Arthroscopic Repair of Anterosuperior Rotator Cuff Tears: In-Continuity Technique Vs. Disruption of Subscapularis-Supraspinatus Tear Margin

Comparison of Clinical Outcomes and Structural Integrity Between the Two Techniques

Sung-Jae Kim, MD, PhD, Min Jung, MD, Jae-Hoo Lee, MD, Chul Kim, MD, and Yong-Min Chun, MD, PhD

Investigation performed at the Department of Orthopaedic Surgery, Arthroscopy and Joint Research Institute, Severance Hospital, Yonsei University College of Medicine, Seoul, South Korea

Background: The purpose of this study was to compare the clinical outcomes and structural integrity after two techniques of arthroscopic anterosuperior rotator cuff repair: in continuity and disruption of the tear margin.

Methods: This study included fifty-nine patients who underwent arthroscopic repair of an anterosuperior rotator cuff tear that was done either by disrupting the margin between the subscapularis and supraspinatus tears (Group A) or by performing the repair in continuity without disrupting the margin (Group B). Clinical outcomes were assessed on the basis of a visual analog scale (VAS) pain score, subjective shoulder value (SSV), American Shoulder and Elbow Surgeons (ASES) score, University of California at Los Angeles (UCLA) shoulder score, and active range of motion of the shoulder. Subscapularis strength was assessed with use of the modified belly-press test. Magnetic resonance arthrography (MRA) or computed tomographic arthrography (CTA) was performed at six months after surgery to assess the structural integrity of the repair.

Results: At the two-year follow-up evaluation, VAS pain scores, SSVs, ASES scores, UCLA shoulder scores, subscapularis strength, and active range of motion improved significantly in both groups compared with preoperatively (p < 0.001). There were no significant differences between groups for any of these follow-up measurements. On follow-up MRA or CTA, the overall retear rate did not differ significantly different between Group A (22%; five of twenty-three) and Group B (19%; six of thirty-two).

Conclusions: In conclusion, in patients treated with arthroscopic repair of anterosuperior full-thickness subscapularis and supraspinatus tears of the rotator cuff, the technique of in-continuity repair did not produce better clinical outcomes or structural integrity than the technique involving disruption of the tear margin. If the muscle in an anterosuperior rotator cuff tear is of good quality, it does not appear to matter whether the tear margin between the subscapularis and supraspinatus is preserved or disrupted.

Level of Evidence: Therapeutic Level III. See Instructions for Authors for a complete description of levels of evidence.

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The anterosuperior rotator cuff tear was first defined by Nové-Josserand et al. in 1997 as a “full-thickness supraspinatus tear that extends anterior to its border involving the rotator interval structures and subscapularis tendon.” Although Gerber et al. reported that this combined subscapularis and supraspinatus tear was more common than an isolated subscapularis tear and other investigators reported a prevalence of anterosuperior rotator cuff tears of 9.3% to 44.4%, there are only a few published studies about the surgical treatment of this disorder. There is also little information in
the literature regarding the structural integrity of an arthroscopic repair of an anterosuperior rotator cuff tear. A subscapularis tear can be repaired arthroscopically through either an intra-articular approach or a bursal approach, depending on the surgeon’s preference. In a patient with an anterosuperior rotator cuff tear, the subscapularis tear can be repaired in the same manner. However, when an anterosuperior rotator cuff tear progresses, a tear margin—a thickened medial sling of the biceps—is formed on the superolateral corner of the subscapularis tendon (see Appendix). During arthroscopic subscapularis repair via the intra-articular approach, this complex obscures the superolateral border of the subscapularis tendon. To obtain a clear view of the tendinous border of the subscapularis, surgeons find it convenient to release this complex by disrupting the anterosuperior tear margin between the subscapularis and supraspinatus.

In contrast, Lo and Burkhart proposed the technique of anterior interval slide in continuity for repair of an anterosuperior rotator cuff tear. This technique involves releasing the superior glenohumeral ligament and the coracohumeral ligament from the coracoid base, which can be performed more easily through the bursal approach in the subacromial space. We thought that not disrupting the tear margin would be less aggressive and provide improved tendon healing after anterosuperior rotator cuff repair.

The purpose of this study was to compare the clinical outcomes and structural integrity after two techniques of arthroscopic repair of an anterosuperior rotator cuff tear: the in-continuity method and the method involving disruption of the tear margin. We hypothesized that, although both repair methods would produce significant improvements in clinical outcomes after surgery, the in-continuity method would yield better clinical outcomes and structural integrity.

