Early Outcome of Arthroscopic Rotator Cuff Repair: A Matched Comparison With Mini-Open Rotator Cuff Repair

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Purpose: The purpose of this study was to compare the early functional outcome of mini-open and arthroscopic rotator cuff repair. **Methods:** This was a retrospective study of 128 patients with chronic small- and medium-sized rotator cuff tears who underwent mini-open rotator cuff repair (MRCR) (n = 63) or arthroscopic rotator cuff repair (ARCR) (n = 65). Data were collected prospectively at baseline 1 to 2 weeks before surgery and at 3 and 6 months after surgery. Patients were identified from a prospectively created database based on the dimensions of the size of the tear as determined intraoperatively. Outcome was assessed via physical examination, visual analog scales (VASs), the Simple Shoulder Test, the Disabilities of the Arm, Shoulder and Hand questionnaire, and the Short Form 36 (SF-36) Health Survey. Changes between baseline and follow-up were compared. **Results:** All demographic variables and preoperative baseline parameters of the 2 groups were equivalent. At 3 and 6 months, both MRCR and ARCR showed statistically significant improvement in all patient-derived outcome parameters ($P \leq .0001$) except for three SF-36 variables. The improvements in the SF-36 bodily pain score at 3 months postoperatively ($P = .041$) and the VAS pain score at 6 months postoperatively ($P = .03$) were better for ARCR. All other improvements in patient-derived parameters were equivalent. **Conclusions:** In our retrospective study we found that the early functional outcomes of MRCR and ARCR of small- and medium-sized rotator cuff tears are nearly equivalent. In light of the purported advantages of ARCR that motivate its popularity, this is an unexpected finding. However, an equally important result of this study was the finding that ARCR was associated with statistically significant improvement in the 3-month SF-36 bodily pain score and 6-month VAS pain score ($P = .041$ and .03, respectively). **Level of Evidence:** Level III, retrospective therapeutic comparative study. **Key Words:** Arthroscopic—Mini-open repair—Rotator cuff repair—Outcome.

Rotator cuff tears are a common cause of shoulder pain and dysfunction. Surgical treatment of chronic rotator cuff tears is indicated when nonoperative treatment fails. The techniques of this procedure have evolved from traditional open repair, to arthroscopically assisted mini-open rotator cuff repair (MRCR), to complete arthroscopic rotator cuff repair (ARCR). Open repair is considered the gold standard and has been shown to yield a high rate of patient satisfaction and durability of successful results.[1-6] Rokito et al.[6] reported a 76% rate of satisfactory results at a mean follow-up of 60 months in 30 patients who had open repair of large and massive tears. More recently, Galatz et al.[2] reported that satisfactory results achieved in 33 patients did not deteriorate over time.

The purported advantages of MRCR and ARCR include the ability to diagnose and treat associated glenohumeral pathology, reduced deltoid morbidity, improved cosmesis from smaller skin incisions, decreased postoperative pain, and more rapid return of function. Several studies have reported that the results

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of open rotator cuff repair and MRCR are equivalent.[7-9] Baker and Lui[7] retrospectively evaluated 37 shoulders and found comparable results between open rotator cuff repair and MRCR techniques. Several other noncomparative observational studies of MRCR reported similar results.[8,9]

Although the popularity and use of ARCR continue to increase, the presumed benefits of arthroscopic over mini-open repair remain unproven. There are few studies that compare the outcome of open and mini-open repair with the outcome of complete arthroscopic repairs. Recent studies of ARCR report good and excellent results in 90% to 95% of cases.[10-13] In an elegant prospective study Gartsman et al.[12] showed statistically significant improvement in outcome measures of 78 patients treated with ARCR with a minimum of 2 years' follow-up. Some surgeons have recommended that ARCR be limited to the treatment of small- and medium-sized tears, especially in light of concerns about the strength and quality of ARCR.[14,15] Nevertheless, ARCR is being performed more frequently, given its appeal to today's active society as a minimally invasive procedure that may facilitate an easier and earlier functional recovery. The presumed benefits of ARCR that are unique to the early postoperative period are not proven.

The purpose of our study was to compare the early functional recovery after MRCR and ARCR for chronic rotator cuff tears. The study design was a retrospective comparison of prospectively collected data in 2 cohorts of patients. Our hypothesis was that the improvement in pain, function, and general health status within the first 6 postoperative months after ARCR is equivalent to the improvement after MRCR.

METHODS

All patients who had surgical treatment of a rotator cuff tear were prospectively entered into a clinical study database. The study was approved by our hospital's investigational review board.

Patients were included in this study if they had a minimum of 12 weeks of symptoms, nonoperative treatment had failed, and they had a small- or medium-sized rotator tear according to measurements made during surgery. Patients were excluded if they had prior surgical treatment for rotator cuff pathology, had concomitant treatment of a lesion of the proximal long head tendon of the biceps brachii muscle, or underwent concomitant distal clavicle resection. Patients were identified in a retrospective manner from a prospectively created database and grouped into either the ARCR or MRCR cohort.

During a 52-month period, 128 patients met the inclusion criteria for this study. The mean duration of symptoms was 17.4 months (range, 12 to 29 months). All of the patients were treated and followed up with postoperative examinations by the senior author.

