



## Can arthroscopic rotator cuff repair prevent proximal migration of the humeral head?

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### ABSTRACT

**Introduction:** Shoulder arthroscopy has become increasingly used in recent years, especially in rotator cuff repair. The purpose of this study was to determine whether arthroscopic rotator cuff repair could prevent proximal migration of the humeral head.

**Material and Methods:** We performed a retrospective study of 56 patients suffering from shoulder pain. They were divided into two groups, one comprising patients with impingement syndrome who underwent acromioplasty only and another comprising patients with rotator cuff tear who underwent acromioplasty combined with rotator cuff repair. The pre-operative Hirooka angle and the results of the simple shoulder test (SST) were compared after 1 year.

**Results:** We found no differences between the groups for the Hirooka angle or SST results. We did find a significant difference ( $P < 0.05$ ) between pre-operative and post-operative SST results.

**Conclusions:** Rotator cuff repair using arthroscopy is a minimally invasive procedure that improves function and prevents proximal migration of the humeral head after 1 year of follow-up.

**Key words:** Arthroscopic rotator cuff repair, humeral proximal migration, rotator cuff tears, shoulder arthroscopy

### Introduction

Rotator cuff tears associated with functional impairment of the shoulder represent a challenge, especially in young and active patients [1,2]. Golding et al. [3] described the acromiohumeral space as a useful method of assessing disorders of the rotator cuff, and Walch and Bellumore [4,5] have examined it for its utility as a prognostic indicator of functional outcome after repair of the rotator cuff. Pre-operative decrease of the normal space has been correlated with poorer pre-operative function, range of motion, strength, and

lower rates of satisfaction after surgery. These findings suggest that proximal humeral migration is a factor of poor prognoses in patients with rotator cuff tears.

This condition has recently received much attention, in particular about the stabilizing role of the humeral head and the loss of glenohumeral joint function [6]. The purpose of our study was to determine whether early repair of the torn rotator cuff could prevent proximal migration of the humeral head and progression to glenohumeral arthropathy. We hypothesized that early rotator cuff repair prevents the ascent of the humeral head (Figure 1).

## Material and Methods

We performed a retrospective study of patients who had undergone shoulder arthroscopy with acromioplasty in our department between 2004 and 2006. We excluded shoulder arthroscopies performed for other reasons (Bankart injuries, superior labrum tear from anterior to posterior, diagnostic arthroscopy), acromioplasty in patients with post-erolateral bundle injury discovered during surgery, and patients with isolated, irreparable complete tears of the cuff [7,8] (total involvement of the supraspinatus and infraspinatus).

The inclusion criteria were symptoms consistent with rotator cuff disease for <1 year, clinical diagnosis confirmed by magnetic resonance imaging (MRI) [9], no improvement after physiotherapy [10] (6 months of treatment), no bone changes on radiographs [11], and complete tendon rupture in the rotator cuff >1 cm and <2.5 cm [11] found during surgery. The exclusion criteria were involvement of the long head of the biceps [12] diagnosed by MRI or ultrasound before or during surgery, presence of an irreparable lesion [7,8], and the need to convert the procedure to conventional open surgery or mini-open surgery (Table 1). The study sample comprised 56 patients.

Of the 56 patients who underwent arthroscopy, nine were not included in the study (three due to lack of follow-up, two due to lack of radiographic evidence, three due to reoperation, and one death). The sample was divided into two groups, one group of 23 patients (49%) who required an arthroscopic cuff repair plus acromioplasty and a second group comprising 24 patients (51%) who underwent acromioplasty only. The mean follow-up was 19.30 months (range, 12-32).

