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Pattern and time phase of shoulder function and power recovery after arthroscopic rotator cuff repair

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Background: It has been our observation that early during rehabilitation after rotator cuff repair, patients may take a step back before improving. The purpose of this study is to investigate the pattern and time phase of changes in Constant score and strength recovery after arthroscopic rotator cuff repair.

Materials and methods: Forty-five patients undergoing arthroscopic rotator cuff repair were prospectively enrolled in this study. Patients underwent scoring preoperatively with the Constant score. All were followed up at 3 months and 6 months after surgery. The Constant score and strength at 3 months were compared with those at the 6-month mark.

Results: The mean Constant score improved from 46.4 points (SD, 17.3) preoperatively to 51.8 points (SD, 13.5) 3 months postoperatively ($P = .0777$). At 6 months postoperatively, the mean Constant score was 69.0 points (SD, 11.1), a significant increase from both the preoperative ($P < .0001$) and 3-month ($P < .0001$) results. The mean preoperative strength result of 4.5 kg (SD, 3.2) decreased significantly to 3.3 kg (SD, 1.8) at 3 months postoperatively ($P = .0154$) before improving to 5.8 kg (SD, 2.6) at 6 months postoperatively. The improvement in strength at 6 months was significant compared with both the preoperative ($P = .0070$) and 3-month ($P < .0001$) results.

Conclusions: Although there is highly significant improvement in overall function (Constant score) and strength 6 months postoperatively, patients appear to take a step back before improving, in fact with a drop in strength at 3 months. This may cause concern in patients and may require assurance that time and effort with physiotherapy will improve function and symptoms.

Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Rotator cuff repair; rotator cuff strength; power; Constant score; recovery; rehabilitation; Isometer

Rotator cuff tears are common and are increasing in prevalence with the aging population. With advances in instrumentation and surgical technique, arthroscopic rotator cuff repair has become an established method in managing many of these tears. Several studies have shown excellent midterm functional outcomes.[2,3,8,9,11]

Further studies are indicated, however, to assess long-term outcomes. Furthermore, to our knowledge, no study has

Institutional review board/ethical committee approval: This is an audit and analysis of the results of the routine assessment of the patients undergoing rotator cuff repair in our institution. Nothing has been changed in the routine treatment or assessment of the patients. The Constant scores that were collected routinely were analyzed later.

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evaluated the pattern and time phase of the outcome changes in the early postoperative period. Understanding this short-term outcome is important in preoperative patient counseling and expectation management because meeting patients' expectations has been shown to be one of the factors that determine the outcome of arthroscopic rotator cuff repair.[6]

It has been the observation of our practice that during their rehabilitation from arthroscopic rotator cuff repair, patients appear to take a step back before improving toward increased function and decreased symptoms. This causes concern and alarm in patients despite our assurance that time and effort with physiotherapy will improve function and symptoms. The purpose of this study was therefore to investigate the pattern of functional outcome in the first 6 months after arthroscopic rotator cuff tear and thus provide guidance for more constructive preoperative counseling of patients. A 6-month time period was used because there are a number of studies that have shown good functional outcomes from 6 months onward after surgery.[2,3,8,9,11] We wanted to concentrate on the early postoperative stage, 6 months after surgery.

Our hypothesis is that after arthroscopic rotator cuff surgery, patients may not have improved function and strength in the first few months after surgery.

Materials and methods

This study prospectively enrolled 47 patients undergoing arthroscopic rotator cuff repair at a single institution by 1 consultant surgeon (O.L.). In all 47 patients, the clinical diagnosis of rotator cuff tear was supported by ultrasound.

Preoperatively, the patients underwent scoring with the Constant score.[4] This included a questionnaire on functional activities, range-of-movement testing, and isometric strength measurements of the supraspinatus musculotendinous complex with an isometric digital gauge—IDO Isometer (Innovative Design Orthopaedics, London, United Kingdom). When rotator cuff tears were associated with stiffness, patients did not undergo repair before their stiffness was resolved. A 2-stage procedure was performed in these patients, where manipulation under anesthesia and intensive physiotherapy was followed by arthroscopic rotator cuff tear repair, usually 3 to 6 weeks later, only after patients had achieved full passive range of movement. Of the 47 patients, 45 (45 shoulders) were available for follow-up.