Demographic and Outcome Assessment

The preoperative clinical evaluation included a detailed history and a physical examination performed by the senior author. The history included standard demographic information, mechanism of injury or onset of symptoms, current symptoms, and prior treatment. Activity levels and job intensity levels were assessed on a scale from 0 to 2, where 0 corresponded to sedentary, 1 corresponded to moderately intensive, and 2 corresponded to highly intensive. The physical examination included assessment of shoulder strength with manual muscle testing (based on a scale from 1 to 5) and shoulder range of motion in active forward elevation (AFE), active external rotation (AER) with the patient upright and the arm resting at the side, and passive internal rotation (PIR) with the patient reaching behind his or her back to place the thumb at the highest vertebral level. Range of motion was recorded both as absolute values and as percentages of the contralateral shoulder (i.e., relative shoulder motion).

Preoperative outcome assessment was obtained via visual analog scales (VASs)[16] for shoulder pain, shoulder function, and quality of life; the Simple Shoulder Test (SST)[17-20]; the Musculoskeletal Outcomes Data Evaluation and Management System (MODEMS) Collection Package (version 2.0; American Academy of Orthopaedic Surgeons, Rosemont, IL); and the Short Form 36 (SF-36) Health Survey.[21-24]

VASs for pain, function, and quality of life were measured on a continuous scale from 0 to 10. The VAS score was determined by measuring the position of a mark made by the patient on a continuous line. A value of 0 corresponded to the least amount of pain, the highest level of function, and the best quality of life. A value of 10 corresponded to the greatest amount of pain, the lowest level of function, and the worst quality of life.

The SST is a function-based outcome assessment tool consisting of 12 bimodal questions. The questions represent specific activities of daily living that can be performed by normal shoulders. The score is the percentage of questions for which the patient's answer is "yes."[17]

The MODEMS is a comprehensive outcome data collection package composed of a total of 82 items based on a Likert-scale format. It includes sections on demographic data and general health status and incorporates the SF-36 Health Survey, as well as the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire.[25] Included in the MODEMS are questions about the frequency of pain medication usage rated on a scale from 0 to 4, with 0 corresponding to "no medication needed" and 4 corresponding to "several times a day."

The DASH is a validated region-specific health assessment questionnaire that assesses upper extremity function. All questions are in Likert format,[26] with the lowest score corresponding to a better result. The raw score is then converted to a relative score on a scale from 0 to 100.

The MODEMS also incorporates questions about patient expectations and satisfaction. The patients are asked to assess their level of postoperative satisfaction with the surgical results, referred to as the "met expectations score." This parameter is scored relative to the patient's preoperative expectations and is based on a discrete scale ranging from 1 to 5, where 1 indicates definitely satisfied; 2, probably satisfied; 3, not sure; 4, probably not satisfied; and 5, definitely not satisfied.

The SF-36 is a validated general health outcome instrument that consists of 8 health status subscores. A score of 100 represents the most healthy and 0 represents the least healthy. The subscores are then converted to a percentage of age- and sex-matched normal subjects. The 8 health parameters are physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health.[24]

All of the data entered into the database were collected in an identical fashion at the same study time points. Preoperative evaluations were performed at 1 to 2 weeks before surgery. Follow-up postoperative clinical evaluations were performed at 1 to 2 weeks, 6 weeks, 3 months, and 6 months after surgery. Study-specific physical examinations and outcome assessments were performed at the preoperative and 3- and 6-month postoperative visits.

Surgical Procedure

Surgery was performed by the senior author, who is a fellowship-trained shoulder surgeon. Assistance was provided by 1 orthopaedic surgical resident physician. All of the procedures were performed with the patient in the beach-chair position by use of a sterile articulating arm positioner (McConnell, Greenville, TX). Interscalene regional block anesthesia with and without general anesthesia was used. All of the surgeries were begun with a manual examination with the patient under anesthesia to assess shoulder stability and range of motion. A 30° arthroscope with an inflow pump set at 40 mm Hg was used for the procedure. Posterior and anterior superior portals were used for the glenohumeral portion of the arthroscopy. An additional midlateral portal was used in the subacromial space. For arthroscopic repair, the tear size was assessed by use of a calibrated probe and standard-sized shaver instruments. For mini-open repair, the tear size was assessed with a paper ruler. The maximal dimension of the tear in either the medial-lateral or anterior-posterior direction was used to classify the tear size. Tears of 1 cm or less in greatest dimension were considered small-sized, and tears of greater than 1 cm but less than 3 cm were considered medium-sized.[27] Tear width referred to the dimension in the medial-to-lateral direction.

An arthroscopic acromioplasty was performed in all cases. The amount of anterior undersurface acromial bone to be resected was determined by assessing the preoperative outlet views, as well as the intraoperative anatomy. The subacromial decompression included release of the coracoacromial ligament and subacromial bursal debridement. The acromioplasty was performed with a 5.5-mm bur placed through the posterior portal while viewing from the midlateral portal. The anterior undersurface of the acromion was flattened. To complete the acromioplasty, the arthroscope was placed through the posterior portal, and the bur was placed through the midlateral portal to slightly bevel the undersurface of the lateral edge of the acromion. The insertion area of the rotator cuff on the greater tuberosity was lightly decorticated by use of the same bur.