Materials and Methods
Study Population
From March 2008 to November 2011, a single surgeon (Y.-M.C.) treated seventy-four patients with arthroscopic anterosuperior rotator cuff repair with one of two techniques: disruption of the tear margin between the subscapularis and supraspinatus (Group A) or in continuity without disruption of the margin (Group B). The indications for surgery were pain and functional impairment in daily living activities that were refractory to conservative treatment for at least three months.

We defined an anterosuperior rotator cuff tear as a full-thickness subscapularis tear combined with a full-thickness supraspinatus tear, involving a medial biceps sling and formation of a tear margin between the two tendons (see Appendix). Patient assignment was not randomized. The inclusion criteria were an anterosuperior rotator cuff tear as defined above and follow-up data available for a minimum of two years after surgery. The exclusion criteria were a partial-thickness tear of either the subscapularis or the supraspinatus tendon, previous surgery involving the affected shoulder, grade-III or IV glenohumeral osteoarthritis as classified with the system of Hamada et al., grade-III or IV fatty infiltration in either the subscapularis or the supraspinatus tendon as classified with the system of Goutallier et al., and follow-up data not available for a minimum of two years after surgery. Fifty-nine patients (twenty-five in Group A and thirty-four in Group B) were included in this study. Patient data, including medical records and imaging findings, were reviewed retrospectively. Our institutional review board approved the study and waived the requirement for informed consent.

Functional and Radiographic Assessments
Evaluation of function included determination of a pain score on a visual analog scale (VAS), ranging from 0 (no pain) to 10 (severe pain); the subjective shoulder value (SSV), which is the patients’ estimate of the value of their affected shoulder as a percentage of the normal shoulder value; the American Shoulder and Elbow Surgeons (ASES) score; the University of California at Los Angeles (UCLA) shoulder score; and the active range of shoulder motion. The modified belly-press test was used to rate the subscapularis muscle strength on a scale of 0 to 5, with 5 indicating normal; 4, good; 3, fair; 2, poor; 1, trace; and 0, nothing. During this test, the patients were asked to maintain the hand on the abdomen with the wrist extended while resisting the examiner’s attempt to push the elbow posteriorly. The active range of motion of the shoulder was assessed for three movements: forward flexion in the scapular plane, external rotation with the elbow at the side, and internal rotation measured by determining the highest spinal segment that the patient could reach with the thumb. To facilitate statistical analysis, the spinal segment that the patient could reach was converted into a number, with the segments at T1 through T12 designated as 1 through 12, the segments at L1 through L5 designated as 13 through 17, and the sacrum designated as 18. An independent examiner who was blinded to the type of surgery performed the preoperative and postoperative shoulder score and active range of motion assessments.

Preoperative radiographic assessments included true anteroposterior and axillary radiographs of the shoulder and magnetic resonance imaging (MRI) or magnetic resonance arthrography (MRA) of the shoulder. Postoperative MRA (3.0-T MR imager, MAGNETOM Tim Trio; Siemens, Erlangen, Germany) or computed tomographic arthrography (CTA) (SOMATOM Sensation 64; Siemens) was obtained to evaluate the structural integrity at six months after surgery. An independent examiner (M.J.) blinded to the type of repair assessed the structural integrity.

Surgical Procedures
The patients underwent the arthroscopic repair in the beach-chair position under general anesthesia. After a standard posterior portal was created, the joint was inspected to identify the status of the rotator cuff (including the subscapularis) and the presence of other intra-articular lesions. A low anterior portal for suture anchor insertion was created with use of a spinal needle to guide placement, and a 5.5-mm cannula (CLEAR-TRAC Complete; Smith & Nephew, Andover, Massachusetts) was inserted. Likewise, a superior portal for the suture passer (Scorpion; Arthrex, Naples, Florida) was established around the lateral border of the anterior aspect of the acromion (see Appendix).

Another cannula (Universal; ConMed Linvatec, Largo, Florida) was introduced through the superior portal and anterosuperior rotator cuff tear, and was directed to the subscapularis tear. A tenotomy of the biceps was then performed, and, if necessary, this was later followed by a subpectoral biceps tenodesis at the conclusion of the arthroscopic surgery. The rotator interval was opened and a 2 to 3-mm-thick coracoplasty was performed. In the anterosuperior rotator cuff tear, a thickened medial sling of the biceps connected the subscapularis and supraspinatus tears. For surgery involving disruption of this thickened medial sling—i.e., the margin between the subscapularis and supraspinatus tendons—the medial sling was cut along the upper tendinous portion of the subscapularis, as viewed from the posterior portal.

