

Comparison of Clinical and Structural Outcomes of the Combined Suture Bridge–Mason-Allen and Conventional Suture Bridge Techniques in Arthroscopic Rotator Cuff Repair: A Retrospective Comparative Cohort Study

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Research Article

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Abstract

Background

Although the suture bridge construct increases footprint contact in arthroscopic rotator cuff repair, failure at the tendon-suture interface and retear remain important concerns. This study aimed to compare the clinical and structural outcomes of the conventional suture bridge (SB) technique with those of the combined suture bridge–Mason-Allen (SBMA) technique, in which a Mason-Allen configuration is used in the medial row.

Methods

The records of 104 patients who underwent primary arthroscopic rotator cuff repair between 2022 and 2025 were reviewed retrospectively. Fifteen patients were excluded because of incomplete imaging and/or follow-up, leaving 89 patients for analysis: 40 in the SB group and 49 in the SBMA group. All procedures were performed by a single surgeon. Depending on tear characteristics, 3 or 4 anchors were used, with a similar mean number of anchors in the two groups (SB, 3.95 ± 0.22 ; SBMA, 3.94 ± 0.24 ; $p = 0.820$). Fatty infiltration was assessed on preoperative MRI according to the Goutallier classification. Mean follow-up was 17.98 ± 3.74 months in the SB group and 18.24 ± 3.72 months in the SBMA group. VAS, ASES, and Constant-Murley scores were recorded preoperatively and at 6 and 12 months. Twelve-month MRI was available for all patients. The primary outcome was MRI-confirmed retear. Changes in clinical scores over time were analyzed using generalized estimating equations including group, time, and group-by-time interaction terms.

Results

Age was similar between the groups (32.43 ± 4.81 vs 32.37 ± 4.70 years; $p = 0.955$), whereas operative time was longer in the SBMA group (82.49 ± 4.61 vs 59.85 ± 6.23 min; $p < 0.001$). Baseline VAS, ASES, and Constant-Murley scores were comparable. Significant group-by-time interactions were observed for VAS, ASES, and Constant-Murley scores (all $p < 0.001$). At 12 months, VAS scores were 3.00 ± 0.78 in the SB group and 2.00 ± 0.79 in the SBMA group; ASES scores were 77.83 ± 5.06 and 90.82 ± 5.87 , respectively; and Constant-Murley scores were 76.10 ± 8.95 and 88.84 ± 8.19 , respectively. Retear occurred in 11/40 patients (27.5%) in the SB group and 3/49 (6.1%) in the SBMA group (Fisher's exact test, $p = 0.008$; RR 4.49, 95% CI 1.34–15.01). All five massive/retracted tears reteared. Of the 14 patients with a retear, 13 were smokers and nine had sustained a new postoperative trauma.

Conclusions

In this retrospective cohort, the SBMA technique was associated with a lower rate of MRI-confirmed retear at 12 months and greater clinical improvement than conventional SB. Given the non-randomized choice of technique and the limited number of events, these findings should not be interpreted as evidence of causality and require confirmation in prospective comparative studies.

Introduction

Rotator cuff tears are a common cause of shoulder pain, loss of strength, and limitations in activities of daily living, and are frequently encountered in the general population [1]. Although clinical outcomes improve substantially in most patients after arthroscopic repair, failure of anatomic tendon healing remains an important concern [2]. Large reviews have shown that the risk of retear is associated with tear size, retraction, fatty infiltration, and patient-related factors [3]. A more recent meta-analysis likewise identified age, tear size, retraction, and fatty infiltration among factors associated with retear [4]. Retear rates may also vary with the duration of follow-up, and healing is influenced by both patient- and surgery-related factors [5]. The move from single-row repairs toward double-row and transosseous-equivalent suture bridge constructs was primarily intended to increase tendon contact over the greater tuberosity footprint and improve initial stability [6]. The suture bridge technique may offer an advantage in structural healing, although differences in functional outcomes have not been consistent across studies [7]. The arthroscopic principles of the transosseous-equivalent suture bridge approach were described by Park et al. [8]. Repair strength depends on more than the number of anchors and footprint contact. Classic biomechanical work has shown that the modified Mason-Allen configuration can provide greater mechanical strength than simple sutures [9]. A modified Mason-Allen technique using suture anchors was subsequently described for arthroscopic rotator cuff repair [10]. Biomechanical studies have also demonstrated that suture geometry can substantially influence mechanical strength at the tendon-suture interface [11]. The combination of this approach with a suture bridge construct has also been evaluated clinically. Itoigawa et al. directly compared conventional SB with SBMA and reported retear rates of 28.0% and 7.7%, respectively [12]. Knotted transosseous-equivalent constructs have been reported to perform better for some time-zero biomechanical parameters [13]. In contrast, clinical meta-analyses have not demonstrated a consistent overall retear advantage for knotted over knotless medial-row constructs [14]. The potential effect of SBMA may therefore relate not simply to the presence of a medial knot, but to the way the Mason-Allen configuration distributes load within the tendon. The aim of this study was to compare the clinical and structural outcomes of conventional SB and SBMA in a single-surgeon cohort of young patients with predominantly traumatic rotator cuff tears, with similar anchor use and an identical rehabilitation protocol. We hypothesized that SBMA would be associated with a lower retear rate on 12-month MRI and, secondarily, with greater improvement in pain and function.

Methods

Study design and patient selection

This single-center retrospective comparative cohort study included patients who underwent primary arthroscopic rotator cuff repair at the Department of Orthopaedics and Traumatology, Private Metrolife Hospital, between 2022 and 2025. The study was approved by the Harran University Non-Interventional Clinical Research Ethics Committee on 9 June 2026 (Session 03; Decision No. HRÜ/26.03.43; Protocol No. HÜ-GOEK-2026-00115) and was conducted in accordance with the principles of the Declaration of Helsinki.