The decision to perform an ARCR or MRCR was based on the chronologic experience of the senior author. The patients were treated during a 5-year period. During the first 2 years, the patients were all treated with an MRCR. During the third year, the senior author transitioned from MRCR to ARCR. During that transition, the decision was based on the mobility of the rotator cuff. If the tendon could be easily reduced to the insertion area of the greater tuberosity, an arthroscopic repair was performed. Subsequently, nearly all of the repairs were arthroscopic.

MRCR: For MRCR, after the initial arthroscopic portion of the procedure, a skin incision was made by extending the transversely oriented midlateral portal anteriorly and posteriorly in Langer's lines for a total length of 3 to 5 cm. The transverse skin opening was reoriented by elevating full-thickness skin and subcutaneous flaps to expose the superficial deltoid fascia. The deltoid fascia was incised from proximal to distal, and the deltoid muscle fibers were split posterior to the raphe between the anterior and middle deltoid. The deltoid was split onto the lateral acromion without detaching the deltoid origin from the acromion. Necessary soft-tissue releases were performed to mobilize the rotator cuff. The tendon was repaired to the greater tuberosity by use of transosseous tunnels that were created with an awl and tenaculum. The bone bridge was 1.5 to 2 cm from the medial (juxta-articular) hole to the lateral hole. Typically, 2 strands of No. 2 Ethibond suture (Ethicon, Somerville, NJ) were passed through each bone tunnel. The sutures were placed into the tendon with a modified Mason-Allen stitch, and the sutures were tied over the greater tuberosity.[28]

ARCR: For ARCR, after the initial arthroscopic glenohumeral evaluation and acromioplasty, the edge of the rotator cuff tear was arthroscopically debrided to stable tissue. The tendon mobility was assessed with a grasper. When necessary, capsular, fascial, and rotator cuff interval releases were performed to mobilize the tendon for repair. The tendon was repaired to the greater tuberosity with a single-row technique. Screw-in metal suture anchors (Mitek Fastin RC; DePuy Mitek, Raynham, MA) with 2 strands of No. 2 Ethibond suture were placed 8 to 10 mm from the edge of the humeral articular surface. The sutures were passed through the full thickness of the tendon approximately 1 cm from the tendon edge by use of an angled disposable suture grasper (Innovasive Devices, Marlborough, MA). Side-to-side No. 2 Ethibond sutures were placed as needed for margin convergence or interval closure.

Associated Procedures

Of the 65 patients who had ARCR, 10 had a limited synovectomy and 13 had a capsular release. Of the 63 patients who underwent MRCR, 12 had a limited synovectomy and 14 had a capsular release.

Postoperative Management and Rehabilitation

Most of the patients were discharged home from the recovery room with oral analgesics. A few were admitted for overnight observation of other medical comorbidities or because of advanced age (or both). No patients required readmission for pain control. All outpatients were seen the next office day after surgery, usually 1 to 4 days postoperatively.

The patients were referred for formal physical therapy. Range-of-motion exercises were initiated on the day after surgery. During the first 5 weeks after either treatment, active use of the upper extremity was discouraged. For patients who had MRCR, passive range of motion was begun with pendulum circumduction, supine forward elevation, supine external rotation, supine horizontal adduction, and standing internal rotation. For patients who had ARCR, passive motion was limited to pendulum circumduction and supine passive external rotation for the first 4 weeks; during the fifth week, these patients started passive self-assisted stretching in all directions. Sling use was discontinued at 5 weeks in both treatment groups.

Isometric strengthening exercises were begun at 6 to 8 weeks after surgery. Isotonic elastic band–resisted exercises were begun at 10 to 12 weeks after surgery. Beyond 3 months, a gradual increase to full active use was permitted as tolerated.

Data Analysis

Data were stored and outcome scores were analyzed by use of Microsoft Excel (Microsoft, Redmond, WA). Subjects were separated into the MRCR and ARCR groups based on the surgical treatment performed. The demographic differences between the groups at baseline were determined by use of paired Student *t* tests and Pearson χ^2 tests for continuous and proportionate variables, respectively. The number of medical comorbidities, mean age, activity level, and job intensity level were analyzed by use of the paired Student *t* test. Gender, insurance status, tobacco and alcohol use, marital status, level of education, involvement of the dominant extremity, tear size, tear length, tear width, and percentage of synovectomies and capsular releases that were performed in addition to cuff repair were compared between the MRCR and ARCR groups by use of the Pearson χ^2 test. Baseline differences in outcome variables between the MRCR and ARCR groups were assessed by use of the paired Student *t* test (Table 1, online only, available at www.arthroscopyjournal.org).

To measure improvement over the 3- and 6-month intervals for both treatment groups, changes in outcome scores at 3 and 6 months for all patients were assessed by use of repeated-measures analysis of variance tests. Statistical analysis was based on the null hypothesis that the mean score values are equal at baseline and 3 and 6 months postoperatively.

To measure the relative improvement between the MRCR and ARCR groups at each postoperative time point, scores for each treatment group at 3 months were subtracted from scores at baseline and scores for each treatment group at 6 months were subtracted from scores at baseline. These differences were then compared by use of the paired Student t test.