To prepare the footprint of the subscapularis, the upper tendinous portion of the subscapularis was pushed inferiorly with the cannula placed in the low anterior portal (see Appendix), and a shaver was introduced through the superior portal. For better exposure and visualization of the subscapularis footprint, the arm was positioned in slight forward flexion and internal rotation, and a 70° arthroscope was used. One or two suture anchors were inserted through the low anterior portal. Through the superior portal, the suture passer was introduced; the sutures were passed through the subscapularis, and a simple repair was performed. The supraspinatus tear was repaired with either a simple repair (for a small tear) or a suture bridge technique (for a medium tear).

For surgery involving no disruption of the tear margin, the anterosuperior rotator cuff tear was repaired in continuity in the subacromial space. A standard lateral portal was created as a viewing portal, and an anterolateral portal was established as a working portal 3 cm distal from the anterolateral corner of the acromion. Viewed from the lateral portal with a 70° arthroscope, the subscapularis footprint was visualized and prepared (see Appendix), and
one or two suture anchors were inserted through the low anterior portal. Through the anterolateral portal, the suture passer was introduced and simple repair of the subscapularis tear was performed. The supraspinatus tear was repaired with either a simple repair or a suture bridge technique.

**Postoperative Rehabilitation**

The affected arm was maintained in an abduction brace for six weeks after surgery. On the first day after surgery, pendulum and self-assisted circumduction exercises were begun. For the first six weeks after surgery, >30° of external rotation of the shoulder with the arm at the side was prohibited. After six weeks postoperatively, self-assisted range-of-motion exercises such as forward flexion of the shoulder in the supine position and table sliding exercises were encouraged. After eight weeks postoperatively, active-assisted range-of-motion exercises were begun. Three months after surgery, isotonic strengthening exercises with use of an elastic band were encouraged. Six months after surgery, patients were allowed to gradually return to their premorbid level of sports activities.

**Statistical Analysis**

Data are presented as the mean and standard deviation unless otherwise indicated. The SPSS statistics version-20.0 program (IBM, Armonk, New York) was used for the statistical analyses. The Mann-Whitney U test was used for between-group comparisons of continuous or continuous ranked data such as the VAS pain score, SSV, subscapularis muscle strength, range of motion, and UCLA shoulder and ASES scores. The Wilcoxon signed-rank test was used to compare preoperative and two-year follow-up values within each group. The Fisher exact test was used to compare categorical data, such as the presence of a tear retear on follow-up MRA or CTA, between groups. Significance was set at p < 0.05.

**Source of Funding**

There was no external source of funding for this study.

**Results**

**Patient Demographics**

Group A included nine men and sixteen women and Group B, thirteen men and twenty-one women. The mean age at the time of surgery was 61.2 years (range, fifty to seventy-six years) in Group A and 62.3 years (range, forty-five to seventy-two years) in Group B. The mean symptom duration before surgery was 22.4 months (range, eight to forty-five months) in Group A and 21.1 months (range, eight to forty-eight months) in Group B. The surgery involved the dominant arm in 80% (twenty) of the twenty-five Group-B patients (Table I).

**Arthroscopic Findings and Concomitant Procedures**

A biceps lesion with or without subluxation or dislocation out of the bicipital groove was found in 92% (twenty-three) of the twenty-five patients in Group A and 94% (thirty-two) of the thirty-four patients in Group B. Although four patients in the series did not have a biceps lesion, biceps tenotomy was performed in all patients. Seven patients in Group A and eight patients in Group B also underwent subpectoral biceps tenodesis after the arthroscopic rotator cuff repair. A superior labrum anterior to posterior (SLAP) lesion was found in seven patients (28%) in Group A and eight patients (24%) in Group B. The supraspinatus tear was treated with a simple repair in six patients (24%) in Group A and five patients (15%) in Group B; the remaining patients underwent a suture bridge technique.

**Functional and Radiographic Outcomes**

The mean VAS pain score improved significantly, from 6.8 preoperatively to 1.1 at the two-year follow-up evaluation in Group A (p < 0.001) and from 6.2 to 1.1 in Group B (p < 0.001). However, the two-year postoperative VAS pain score was similar for the two groups. The SSV also improved significantly in both groups—from 37.6 preoperatively to 88.0 at two years in Group A (p < 0.001) and from 37.9 to 89.6 in Group B (p < 0.001)—but it did not differ significantly between groups (p = 0.481).