The exact surgical technique used was dependent on the size and shape of the tear. Changes such as tendon delamination, fraying, and thinning also influenced the surgical technique. In the presence of small- to medium-sized C-shaped tears, the technique used was a form of the single-row ''parachute technique'' as previously described.[9] L-shaped or inverted L−shaped tears were managed by a single-row technique with 1 or 2 anchors and side-to-side suture repair. A double-row technique in a ''ratchet-loop'' configuration, as previously described,[9] was added in large tears. Massive U-shaped tears were treated with a marginal convergence technique by use of side-to-side repair. Patients' clinical features, surgical findings, and operative findings were collected prospectively in a computerized database.

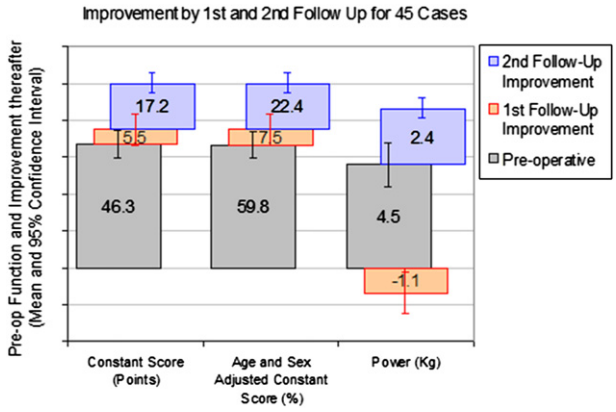

Figure 1 Constant score and strength changes at 3 months (first follow-up) and 6 months (second follow-up) for all cuff sizes.

All patients were advised to wear a sling for 6 weeks postoperatively. In this period, patients underwent pendulum and passive-assisted exercises. Active-assisted exercises progressing to resistive and strengthening exercises were introduced at the 6-week mark.

The patients were followed up at 3 weeks (for portal wound check) and at 3 and 6 months postoperatively, when the Constant score was again obtained. Although the aim of this study was to investigate function and strength during the first 6 months after surgery, patients were called to back to attend a clinical review beyond the initial 6 months as well. The mean follow-up for this clinical visit was 35.8 months (range, 24-73 months) after surgery, and patients attending this clinical visit were assessed clinically with the Constant score and sonographically with an ultrasound scan.

Statistical analysis

Differences in means were tested by use of the *t* test and analysis of variance. Associations between categorical variables were tested with the χ^2 test. Differences between Constant scores recorded preoperatively and postoperatively, as well as among the score's individual items, were evaluated by use of means with 95% confidence intervals and the paired *t* test. Statistical analysis was carried out with SAS software, release 8.2 (SAS Institute, Cary, NC, USA).

Results

Forty-five patients were available for follow-up. There were 24 men and 21 women. The mean age of the patients was 55.3 years (range, 29-80 years). None were involved in workers' compensation claims. The tears were categorized according to the classification of Post et al,[14] and there were 2 small-, 34 medium-, and 9 large-sized tears.

Subacromial decompression was performed in all 45 patients. Arthroscopic acromioclavicular excision arthroplasty was also performed in 18 patients (40%) undergoing rotator cuff repair. In addition, 2 patients (4.4%) underwent tenotomy and 3 (7%) underwent tenodesis for associated pathology of the long head of the biceps.

Table I Constant score and strength changes in patients with medium tears

Time of assessment/shoulder function change	Constant score (points)	Age- and sex-adjusted Constant score (%)	Power (kg)
Preoperative	48.0 ± 17.4	62.3 ± 21.6	4.7 ± 3.1
Change at 3 mo FU compared with preoperatively	3.2 ± 20.3 ($P = .3589$)	4.9 ± 25.9 ($P = .2814$)	−1.3 ± 2.9 ($P = .0103$)
3-mo FU	51.2 ± 14.6	67.1 ± 19.5	3.4 ± 1.9
Change at 6-mo FU compared with 3-mo FU	17.2 ± 13.7 ($P < .0001$)	22.6 ± 17.5 ($P < .0001$)	2.6 ± 1.7 ($P < .0001$)
Overall change (6-mo FU compared with preoperatively)	20.4 ± 17.2 ($P < .0001$)	27.4 ± 22.5 ($P < .0001$)	1.2 ± 3.1 ($P = .0267$)
6-mo FU	68.4 ± 12.1	89.7 ± 15.9	5.9 ± 2.7

FU, follow-up.
Data are given as mean ± SD (*P* value).