In the cuff repair group, arthroscopy through the anterior and posterior portals was the technique of choice [13]. After examination, the acromioplasty was performed by sparing most of the acromion and with no release of the acromioclavicular joint (Figure 2). The cuff was repaired using two FASTIN implants (DePuy Mitek, Inc.) following the single-row technique [14,15] (Figure 3). Post-operative drainage was applied, and the affected limb was immobilized with a brace in internal rotation for 4 weeks. In the simple acromioplasty group (study group), the procedure was performed as described above [6], and with post-oper-

ative drainage and immobilization. The post-operative protocol was the same for both groups; namely, drainage was stopped 24 h after surgery. Pendular movements were performed from the 1st week, and passive movements were left for the 3rd week. In the 4th week, the brace was removed so that the patients could begin physiotherapy [10,16,17].

In both groups, the Hirooka index (the ratio of the humeral head-acromion distance to the radius of the humeral head)[18](Figure 4) was calculated using an anteroposterior radiograph before and after surgery [19] (Figure 1). The difference in the Hirooka index was used to assess whether the humeral head had risen, and the measurement was not affected by radiographic magnification. We also measured functional status using the simple shoulder test (SST) [20] before and after surgery [19].

The groups were demographically homogeneous (Table 2). Of the 23 patients in the first group, six were men (26%) and 17-were women (74%), with a mean age of 62.45 years (range, 49-79) and a mean follow-up of 19.32 months (range, 12-32). Of the 24 patients in the second group, seven were men (29%) and 17 were women (71%), with a mean age of 56.96 years (range,

**Table 1.** Inclusion criteria.

Inclusion criteria	Exclusion criteria
Symptoms compatible with cuff disease <1 year	Injury of long head of biceps
Clinical diagnosis confirmed by MRI	Irreparable injury
No improvement after physiotherapy (6 months)	Open surgery or mini-surgery
No bone changes on X-ray	
Rotator cuff tear >1 cm/<2.5 cm	

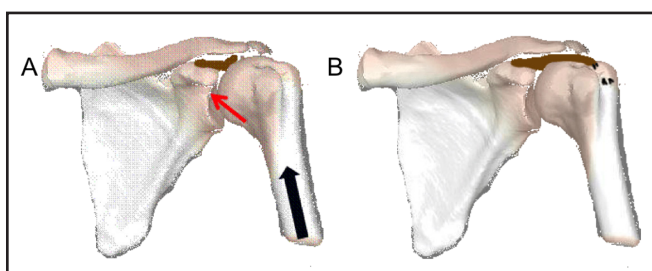
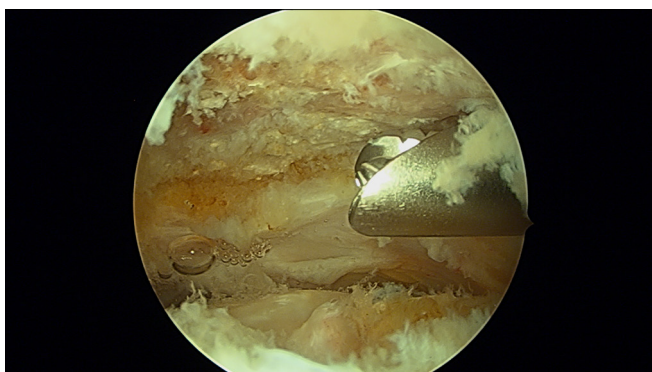
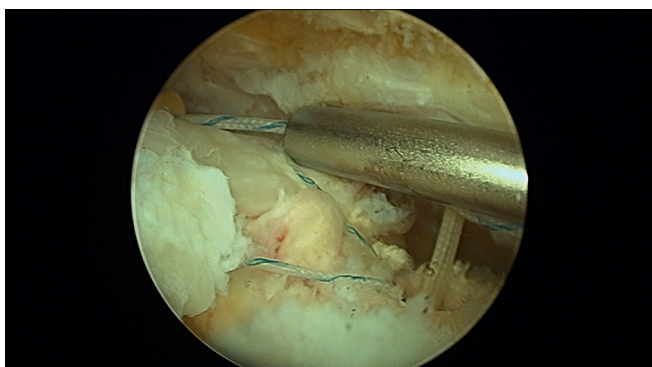
**Table 2.** Patient demographic data.

