27.3%) on ultrasound. Of the recurrent tears, 7 were smaller, 2 were the same size, and no tear was larger. In the arthroscopic group, recurrent tears were noted in 9 shoulders (23.7%) (Fig 2). Of the recurrent tears, 3 were the same size as the original tear, 6 were smaller, and no tear was larger.

Results of the ASES, L'Insalata, VAS, and SST, and patient satisfaction information with regard to repair status are listed in Table 3. No statistically significant differences between ASES, L'Insalata, SST, and VAS scores were observed for patients with intact repairs versus those with recurrent defects, and between tears repaired arthroscopically and those addressed through the mini-open approach. No statistically significant differences with regard to external rotation were noted between patients with intact repairs and those with recurrent defects. However, a small but statistically significant difference was documented in forward flexion between shoulders with intact repairs and those with recurrent defects. With regard to patient satisfaction, 85% of patients in the intact group were completely or very satisfied, compared with 88.9% of patients in the group with recurrent defects. Only 1 patient in the intact group treated with all-arthroscopic repair was dissatisfied at follow-up. This patient required reoperation for stiffness at 6 months after the initial repair.

Strength measurements were evaluated with regard to the opposite shoulder (Table 4). Differences between strength in the involved shoulder and that in the normal opposite shoulder were calculated for both forward flexion and external rotation. Patients who had known rotator cuff tear or failed rotator cuff repairs on the opposite shoulder were eliminated from this analysis. This left 22 patients (20 with intact repairs and 2 with failed repairs) available for analysis in the arthroscopic group and 25 (17 with intact repairs and 8 with failed repairs) in the mini-open group. Overall, for the entire group, a statistically significant difference was observed in forward flexion strength for failed repairs versus intact repairs ($P = .003$) but not for external rotation strength ($P = .14$).

TABLE 2. *Outcomes With Regard to Range of Motion, Shoulder Scoring Scales, Visual Analogue Scale*

	Group 1 (n = 38)	Group 2 (n = 33)	*P* Value
Mean FF (SD)	170.5 (6.9)	169.4 (6.9)	
Mean ABD (SD)	169.6 (7.5)	168.9 (8.4)	
Mean ER (SD)	68.2 (16.7)	70.2 (14.4)	
Mean IR* (SD)	9.8 (3.1)	9.2 (3.1)	
Mean ASES (SD)	94.6 (8.9)	95.1 (9.3)	
Mean L'Insalata (SD)	92.7 (9.0)	94.2 (8.8)	
Mean SST (SD)	11.4 (0.9)	11.3 (1.4)	
Mean VAS (SD)	0.7 (1.2)	0.4 (1.0)	
Satisfaction, n (%)			.34
Completely satisfied	22 (57.9%)	22 (66.7%)	
Very satisfied	9 (23.7%)	8 (24.2%)	
Satisfied	7 (18.4%)	2 (6.1%)	
Dissatisfied	1 (3.0%)	0	

Analog pain scales and patient satisfaction for each group.

Abbreviations: FF, forward flexion; ABD, abduction; ER, external rotation; IR, internal rotation; ASES, American Shoulder and Elbow Society; SST, Simple Shoulder Test; VAS, visual analogue scale.

*Scale from 1 to 18; 1 = T1, 12 = T12, 13 = L1, 17 = L5, 18 = below L5.

TABLE 3. *Outcome Measures Stratified by Tendon Status*

	Intact (n = 53)	Failed (n = 18)	*P* Value
Mean ASES	95.8 (8.0)	91.8 (11.5)	.19
Mean L'Insalata	93.9 (8.6)	91.8 (9.7)	.37
Mean SST	11.5 (0.90)	10.9 (1.6)	.18
Mean VAS	0.57 (1.1)	0.58 (1.3)	.96
Mean ER Diff*	0.07 (2.6)	0.6 (7.4)	.82
Mean FF Diff†	−1.5 (3.5)	−5.7 (5.0)	.003
Satisfaction, n (%)			.64
Completely satisfied	34 (64.2%)	11 (55.6%)	
Very satisfied	11 (20.8%)	6 (33.3%)	
Satisfied	7 (13.2%)	2 (11.1%)	
Dissatisfied	1 (2.0%)	0	

*n = 37 for intact and n = 11 for failed.

†n = 37 for intact and n = 10 for failed.

Complications

In the arthroscopic group, 2 patients required reoperation. One patient required reoperation at 6 months for stiffness, and 1 patient required reoperation for a loose anchor. The repair was found to be intact in this patient at the time of arthroscopy. No patient in the mini-open group required reoperation.