**TABLE I Patient Demographics**

<table>
<thead>
<tr>
<th></th>
<th>Group A* (N = 25)</th>
<th>Group B* (N = 34)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex: M/F (no.)</td>
<td>9/16</td>
<td>13/21</td>
<td>0.861</td>
</tr>
<tr>
<td>Age† (yr)</td>
<td>61.2 ± 7.6</td>
<td>62.3 ± 7.8</td>
<td>0.407</td>
</tr>
<tr>
<td>Symptom period† (mo)</td>
<td>22.4 ± 9.2</td>
<td>21.1 ± 8.8</td>
<td>0.501</td>
</tr>
<tr>
<td>Dominant arm involved</td>
<td>80% (20/25)</td>
<td>76% (26/34)</td>
<td>0.502</td>
</tr>
</tbody>
</table>

*Group A = repair with disruption of the tear margin between the subscapularis and supraspinatus and Group B = repair in continuity of the tear margin. †The values are given as the mean and standard deviation.

**TABLE II Visual Analog Scale (VAS), Subjective Shoulder Value (SSV), and American Shoulder and Elbow Surgeon (ASES) Scores for Both Groups**

<table>
<thead>
<tr>
<th></th>
<th>Group A*</th>
<th>Group B*</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preoperative</td>
<td>6.8 ± 1.5</td>
<td>6.2 ± 1.8</td>
<td>0.238</td>
</tr>
<tr>
<td>2-yr follow-up</td>
<td>1.1 ± 1.2</td>
<td>1.1 ± 1.2</td>
<td>0.762</td>
</tr>
<tr>
<td>SSV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preoperative</td>
<td>37.6 ± 7.2</td>
<td>37.9 ± 8.4</td>
<td>0.871</td>
</tr>
<tr>
<td>2-yr follow-up</td>
<td>88.0 ± 7.4</td>
<td>89.6 ± 9.0</td>
<td>0.481</td>
</tr>
<tr>
<td>ASES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preoperative</td>
<td>36.0 ± 6.3</td>
<td>38.1 ± 8.6</td>
<td>0.312</td>
</tr>
<tr>
<td>2-yr follow-up</td>
<td>89.1 ± 6.8</td>
<td>90.2 ± 8.1</td>
<td>0.564</td>
</tr>
</tbody>
</table>

*Group A = repair with disruption of the tear margin between the subscapularis and supraspinatus and Group B = repair in continuity of the tear margin. The values are given as the mean and standard deviation.
Likewise, the mean ASES score improved significantly, from 36.0 preoperatively to 89.1 at two years in Group A (p < 0.001) and from 38.1 to 90.2 in Group B (p < 0.001), but there was no significant difference in the two-year ASES score between groups (Table II). In addition, the mean UCLA shoulder score improved significantly, from 15.2 preoperatively to 30.3 at two years in Group A (p < 0.001) and from 15.0 to 30.9 in Group B (p < 0.001) but, again, the two-year postoperative UCLA score was similar for the two groups (Table III). Finally, the subscapularis muscle strength improved significantly, from 3.8 preoperatively to 4.4 at two years in Group A (p < 0.001) and 3.9 to 4.5 in Group B (p < 0.001), with no significant difference between groups.

The active range of motion improved significantly between the preoperative and two-year evaluations in both groups: forward flexion improved from 128.0° ± 14.7° to 143.2° ± 10.3° in Group A (p < 0.001) and from 129.7° ± 13.6° to 146.2° ± 10.7° in Group B (p < 0.001), external rotation with the elbow at the side improved from 51.4° ± 9.9° to 55.6° ± 10.3° in Group A (p = 0.016) and from 54.7° ± 9.0° to 57.9° ± 8.4° in Group B (p = 0.025), and internal rotation improved from 14.9 ± 1.8 to 11.1 ± 1.9 in Group A (p < 0.001) and from 14.4 ± 1.6 to 11.2 ± 1.8 in Group B (p < 0.001). However, the two-year postoperative values for all three active-range-of-motion assessments were similar for the two groups (Table IV).