$P < .05$ was considered statistically significant. All statistical tests were performed by use of Stata software, version 7 (Stata, College Station, TX).

RESULTS

Baseline Assessment

In this study 63 patients underwent MRCR and 65 underwent ARCR. Comparison of the preoperative demographic data, including patient age, gender, number of medical comorbidities, activity level, job labor-intensity level, Workers' Compensation status, tobacco use, alcohol use, marital status, level of education, and injury to the dominant side, showed no statistically significant differences between the MRCR and ARCR groups (Fig 1).

The mean tear size in the MRCR group (1.8 cm) was slightly greater than that in the ARCR group (1.6 cm) (P = .01), but the maximal tear size did not exceed 2.2 cm in either group. (The range of sizes was 1.4 to 2.2 cm in the MRCR group and 1.1 to 2.1 cm in the ARCR group.) The tear width (i.e., medial-to-lateral tear dimension) was similar between the 2 groups (P = .08) (Fig 1).

Outcome Scores at 3 and 6 Months

The mean outcome parameter scores for all patients over the duration of the study showed improvement in the following parameters: pain medication usage, SST scores, all VAS scores, DASH scores, average "met expectations score," and SF-36 subscores for physical functioning, bodily pain, role-physical, vitality, and social functioning ($P \leq .003$). SF-36 subscores for general health (P = .119), role-emotional (P = .068), and mental health (P = .150) did not significantly improve. The components of the physical examination that were significantly improved were relative AFE and elevation strength (P = .0004 and P = .0001, respectively). The mean outcome scores for the MRCR and ARCR groups at 3 and 6 months are shown in Tables 2 and 3 (online only, available at www.arthroscopyjournal.org).

Comparison of 3-Month Postoperative Outcome Between MRCR and ARCR Groups

At 3 months after surgery, there was no statistically significant difference in the amount of improvement between the MRCR and ARCR groups for most of the parameters evaluated. There was no difference in the frequency of pain medication usage (P = .2109), relative shoulder range of motion (P = .5416 for % AFE, P = .4598 for % AER, and P = .2273 for % PIR), SST scores (P = .332), and DASH scores (P = .7115) (Fig 2). The changes from baseline to 3 months postoperatively in the VAS scores for pain (P = .3102), function (P = .1715), and quality of life (P = .7650) were not statistically different (Fig 2).

The SF-36 score for bodily pain was the only outcome parameter for which there was a statistically significant difference (P = .04) (Fig 3). The change in MRCR SF-36 bodily pain score was 12.87 (95% confidence interval, 6.0 to 19.7) compared with 22.84 (95% confidence interval, 16 to 29.7) in the ARCR group.

Comparison of 6-Month Postoperative Outcome Between MRCR and ARCR Groups

At 6 months after surgery, there were no significant differences in the changes from baseline in the frequency of pain medication usage between the groups (P = .54). There was also no statistically significant difference in the changes from baseline in relative range of motion (P = .42 for % AFE, P = .12 for % AER, and P = .42 for % PIR), VAS scores for function (P = .39) and quality of life (P = .91), SST scores (P = .67), DASH scores (P = .32), and SF-36 scores (P = .10-.81 for all SF-36 parameters) (Figs 2 and 3). At 6 months postoperatively, the improvement in the VAS score for pain was statistically significant in favor of the ARCR group, with a change of 4.4, versus a change of 3.3 in the MRCR group (P = .03) (Fig 2).

Complications

A painful contracture developed in 1 patient after ARCR. At the time of the ARCR, the biceps tendon was noted to have between 25% and 50% partial-thickness tearing. This patient was successfully treated with an arthroscopic capsular release and bi-