DISCUSSION

All-arthroscopic techniques are becoming an increasingly popular method of rotator cuff repair. Initial reports of outcomes with this technique have indicated similar results when compared with open techniques, with less perioperative morbidity.[1,4,9-11] Our study demonstrated similar results, with no differences noted in clinical outcomes between the arthroscopic group and the mini-open group for all scoring scales evaluated. This study had adequate power to detect a conservative estimate of the MCID in ASES points—the primary end-point of this study. This study was underpowered so that inferences could not be made about differences in healing between the 2 techniques.

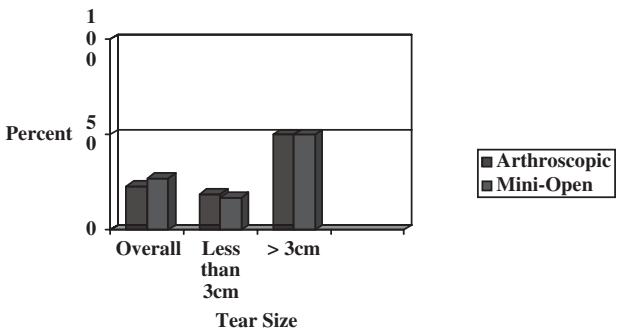

FIGURE 2. Graph depicting overall recurrent tear rates for Group 1 and Group 2, as well as rates for tears smaller than 3 cm and tears 3 cm or larger.

Recently, Galatz et al. reported on 18 patients who underwent arthroscopic repair of tears larger than 2 cm in transverse dimension, 15 of which were larger than 3 cm.[12] In this report, 17 of 18 patients demonstrated recurrent tears on ultrasound at 1-year follow-up. This retearing rate was much greater than had been reported in the previous literature for open or mini-open repairs. It is interesting to note, however, that the average ASES score at 1-year follow-up was 84.6 points, with 72% of patients scoring more than 90 points. There was some concern, however, that these scores demonstrated deterioration at 2-year follow-up. This study demonstrates similar outcomes with regard to ASES scores, with no deterioration seen at a minimum of 2 years' follow-up, regardless of tendon integrity.

Recently, Bishop et al. reported on 32 patients who underwent mini-open repair and 40 who underwent arthroscopic repair (Bishop JL, et al. Presented at: AAOS Annual Meeting; March 10-14, 2004; San Francisco, CA). Patients were divided into 2 groups—those with tears smaller than 3 cm and those with tears 3 cm or greater. Tear integrity was assessed by means

TABLE 4. *Side-to-Side Strength Differences* for Intact Versus Failed Repairs for Arthroscopic Repairs, Mini-Open Repairs, and All Repairs*

	Arthroscopic Intact (n = 20)	Arthroscopic Failed (n = 2)	Mini-Open Intact (n = 17)	Mini-Open Failed (n = 8)	All Intact (n = 37)	All Failed (n = 10)
Forward flexion	−0.54 (3.2)	−2.1 (1.3)	−2.6 (5.2)	−6.7 (3.3)	−1.50 (3.5)	−5.74 (5.0)
External rotation	−0.35 (1.8)	0	0.56 (3.3)	1.7 (3.7)	0.07 (2.6)	−1.42 (3.4)

*Difference in pounds; standard deviations in parentheses.

of magnetic resonance imaging (MRI). Retearing rates were 26% for the open group and 16% for the arthroscopic group for tears smaller than 3 cm. For tears larger than 3 cm, retear rates were 38% for the open group and 76% for the arthroscopic group, although this difference was not statistically significant. These data had not been published at the time this manuscript was submitted; therefore, power analysis data were not available for review.

In the present study, we found overall rates of repair failure of 24% in the mini-open group and 25% in the arthroscopic group. For tears smaller than 3 cm, results were similar to those reported by Bishop et al., with failure rates of 17% in the mini-open group and 19% in the arthroscopic group. However, we also found similar rates of repair failure in the larger than 3 cm group, with failure rates of 50% in the mini-open group and 50% in the arthroscopic group. It should be noted, however, that both studies did not include sufficient numbers of larger tears to reach statistical significance. Both studies did report significantly better rates of tendon healing for larger tears with the arthroscopic technique than were described by Galatz et al.[12] As noted in their study report, the high rate of repair failure may have resulted from an aggressive rehabilitation protocol that involved the immediate use of pulley exercises postoperatively, which may have overloaded the initial repair.