### TABLE III UCLA Shoulder Scores in Both Groups

<table>
<thead>
<tr>
<th></th>
<th>Group A*</th>
<th>Group B*</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preoperative</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>15.2 ± 3.2</td>
<td>15.0 ± 2.8</td>
<td>0.809</td>
</tr>
<tr>
<td>Pain</td>
<td>3.3 ± 2.2</td>
<td>3.4 ± 1.6</td>
<td>0.835</td>
</tr>
<tr>
<td>Function</td>
<td>4.2 ± 1.4</td>
<td>3.7 ± 1.3</td>
<td>0.202</td>
</tr>
<tr>
<td>Forward flexion</td>
<td>3.8 ± 0.6</td>
<td>4.0 ± 0.5</td>
<td>0.386</td>
</tr>
<tr>
<td>Strength of flexion</td>
<td>3.8 ± 0.4</td>
<td>3.9 ± 0.3</td>
<td>0.646</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>2-yr follow-up</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>30.3 ± 3.3</td>
<td>30.9 ± 3.6</td>
<td>0.560</td>
</tr>
<tr>
<td>Pain</td>
<td>8.6 ± 1.5</td>
<td>8.6 ± 1.4</td>
<td>0.939</td>
</tr>
<tr>
<td>Function</td>
<td>8.2 ± 1.3</td>
<td>8.2 ± 1.2</td>
<td>0.816</td>
</tr>
<tr>
<td>Forward flexion</td>
<td>4.4 ± 0.5</td>
<td>4.6 ± 0.5</td>
<td>0.101</td>
</tr>
<tr>
<td>Strength of flexion</td>
<td>4.8 ± 0.4</td>
<td>4.8 ± 0.4</td>
<td>0.822</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>4.4 ± 1.6</td>
<td>4.6 ± 1.4</td>
<td>0.696</td>
</tr>
</tbody>
</table>

*Group A = repair with disruption of the tear margin between the subscapularis and supraspinatus and Group B = repair in continuity of the tear margin. The values are given as the mean and standard deviation.

### TABLE IV Active Ranges of Motion in Both Groups

<table>
<thead>
<tr>
<th></th>
<th>Group A*</th>
<th>Group B*</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forward flexion (deg)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preoperative</td>
<td>128.0 ± 14.7</td>
<td>129.7 ± 13.6</td>
<td>0.648</td>
</tr>
<tr>
<td>2-yr follow-up</td>
<td>143.2 ± 10.3</td>
<td>146.2 ± 10.7</td>
<td>0.289</td>
</tr>
<tr>
<td><strong>External rotation (deg)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preoperative</td>
<td>51.4 ± 9.9</td>
<td>54.7 ± 9.0</td>
<td>0.482</td>
</tr>
<tr>
<td>2-yr follow-up</td>
<td>55.6 ± 10.3</td>
<td>57.9 ± 8.4</td>
<td>0.418</td>
</tr>
<tr>
<td><strong>Internal rotation†</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preoperative</td>
<td>14.9 ± 1.8</td>
<td>14.4 ± 1.6</td>
<td>0.262</td>
</tr>
<tr>
<td>2-yr follow-up</td>
<td>11.1 ± 1.9</td>
<td>11.2 ± 1.8</td>
<td>0.908</td>
</tr>
</tbody>
</table>

*Group A = repair with disruption of the tear margin between the subscapularis and supraspinatus and Group B = repair in continuity of the tear margin. The values are given as the mean and standard deviation. †Internal rotation was measured by observing the highest spinal segment that the patient could reach with the thumb. To facilitate the statistical analysis, the spinal segments were converted into numbers: T1-T12 was designated 1 through 12; L1-L5, 13 through 17; and the sacrum, 18.
A follow-up MRA or CTA was performed in twenty-two (88%) of the twenty-five patients in Group A and thirty-two (94%) of the thirty-four patients in Group B. The overall rate of retears (of the subscapularis or supraspinatus, or both) was 22% (five of twenty-three) in Group A and 19% (six of thirty-two) in Group B. A subscapularis retear was identified in 18% (four) of the twenty-two patients in Group A and 13% (four) of the thirty-two patients in Group B. There were no significant differences in retear rates between the two groups.

**Discussion**

The purpose of this study was to compare the clinical outcomes and structural integrity of arthroscopic repairs of an anterosuperior rotator cuff tear done with either the in-continuity technique or a technique involving disruption of the tear margin. Although both repair methods yielded significantly improved clinical outcomes, which was consistent with part of our hypothesis, the remaining part of our hypothesis was not confirmed. The in-continuity method did not yield better clinical outcomes or structural integrity than the technique involving disruption of the tear margin.