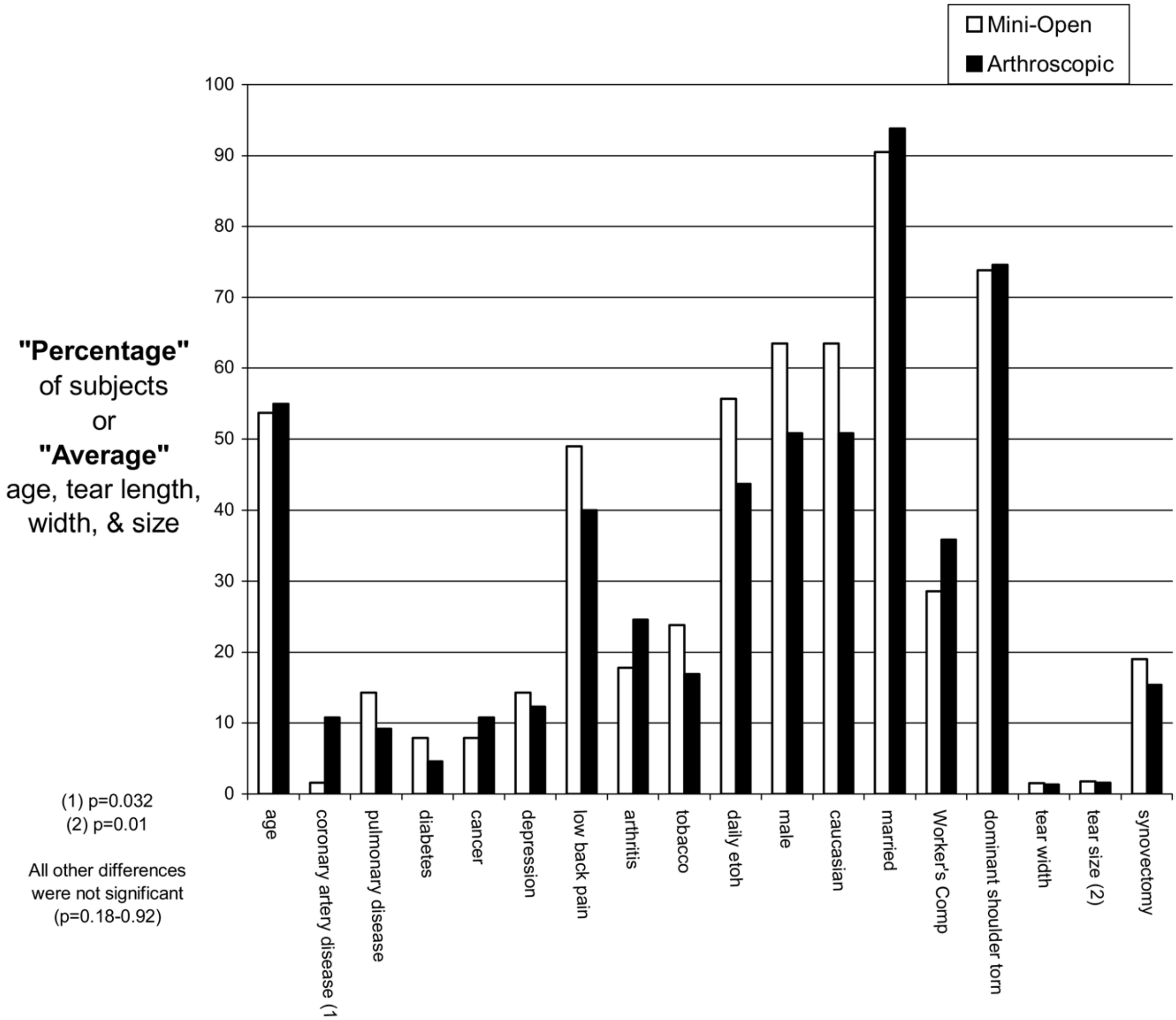

FIGURE 1. Baseline differences between ARCR and MRCR groups. The y-axis corresponds to the differences in percentage or mean value for each category on the x-axis. Tobacco indicates any use of cigarettes within the past 6 months, daily etoh use corresponds to a minimal daily intake of a 1-oz serving of alcohol, Caucasian refers to this ethnicity in contrast to any other minority group, and dominant shoulder torn indicates that the operative side was also the dominant side. Tear size corresponds to the maximal dimension of the tear in either the medial-lateral or anterior-posterior direction. Tear width refers to the dimension in the medial-to-lateral direction. There was a small but statistically significant difference at baseline between the study groups in the percentage of patients with coronary artery disease and in the average tear size. All other patient demographics and tear measurements were equivalent at baseline.

ceps tenotomy. The rotator cuff repair was found to be healed. There were no complications in the MRCR group. There were no cases of suture anchor failure and no neurovascular complications.

DISCUSSION

Operative repair of chronic rotator cuff tears is widely practiced and has been shown to be effective in numerous studies.[1,2,9,29] However, there are no studies showing that one technique results in better outcomes than the other. ARCR has gained acceptance as an alternative to open rotator cuff repair or MRCR. Dissemination of information about the condition and treatment among the lay population has also resulted in an increased demand for less invasive surgical procedures with the hope for reduced morbidity and faster recovery.