Demographic data	Acromioplasty +rotator cuff repair	Acromioplasty
Gender		
Men	6	7
Women	17	17
Shoulder		
Right	15	17
Left	7	7
Age (years)	62.45 (49-79)	56.96 (37-83)
Follow-up (months)	19.32 (12-32)	19.29 (12-33)

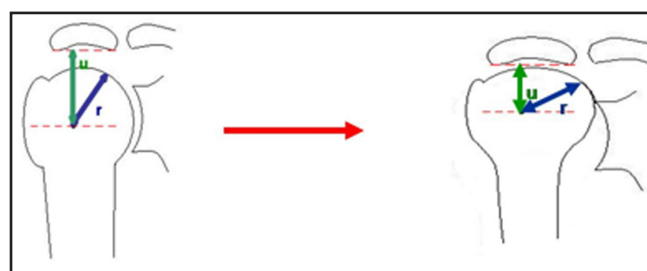
**Table 3.** Results with the different surgical techniques.

	Acromioplasty+Rotator cuff repair	Acromioplasty	P values
Pre-operative SST	1.05 (0-7)	1.29 (0-9)	0.37
Post-operative SST	9.98 (9-12)	10.96 (7-12)	0.24
Pre-operative Hirooka index	1.07 (1-1.54)	1.27 (0.88-1.71)	0.7
Post-operative Hirooka index	1.42 (1.04-1.9)	1.44 (1.11-2)	0.6
Difference in Hirooka index	0.132 (-0.44-0.67)	0.174 (-0.4-0.38)	0.51

SST: Simple shoulder test

**Figure 1.** (A) Humeral head upward trend after chronic rotator cuff tear. (B) Rotator cuff stabilizing effect after repair.**Figure 2.** Intraoperative picture showing acromioplasty.**Figure 3.** Rotator cuff repair with single-row technique.

37-83) and a mean follow-up of 19.29 months (range, 12-33). The difference in age between the groups was not significant ( $P = 0.089$ ). The same was also true of the difference in follow-up time ( $P > 0.05$ ). Complications, such as functional impotence, fever accompanied by surgical alteration, and poor pain control, were re-

**Figure 4.** Hirooka index (ratio between the humeral head-acromion distance and the humeral head radius). Raising the humeral head in relation to the Hirooka index.

corded during follow-up. The right arm was involved in 69.6% (32) of cases and the left arm in 30.4% (14), although the difference was not significant ( $P > 0.05$ ).

#### Statistical Analysis

The pre- and post-operative values were compared using the t test for paired data. The Mann-Whitney test was used to compare gender, age, and the arm involved. The correlation between proximal migration of the humeral head was studied by calculating the correlation coefficient. A statistical analysis was conducted using the software package SPSS 15.0 (SPSS Inc., Chicago, Illinois, USA) with a confidence interval of 95%.

#### Results

Men accounted for 26.1% (12) of the sample, and women accounted for 73.9% (34); the sexes were equally distributed for each procedure. The cuff repair group had a mean pre-operative Hirooka index of 1.07 (range, 1-1.54) and a mean post-operative Hirooka index of 1.42 (range, 1.04-1.9). The mean pre-operative SST was 1.05 (range, 0-7) with a mean value of 9.86 after surgery (range, 2-12) (Table 3). In the acromioplasty group, the mean pre-operative Hirooka index was 1.27 (range, 0.88-1.71) and the mean post-operative Hirooka index was 1.44 (range, 1.11-2). The mean pre-operative SST was 1.29 (range, 0-9), and the mean post-operative SST was 10.96 (range, 7-12) (Table 3).

No statistically significant differences were observed between the groups for pre-operative values of the Hirooka index ( $P = 0.7$ ) or for post-operative values ( $P = 0.6$ ). The difference in ratios in the cuff repair group was 0.132 (-0.44-0.67) compared to 0.174 (-0.4-0.38) in the simple acromioplasty group. No statistically significant differences were observed between the groups ( $P = 0.51$ ) (Table 1).