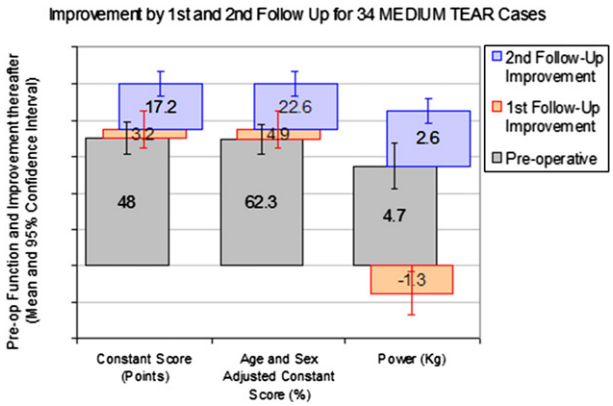

Figure 2 Constant score and strength changes at 3 months (first follow-up) and 6 months (second follow-up) for medium-sized tears.

Constant score changes

The mean preoperative Constant score for all patients was 46.3 ± 17.3 points. At 3 months postoperatively, the raw Constant score increased on average by 5.5 ± 20.3 points to a mean Constant score of 51.8 ± 13.5 points, but this increase was not significant. At 6 months' follow-up, the mean Constant score was 69.0 ± 11.1 points, which was a highly significant increase ($P < .0001$) (paired *t* test) from both the preoperative Constant score (22.7 ± 17.3 points) and the Constant score at 3 months' follow-up (17.2 ± 12.6 points) (Fig. 1). When the Constant score was adjusted for age and sex, the overall results followed the same pattern as for the raw Constant score (Fig. 1).

The mean preoperative rotator cuff strength measurement was 4.5 ± 3.2 kg. This decreased significantly ($P = .0154$), by 1.1 ± 3.0 kg, to 3.3 ± 1.8 kg at 3 months' follow-up. For the whole group of patients regardless of tear size, power at 6 months' follow-up was 5.8 ± 2.6 kg, a significant increase from both preoperative power (1.3 ± 3.0 kg) and power at 3 months' follow-up (2.4 ± 1.5 kg) (Fig. 1).

When the results from the operations are separated into medium and large tears (Table I), the medium tear results reflect those found overall (Fig. 2). However, the results from the large tears differ because of a nonsignificant increase in power from the preoperative value to both the 3-month and 6-month follow-up values (Table II, Fig. 3).

Of the 45 patients, 40 attended the final review follow-up clinical visit. The mean time for this clinical visit was 35.8 months (range, 24-73 months). The mean Constant score at this follow-up was 86.5 points. Ultrasound scan performed at this clinical visit showed recurrent rotator cuff tears in 7 of 40 patients (17.5%). However, there was still a significant improvement in Constant score ($P < .0001$) in these patients despite the recurrent rotator cuff tear. We also investigated the relationship of the tear recurrences to Constant score at 3 and 6 months and found no significant associations.

Discussion

In recent years, arthroscopic repair has become an established technique in managing rotator cuff tears. Good midterm outcomes have been reported by many authors.[2,3,5,9,11,12,15,16] These good outcomes have been attributed to more advanced surgical techniques, instrumentation, suture materials, and anchors. There is little controversy that these factors have led to biomechanically stronger repairs that are more likely to remain structurally intact.[1,7,10] One would expect stronger, longer-lasting repairs to lead to better satisfaction rates and function. There are, however, a number of studies that suggest that this may not always be the case and highlight that patient satisfaction and function improve even with a failed tendon repair (retear).

Levy et al[9] reported a satisfaction rate of 92% and good functional results despite a retear rate of 18.6% after arthroscopic rotator cuff repair. Similarly, Cole et al[3] showed that despite a retear rate of 22% after arthroscopic repair, 96% of patients were satisfied and stated that they would undergo the surgery again. Furthermore, there were no significant differences in any of the functional scores between the intact and retear groups. Galatz et al[5]

Table II Constant score and strength changes in patients with large tears

Time of assessment/shoulder function improvement	Constant score (points)	Age- and sex-adjusted Constant score (%)	Power (kg)
Preoperative	36.1 ± 12.8	47.2 ± 19.5	2.6 ± 2.1
Change at 3-mo FU compared with preoperatively	17.6 ± 16.0 ($P = .0108$)	21.9 ± 19.8 ($P = .0107$)	0.3 ± 2.9 ($P = .8082$)
3-mo FU	53.7 ± 10.2	69.1 ± 15.6	3.0 ± 1.5
Change at 6-mo FU compared with 3-mo FU	16.2 ± 6.9 ($P = .0001$)	21.2 ± 9.3 ($P = .0001$)	1.9 ± 0.8 ($P = .0002$)
Overall change (6-mo FU compared with preoperatively)	33.8 ± 14.8 ($P = .0001$)	43.1 ± 18.4 ($P = .0001$)	2.0 ± 2.8 ($P = .0891$)
6-mo FU	69.9 ± 7.7	90.3 ± 15.7	4.8 ± 1.7

FU, follow-up.
Data are given as mean ± SD (*P* value).