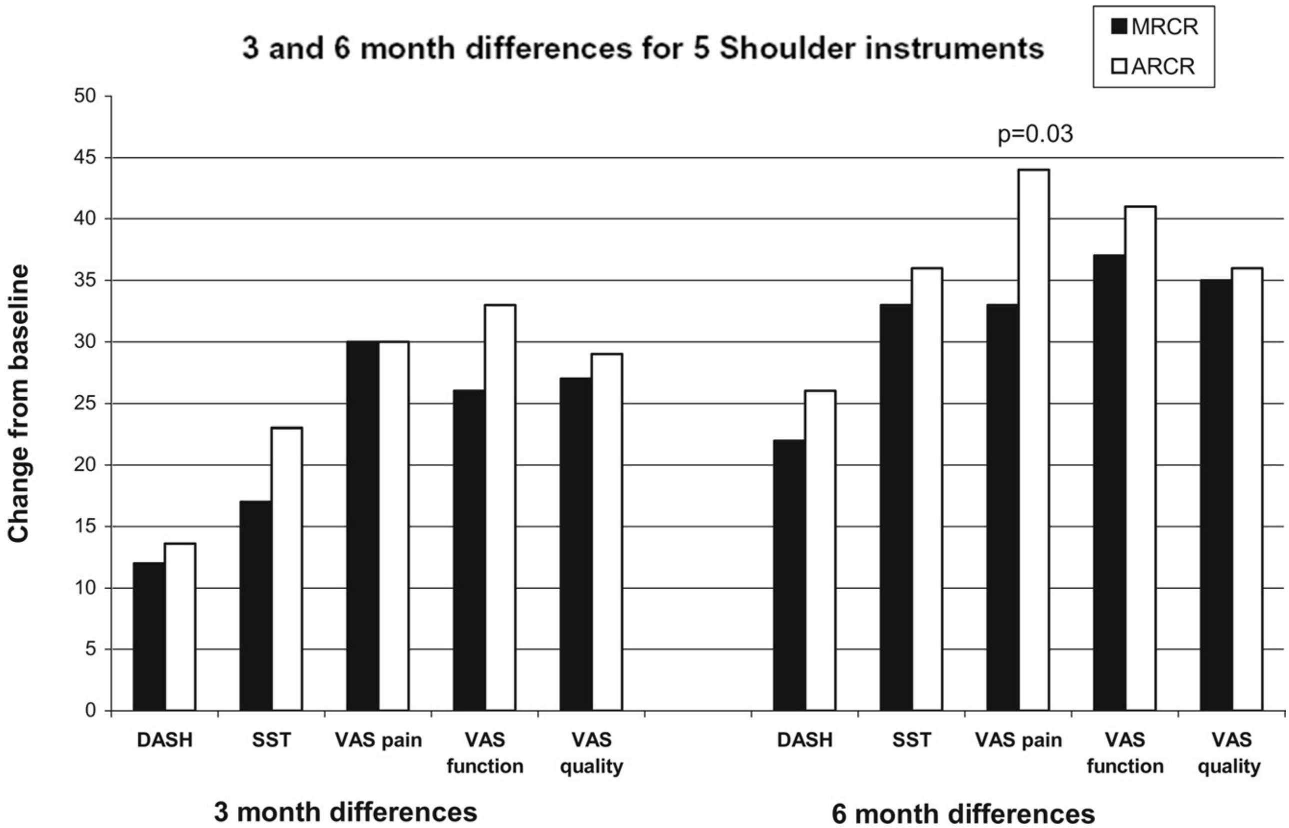

FIGURE 2. Differences between ARCR and MRCR groups at 3 and 6 months postoperatively, as compared with baseline scores, for 5 outcome instruments. For ease of comparison, differences in VAS scores have been multiplied by a factor of 10 and then converted to fit a scale ranging from 0 to 100. A statistically significant difference in the VAS pain score was observed at 6 months.

Most of the studies on ARCR are limited by an observational or retrospective experimental design (or both). For example, Lui and Baker[30] reported 85% good to excellent results and 92% patient satisfaction in a retrospective study of 17 shoulders treated with ARCR. Snyder[15] suggested that the success of this technique was dependent on the size of the tear. Burkhart et al.[10] reported on a series of 59 patients treated with ARCR and found a 95% success rate that was dependent more on repair technique than on tear size. More recently, Kim et al.[31] and Severud et al.[32] reported the results of a retrospective comparison of the midterm outcome of ARCR and MRCR, but they assessed the results for both acute and chronic tears rather than chronic tears alone. These studies used 2 shoulder-specific outcome assessment tools (University of California, Los Angeles shoulder score[31] and American Shoulder and Elbow Surgeons shoulder evaluation form[32]) and did not include a general health assessment instrument such as the SF-36.

Our study is unique in that it uses multiple validated outcome instruments, both general and joint-specific, to compare 2 matched groups of patients treated with either MRCR or ARCR. Outcome values were obtained at 3 to 6 months after surgery to identify the differences during this early postoperative period that would potentially reflect advantages of one technique over another. In addition, our study used outcome function tools that yield scores based solely on patient-derived data (VAS, SST, DASH, SF-36), in contrast to many of the early studies on rotator cuff repairs that rely on traditional measures of assessment or on scores obtained from physician-derived parameters and physical examination findings. Although objective assessment was once heavily used in clinical shoulder surgery research, there is now a greater emphasis on patient-derived outcome assessment.[18,20-22,25]

The degree of postoperative improvement from baseline in our study with both MRCR and ARCR is