In the cuff repair group, the improvement in SST before and after surgery was significant: 1.05 (0-7) to 9.86 (2-12);  $P < 0.05$ . This difference was also significant for the simple acromioplasty group: 1.29 (0-9) to 10.96 (7-12);  $P < 0.05$ . No significant differences were observed between the groups for pre-operative and post-operative SST values ( $P > 0.05$ ). A detailed response-by-response analysis of the SST results [20] revealed no differences between the groups. The poor pain control observed in both groups was resolved by increasing the dose of analgesic treatment. One patient in the cuff repair group had a surgical wound infection that was resolved with antibiotic treatment.

### Discussion

Rotator cuff tears are one of the most painful acute diseases of the shoulder. A review of the medical literature revealed no clear consensus as to the possible factors that influence the final result of treatment of this condition by means of arthroscopic surgery.

What has been observed in this study, in line with other published articles, is that shoulder function and patient satisfaction after arthroscopic surgery can be considered very good or satisfactory in 100% of cases [21], with a post-operative SST score of 9.98 in repair group and 10.96 in the acromioplasty group.

Both groups had a similar distribution for age, sex, dominant arm, and follow-up time (Table 3), and the values recorded were similar to those of other studies with the same type of injury [6,10,15,22]. Surgery was indicated due to the absence of response to conservative treatment, as recommended by Ketola et al. [23], namely, simple acromioplasty in the group without cuff injury. Patients with cuff injury underwent repair using a single-row technique, because, although double-row suturing is well accepted by some authors [14], others find no clear differences between the techniques [14,24], and even Mihata et al. [25] noted more dis-

continuity of the rotator cuff tendon with double-row repair than with single-row repair. Therefore, and due to our scarce experience with double-row suturing, we used the single-row technique.

Consistent with the literature [14], we found no significant differences in migration of the humeral head in patients undergoing repair and those who did not. This observation reinforces the option of premature repair of rotator cuff injury to prevent degeneration of the cuff, which it could prevent superior migration of the humeral head. We found no functional differences between the groups in terms of the reactive bursitis that commonly presents with rotator cuff tear, which, in many cases, especially in older patients, limits activities of daily living as a result of the tendon injury and partial limitation of mobility [20]. This observation was further reinforced by the fact that no differences were found either before surgery or at the end of follow-up when the SST results were analyzed question by question, although there was a clearly significant improvement in both groups 6 weeks after surgery, with a significant decrease in pain, functional improvement, and quality of life.

As to the association of acromioplasty, it is still a matter of debate. Although there are authors, such as Chahal et al. [26], who advise performing acromioplasty, most surgeons recommend it in cases with a subacromial conflict. Several studies have shown similar results in groups with or without associated acromioplasty [27].

Our results are consistent with those of other studies [6,10,15,19,20,22,28,29], and they show the importance of an early diagnosis of cuff injury. Keener et al. showed that proximal humeral migration correlates with rotator cuff tear size [10] and Thomazeau et al. [15] recommend early repair of rotator cuff tears due to the greater failure rate in large lesions.

This study was a retrospective case series, and it has a number of inherent limitations. It had a relatively small sample size, which may have introduced bias into the study, thereby limiting its statistical strength. The follow-up period was relatively short, and we did not have a control group to make comparative inferences, which could lead to final conclusions that are useful, but not definitive, and that can be of help when deciding whether to conduct certain surgical procedures.

However, we believe our results are significant, should be taken into consideration when treating patients with initial rotator cuff tears, and provide direction for further research.

### Conclusion

We conclude that early rotator cuff repair could prevent proximal migration of the humeral head in patients with rotator cuff tears and it could maintain a shoulder function that is similar to that in patients without rotator cuff tears. We believe that more studies are necessary to confirm our findings.

### Conflict of interest statement

The authors have no conflicts of interest to declare.

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