In an anterosuperior rotator cuff tear, the subscapularis and supraspinatus tears become extended and retracted medially along the direction of tendon and muscle, resulting in involvement of the medial sling of the biceps. Eventually, a thickened margin may form between the subscapularis and supraspinatus tendons. In the intra-articular approach, this thickened medial sling of the biceps often hinders visualization of the bursal side of the superolateral corner of the subscapularis. When the torn subscapularis is retracted medially, visualization becomes especially challenging, despite the use of a 70° arthroscopic and traction sutures. To improve visualization in the intra-articular approach, the medial sling is removed by cutting the tear margin along the tendinous border of the subscapularis and repairing the subscapularis tear first, as viewed from the posterior portal. This is followed by repair of the supraspinatus tear in the subacromial space. In the subacromial approach, the tear margin is preserved and the two tendons are repaired in continuity, as viewed from the lateral portal.

In the initial part of the study period, we used the intra-articular approach. We subsequently postulated that preservation of the thickened medial sling and repair of the supraspinatus and subscapularis in continuity in the subacromial space not only would be a less aggressive way to repair the torn cuff but also would improve cuff healing and prevent a retear. Thus, in the latter half of the study period, we switched to the subacromial approach, preserving the tear margin of the subscapularis and supraspinatus. However, contrary to our hypothesis, preservation of the tear margin did not lead to significantly better clinical outcomes or structural integrity on follow-up imaging studies.

There have been previous studies of arthroscopic repair of anterosuperior rotator cuff tears. Bennett described an intra-articular approach for repairing the subscapularis tear in which the extra-articular portion of the coracohumeral ligament was resected but the medial and lateral heads of that ligament were left intact to avoid violating the biceps sling. The biceps sling was involved in our patients, and we did not try to preserve it or the biceps tendon. Nho et al. also used the intra-articular approach; they released the rotator interval capsule to allow better visualization of the subscapularis tendon. In reading the description of their rotator interval capsule release, we concluded that they may have cut the tear margin of the two tendons. Both studies showed satisfactory outcomes with use of the intra-articular approach, although neither Bennett nor Nho et al. evaluated postoperative structural integrity with follow-up imaging studies.

Several studies have indicated that, in an arthroscopic repair of a massive rotator cuff tear, separation of the adjoining tendons through the interval slide may have an adverse effect on postoperative healing. We therefore hypothesized that this might be applicable to our patients, but we observed no significant differences in clinical outcomes or structural integrity between groups. Although the lack of a difference may reflect a type-II error due to low statistical power, it may also be due to the fact that we restricted our study to patients with relatively good subscapularis and supraspinatus muscle quality (Goutallier grade II or lower fatty infiltration). Our results suggest that it is not important whether the tear margin is disrupted during arthroscopic repair of an anterosuperior rotator cuff tear when the quality of the cuff muscle is good. Additional studies are necessary to determine whether preserving the tear margin is important when the muscle quality is poor.

This study has limitations. First, it was a nonrandomized retrospective study in which the intra-articular approach with disruption of the tear margin was used initially and the subacromial approach with preservation of the tear margin was used later. Second, this study had a low statistical power because of the small number of patients. Third, the timing of the follow-up images at six months postoperatively differed from the timing of the clinical follow-up at two years postoperatively. Fourth, this study did not include patients with a late-stage anterosuperior rotator cuff tear, which might extend to the infraspinatus tendon and/or be accompanied by moderate to severe subscapularis muscle atrophy. Many anterosuperior rotator cuff tears with moderate to severe muscle atrophy involve the infraspinatus. However, they were not included in this study because we defined an anterosuperior rotator cuff tear as a full-thickness subscapularis tear combined with a full-thickness supraspinatus tear.

In conclusion, for arthroscopic repair of anterosuperior rotator cuff tears involving full-thickness tears of both the subscapularis and the supraspinatus tendon, the technique of in-continuity repair did not produce better clinical outcomes or structural integrity than the technique involving disruption of the tear margin. If the quality of the cuff muscle in the anterosuperior rotator cuff tear is good, it does not appear to be important whether the tear margin between the subscapularis and supraspinatus is preserved or disrupted.

**Appendix**

Figures showing arthroscopic images and schematic drawings of the relevant structures and surgical steps are available with the online version of this article as a data supplement at jbjs.org.
Sung-Jae Kim, MD, PhD  
Min Jung, MD  
Jae-Hoo Lee, MD  
Chul Kim, MD  
Yong-Min Chun, MD, PhD  

Department of Orthopaedic Surgery,  
Arthroscopy and Joint Research Institute,  
Severance Hospital,  
Yonsei University College of Medicine,  
CPO Box 8044, 134, Shinchon-dong, Seodaemun-gu,  
Seoul 120-752, South Korea.  
E-mail address for Y.-M. Chun: min1201@hanmail.net

References