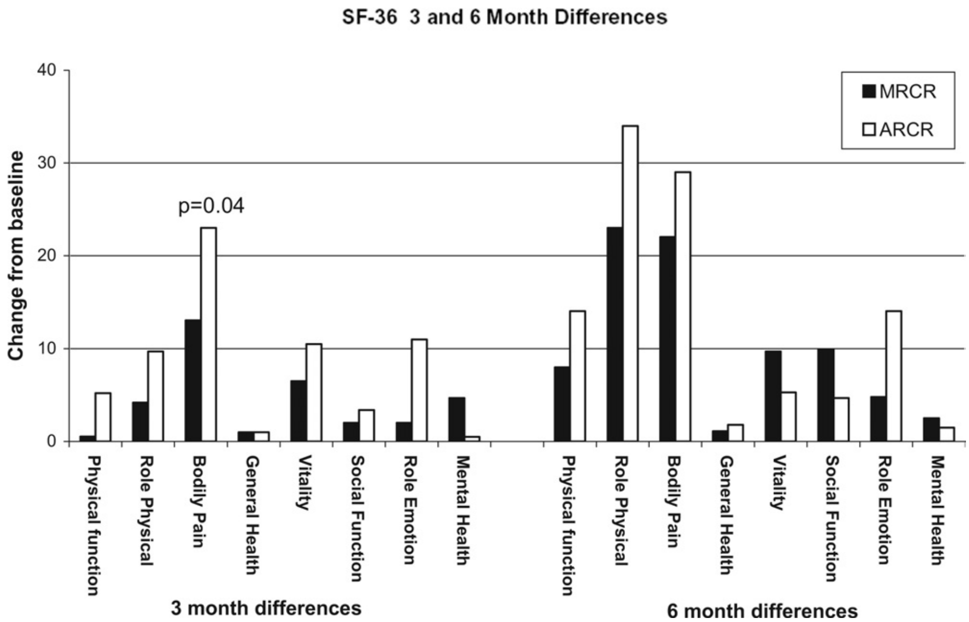

FIGURE 3. Differences in SF-36 scores at 3 and 6 months postoperatively compared with baseline scores. A statistically significant difference in the bodily pain score was observed at 3 months.

consistent with previously reported results.[33] The only patient-derived parameters that did not show improvement at 6 months were the SF-36 tests for general health, role-emotional, and mental health. This may be indicative of the fact that rotator cuff repair does not affect certain emotional, social, and psychological factors. Moreover, these results are similar to those reported by Gartsman et al.[12,33] In studying 50 patients treated with ARCR, by use of the SF-36, the UCLA score,[34] the Constant score,[35] and the American Shoulder and Elbow Surgeons shoulder index,[20,36] they showed statistically significant improvements in all postoperative total and component scores compared with preoperative scores and found significant improvements in postoperative pain and function. They did not address whether ARCR had outcome advantages over other methods of repair.

The results of our study are open to various interpretations. First, both ARCR and MRCR produce significant outcome improvements as early as 3 months after surgery. These improvements continue at least until 6 months after surgery, and likely beyond that time. Second, it is possible that in the immediate postoperative recovery period after rotator cuff repair, there is no substantial advantage or disadvantage to either of the techniques that we studied when repairing small- and medium-sized chronic rotator cuff tears. In our retrospective study we found that the early functional outcomes of MRCR and ARCR of small- and medium-sized rotator cuff tears are nearly equivalent. In light of the purported advantages of ARCR that motivate its popularity, this is an unexpected finding. However, an equally important result of this study was the finding that ARCR was associated with statistically significant improvement in the 3-month SF-36 bodily pain score and the 6-month VAS pain score (P = .041 and .03, respectively). Future randomized controlled trials may provide additional data that distinguish advantages of one technique over the other.

This study has limitations. The application of ARCR and MRCR was biased. The selection criteria for the repair technique were based on the senior author's chronologic experience. During the transition phase from ARCR to MRCR, there was a bias to treat more difficult tears with the mini-open approach. This is evidenced by the statistically significantly larger tear size in the MRCR group. Nevertheless, the mean size difference between the groups was only a few millimeters, and this difference was not likely to have had a clinically relevant impact on the outcome of the repairs. Thus the presence of a slightly larger mean tear size in the MRCR group might have biased this group to have a worse outcome. However, a worse outcome was not found, and there were no significant differences between the outcomes at 3 and 6 months. Furthermore, the difference in tear sizes was only a few millimeters, and neither treatment group included tears greater than 3 cm in any dimension. The postoperative rehabilitation that we used also presents a bias. Passive range of motion was instituted earlier in the MRCR group. Yet, a difference in early outcome, either for or against either treatment group, was not observed, despite a more conservative postoperative therapy protocol for the ARCR group, which favored protection of the arthroscopic repair. Further study is needed to address these limitations and compare the longer-term outcomes.

The prospective and consecutive nature of collected data in this study facilitated the comparison of relative improvements and not just a comparison of the absolute outcome at the follow-up time intervals. This method enabled us to account for differences in the severity of the preoperative status. This approach is not routinely incorporated by other researchers.

The results of this study call for further investigation of the outcome of different techniques for rotator cuff repair. Although we showed that the 3- and 6-month functional recovery after MRCR and ARCR is comparable, there may be differences earlier than 3 months that our study was unable to detect. Indeed, the proclaimed benefits of ARCR include decreased immediate postoperative pain and morbidity and easier rehabilitation. However, the immediate postoperative physical therapy program that is prescribed and followed for the first 6 weeks after rotator cuff repair is the least vigorous phase of the entire rehabilitation course. This is because patients are intentionally immobilized and restricted from active use to protect the repair during the important and tenuous early healing stages. It would therefore be very difficult to study the functional benefits of ARCR during this time period. Additional study is thus needed to address the question of whether ARCR improves the immediate postoperative recovery and whether this is a clinically relevant improvement.

CONCLUSIONS

Our study shows that ARCR is associated with significantly less pain at 3 and 6 months after surgery for small- and medium-sized chronic rotator cuff tears. However, this study also showed that for all other functional parameters, ARCR and MRCR have similar outcomes in the very short term.