In this study, ultrasound was the imaging modality selected to assess cuff integrity. Ultrasound has been described in the literature as an accurate method of diagnosing rotator cuff tears.[15-18] The advantages of ultrasound in this type of study are multiple. First, the cost of an ultrasound analysis is significantly lower than that of MRI. Second, limited ultrasound examination of the shoulder to assess cuff integrity can be performed in less than 5 minutes. The fact that the exam can be completed expediently combined with the ease of scheduling allowed us to maximize patient compliance; this study did involve a voluntary return to the hospital.

The main goals of rotator cuff surgery are to eliminate pain and restore function. In achieving these goals, an integral part of rotator cuff surgery is to repair the torn portion of the tendon. It remains controversial, however, to what degree tendon healing contributes to the elimination of patient symptoms.[6,19-21] It is interesting to note that in the present study, we found no difference in outcome measures with regard to the pain recorded on the VAS, the ASES, or the L'Insalata between the intact group and the failed repair group. These results indicate that excellent symptomatic relief can be achieved regardless of tendon healing. Similar results were noted by Galatz et al. and by Bishop et al., although Galatz et al. did document deterioration of outcome measures at 2-year follow-up versus 1-year follow-up, which was a matter of concern.[12] However, all patients in the current study reported maintenance of symptomatic relief at a minimum of 2-years follow-up. Klepps et al. also found no correlation between clinical outcome and repair integrity with regard to open repairs.[20] Other studies, however, have found tendon integrity to be an important factor in clinical outcome.[19,21]

It should be noted that none of the outcome scales used in the current study allocates points specifically for strength measurements. Therefore, the authors believed that it was important to include the measurements of forward flexion and external rotation strength recorded with the handheld dynamometer. Results indicate that a significant difference exists between intact and failed repairs in the restoration of forward flexion strength, regardless of the repair technique used. Thus, although our results indicate that symptomatic relief can be achieved despite repair failure, obtaining an adequate repair remains vital to the success of the procedure if strength is to be restored—an event that is important for a successful patient outcome, particularly in younger patients.

We noted that 6 patients within the intact repair group had persistent deficits in strength compared with the opposite normal shoulder (greater than 4-lb side-to-side difference). Ultrasound images for these patients were reviewed by the senior radiolo-

gist to evaluate the quality of tissue at the repair site. Again, all patients were noted to have tendon tissue that extended to the insertion site on the greater tuberosity. In 2 patients, tendon quality was excellent. In 2 patients, the tendon was thin in some locations but present. In the last 2 patients, substantial tendon thinning with abnormal tissue (granulation tissue or focal scarring) was noted. Our overall impression was that this group did not differ significantly from the group of patients with intact repairs and preserved strength. These mixed results would seem to indicate that other factors are involved in restoration of strength, including muscle quality, chronicity of the tear, and degree of fatty infiltration.[22,23] In future studies, it may be important for investigators to use ultrasound to evaluate the quality of muscle and the repair site and to correlate these findings with strength testing results.

Major limitations of this study include retrospective data collection, lack of randomization of surgical techniques, and loss of patients during the follow-up period. All data regarding the operative procedure were obtained through review of the original operative report. Thus, no comment can be made on interobserver reliability regarding estimated tear size. Furthermore, repairs were performed by multiple surgeons by means of similar but not identical techniques. Again, because information was obtained only through an operative report, the surgical technique was not reliably recorded and could not be included in the analysis. Furthermore, no standardized rehabilitation program was used for all patients. However, encouraging findings indicate that arthroscopic procedures were performed during the transition from mini-open to all-arthroscopic techniques; consequently, this occurred early in the learning curve.

Further research in this area is necessary. Large numbers of patients would be required for comparison of these techniques, with retearing serving as the primary end-point. For instance, with the difference in retearing proportions of 3% that was observed in the current study, each group would have to include 3,000 subjects for a power of 80% ($\alpha = .05$) to be attained. An MCID of 10% difference in the proportion of retearing between the 2 techniques would require approximately 300 subjects in each group. Furthermore, larger numbers of large tears are needed if investigators are to determine whether a true difference exists with regard to surgical technique in this population.

CONCLUSIONS

The goals of rotator cuff repair remain the same, regardless of which surgical technique is chosen. Our results indicate that all-arthroscopic techniques provide similar clinical outcomes, improvements in function, and elimination of pain as those that occur following mini-open repair. Although the current study was underpowered with regard to tendon healing, we believe it provides another important piece of evidence in support of similar healing rates for both techniques. However, the clear indications for all-arthroscopic versus mini-open repair remain controversial, particularly with larger tears. It must be recognized that both techniques can provide satisfactory outcomes; the decision regarding which technique should be used must be based on the experience and comfort level of the surgeon. However, if an all-arthroscopic technique is chosen, excellent clinical results can be achieved.

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