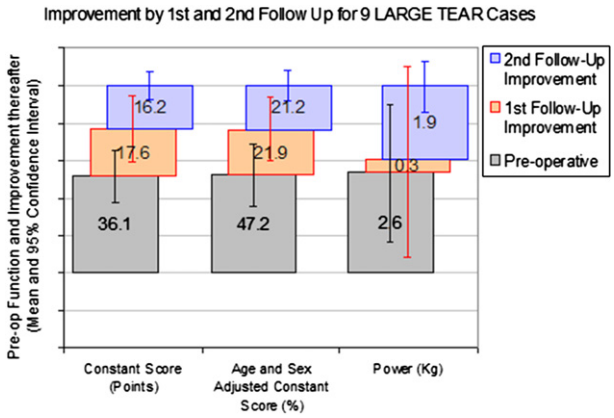

Figure 3 Constant score and strength changes at 3 months (first follow-up) and 6 months (second follow-up) for large-sized tears.

found a retear rate of 94% with large and massive tear repairs, but despite this very high retear rate, they reported excellent pain relief and patients' improved ability to perform activities of daily living. Likewise, Boileau et al[2] concluded that partial or absent tendon healing after repair does not compromise improvement in pain or patient satisfaction. Our findings also complement the previous body of evidence because we showed a significant improvement in Constant score in those patients with recurrent rotator cuff tear at the final follow-up clinical visit. Furthermore, we could not find any relationships between tear recurrence and Constant scores at 3 or 6 months; therefore, function in these periods does not appear to predict cuff integrity.

It is therefore apparent that patient satisfaction and function improve even with a failed tendon repair. It may be that future long-term studies will show that with time, satisfaction and function deteriorate in patients with failed tendon repairs. A more likely explanation, however, is that satisfaction and functional improvement comprise a multifactorial phenomenon with tendon healing itself being just one of the factors.[13] Most surgeons also perform subacromial decompression during arthroscopic rotator cuff repair. It may be the case that this decompression results in satisfaction and functional improvement even in those cases with retears. It has also been suggested that patients who have undergone arthroscopic rotator cuff repair are more likely to undergo a more intensive physiotherapy regimen than those who are treated nonoperatively for rotator cuff tears. This may be because of better access to strict, intensive physiotherapy after surgery and/or increased patient motivation.[9] Other important factors that are thought to be correlated with satisfaction after arthroscopic rotator cuff surgery include pain relief, general health status of the patient, absolute postoperative functional outcome, and marital and work status.[6] Preoperative patient expectations and postoperative met expectations are also reported to be highly correlated with satisfaction after repair.[6] If meeting patient expectations is important in delivering satisfaction, as suggested by previous studies,[6] then preoperative patient counseling becomes crucial. Our study aims to aid this preoperative counseling by highlighting the early pattern and changes in Constant score and power after arthroscopic rotator cuff surgery.

Our results show that although there were improvements in Constant scores at the 3-month mark compared with preoperative scores, this improvement was not significant. Furthermore, there was a significant decrease in power at 3 months (when compared with preoperative power). At the 6-month mark, there were significant improvements in both Constant score and power compared with the preoperative values. One of the contributing factors for this mode of strength behavior, with a significant decrease in power at 3 months, may be the postoperative immobilization. Our patients wore a sling for 6 weeks after rotator cuff repair.

Although one of the main weakness of this study is the small number of patients, to our knowledge, this is the first study to highlight early postoperative pattern changes in power and Constant score, comparing the 3-month changes with the 6-month changes. These findings suggest that although there is highly significant improvement in overall function (Constant score) and power 6 months postoperatively, patients appear to take a step back before improving, in fact with a drop in power at 3 months. This may cause concern in patients and may require assurance

that time and effort with physiotherapy will improve function and symptoms. We believe that this study provides the evidence to allow better constructive counseling of patients undergoing arthroscopic rotator cuff repair.

Conclusions

Our findings show that although there is highly significant improvement in overall function (Constant score) and power 6 months postoperatively, patients appear to take a step back before improving, in fact with a drop in power at 3 months. This may cause concern in patients and may require assurance that time and effort with physiotherapy will improve function and symptoms.

Disclaimer

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