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TABLE 1. *Mean Baseline Outcome Scores*

Outcome Test	MRCR Group	ARCR Group	*P* Value
DASH	59.3 ± 17.5	57.2 ± 17.9	.511
SST	46.4 ± 27.4	40.3 ± 24.0	.188
VAS			
Pain	40.6 ± 21.7	37.6 ± 18.5	.412
Function	37.9 ± 22.0	38.6 ± 20.9	.862
Quality of life	39.4 ± 20.5	47.5 ± 25.9	.065
SF-36			
Physical functioning	73.9 ± 20.4	66.6 ± 20.2	.050
Role-physical	44.3 ± 42.8	33.5 ± 36.7	.140
Bodily pain	43.4 ± 19.6	38.4 ± 16.4	.125
General health	78.9 ± 17.0	75.7 ± 19.6	.349
Vitality	57.6 ± 21.9	55.3 ± 21.2	.557
Social function	75.8 ± 25.6	74.6 ± 23.1	.782
Role-emotional	78.4 ± 37.5	66.0 ± 42.9	.101
Mental health	72.3 ± 18.3	76.9 ± 14.3	.122

TABLE 2. *Outcome Scores in MRCR Group*

		Postoperative	
Outcome Test	Preoperative	3 mo	6 mo
DASH	40.7 ± 17.5	29.1 ± 18.8 (*P* = .001)*	18.8 ± 19.1 (*P* < .0001)*
SST	5.2 ± 3.1	7.4 ± 2.7 (*P* = .0001)*	9.3 ± 2.5 (*P* < .0001)*
VAS			
Pain	5.9 ± 2.2	3.0 ± 1.9 (*P* < .0001)*	2.5 ± 2.3 (*P* < .0001)*
Function	6.2 ± 2.2	3.8 ± 2.2 (*P* < .0001)*	2.5 ± 2.1 (*P* < .0001)*
Quality of life	6.1 ± 2.1	3.2 ± 2.4 (*P* < .0001)*	2.4 ± 2.5 (*P* < .0001)*
SF-36			
Physical functioning	73.9 ± 20.4	73.2 ± 21.4 (*P* = .87)	79.2 ± 21.4 (*P* = .19)
Role-physical	44.3 ± 32.8	38.2 ± 37.5 (*P* = .44)	66.3 ± 42.6 (*P* = .009)*
Bodily pain	43.4 ± 19.6	55.0 ± 22.6 (*P* = .004)*	65.4 ± 25.3 (*P* < .0001)*
General health	78.9 ± 17.0	76.7 ± 17.8 (*P* = .51)	80.4 ± 16.8 (*P* = .64)
Vitality	57.6 ± 21.9	63.8 ± 18.7 (*P* = .11)	68.6 ± 18.2 (*P* = .006)*
Social function	75.8 ± 25.6	77.6 ± 24.5 (*P* = .70)	85.5 ± 26.3 (*P* = .053)
Role-emotional	78.4 ± 37.5	77.1 ± 37.1 (*P* = .86)	81.6 ± 32.5 (*P* = .65)
Mental health	72.3 ± 18.3	76.5 ± 13.3 (*P* = .17)	76.4 ± 17.4 (*P* = .24)

NOTE. Data are presented as mean ± SD, with *P* values indicating comparisons between postoperative and preoperative scores.
*Statistically significant (*P* < .05).

TABLE 3. *Outcome Scores in ARCR Group*

Outcome Test	Preoperative	Postoperative	
		3 mo	6 mo
DASH	42.8 ± 17.9	30.6 ± 19.8 (*P* = .006)*	18.4 ± 16.8 (*P* = .0001)*
SST	4.7 ± 2.9	6.8 ± 3.0 (*P* < .0001)*	8.2 ± 3.3 (*P* = .0001)*
VAS			
Pain	6.2 ± 1.9	2.7 ± 2.7 (*P* = .0001)*	1.9 ± 2.1 (*P* = .0001)*
Function	6.1 ± 2.1	3.0 ± 2.6 (*P* = .0001)*	2.2 ± 2.4 (*P* = .0001)*
Quality of life	5.3 ± 2.6	2.3 ± 2.3 (*P* = .0001)*	1.8 ± 2.2 (*P* = .0001)*
SF-36			
Physical functioning	66.6 ± 20.2	70.0 ± 21.6 (*P* = .37)	77.9 ± 21.3 (*P* = .0037)*
Role-physical	33.5 ± 36.7	40.3 ± 41.7 (*P* = .35)	59.5 ± 39.2 (*P* = .0004)*
Bodily pain	38.4 ± 16.4	59.1 ± 25.2 (*P* = .0001)*	65.2 ± 23.9 (*P* = .0001)*
General health	75.7 ± 19.6	73.3 ± 19.0 (*P* = .50)	75.1 ± 20.3 (*P* = .86)
Vitality	55.3 ± 21.2	62.5 ± 18.6 (*P* = .054)	59.8 ± 22.6 (*P* = .27)
Social function	74.6 ± 23.1	77.2 ± 24.5 (*P* = .55)	78.4 ± 26.3 (*P* = .40)
Role-emotional	66.0 ± 42.9	71.9 ± 39.2 (*P* = .44)	76.6 ± 37.1 (*P* = .17)
Mental health	76.9 ± 14.3	77.1 ± 15.6 (*P* = .94)	78.0 ± 14.1 (*P* = .68)

NOTE. Data are presented as mean ± SD, with *P* values indicating comparisons between postoperative and preoperative scores.
*Statistically significant (*P* < .05).