A total of 104 patients were screened. Fifteen were excluded because of missing postoperative MRI and/or loss to follow-up. The final analysis included 89 patients: 40 treated with conventional SB and 49 with SBMA. Eligibility criteria were age > 18 years, primary arthroscopic rotator cuff repair, at least 12 months of clinical follow-up, and availability of a 12-month MRI. Patients with previous surgery on the same shoulder, advanced glenohumeral arthritis, a relevant neurologic disorder, or inadequate follow-up were excluded.

Treatment allocation was not randomized and changed chronologically during the study period. Conventional suture bridge (SB) repair was used during the earlier part of the study. After the surgeon introduced the SBMA technique into clinical practice, it was used in subsequent consecutive cases and remained the preferred technique for the rest of the study period. The choice of technique was not based on individual patient or tear characteristics.

Patient and tear characteristics

Patients were 25–40 years of age. Mean age was 32.43 ± 4.81 years in the SB group and 32.37 ± 4.70 years in the SBMA group, with no between-group difference ($p = 0.955$). The SB group included 29 men and 11 women, and the SBMA group 30 men and 19 women. The operated side was the dominant extremity in approximately 80% of patients.

The SB group comprised 7 partial-thickness tears, 31 medium-sized full-thickness tears, and 2 massive/retracted tears; the corresponding numbers in the SBMA group were 9, 37, and 3. Partial-thickness tears were completed to full thickness and then repaired using the technique assigned to that group. Most tears involved the supraspinatus. In the SB group, two patients also had infraspinatus involvement, one had subscapularis involvement, and one had a three-tendon tear. In the SBMA group, four patients had infraspinatus involvement, two had subscapularis involvement, and one had involvement of all three tendons.

Most tears were traumatic, with sports injuries and falls being the most common mechanisms. The interval from trauma or symptom onset to surgery was 3–6 months in all patients. All patients had received NSAIDs and three weeks of physical therapy before surgery. Some patients, particularly those with partial-thickness tears, had previously received PRP and/or corticosteroid injections. Twenty-one patients (52.5%) in the SB group and 30 (61.2%) in the SBMA group were smokers. None of the patients had diabetes mellitus.

Fatty infiltration of the rotator cuff muscles was assessed on preoperative MRI according to the Goutallier classification. Patients without fatty infiltration were classified as Goutallier grade 0, and the grade of any existing infiltration was recorded.

Surgical technique

All procedures were performed by the same surgeon under general anesthesia with the patient in the lateral decubitus position. After diagnostic arthroscopy, subacromial bursectomy and debridement were performed as required. The greater tuberosity footprint was prepared with light decortication to create a bleeding bone bed.

The same implant system was used in both groups. Depending on tear characteristics, a total of 3 or 4 anchors were used: 38 patients in the SB group received 4 anchors and 2 received 3 anchors, while 46 patients in the SBMA group received 4 anchors and 3 received 3 anchors. The mean number of anchors was 3.95 ± 0.22 and 3.94 ± 0.24 , respectively ($p = 0.820$). In the conventional SB group, sutures were passed through the rotator cuff and a suture bridge construct was created between the medial and lateral rows. In the SBMA group, the medial sutures were passed through the tendon in a Mason-Allen configuration and then brought to the lateral row to complete the bridge. Thus, implant use was similar between groups, with the medial suture configuration representing the principal technical difference.

Acromioplasty was performed in 5 patients (12.5%) in the SB group and 4 (8.2%) in the SBMA group. Biceps pathology was managed according to intraoperative findings; four tenotomies and two tenodeses were performed in the SB group, compared with seven tenotomies and five tenodeses in the SBMA group. Mean operative time was 59.85 ± 6.23 minutes in the SB group and 82.49 ± 4.61 minutes in the SBMA group ($p < 0.001$).

Rehabilitation and follow-up

The rehabilitation protocol was identical in both groups. All patients used a Velpeau sling for four weeks, during which pendulum exercises were permitted. A standard physical therapy program was started after the fourth week. Patients routinely remained in hospital for two nights. Mean follow-up was 17.98 ± 3.74 months in the SB group and 18.24 ± 3.72 months in the SBMA group ($p = 0.735$), with a range of 12–24 months in both groups.

VAS, ASES, and Constant-Murley scores were recorded by the same physician preoperatively and at 6 and 12 months. Range of motion was assessed clinically. All 89 patients underwent MRI at 12 months, and the images were assessed by the same radiologist for the presence or absence of retear. Because a standardized Sugaya classification was not available in the retrospective records, it was not used.

Statistical analysis

Continuous variables are presented as mean±standard deviation, and categorical variables as number and percentage. Welch's independent-samples t test was used for between-group comparisons of continuous variables at individual time points. Repeated measurements of VAS, ASES, and Constant-Murley scores were analyzed using generalized estimating equations with a Gaussian distribution and an exchangeable working correlation structure; group, time, and group-by-time interaction were included in the model. Categorical variables were compared using Pearson's chi-square test or Fisher's exact test, as appropriate. Risk ratio (RR) and 95% confidence interval (CI) were calculated for retear. Because only 14 retear events occurred, a conventional multivariable logistic regression model including multiple covariates was not fitted. Analyses of smoking and postoperative trauma were considered exploratory. A two-sided p value < 0.05 was considered statistically significant.

Results

The final analysis included 89 patients (SB, n = 40; SBMA, n = 49). Age (32.43 ± 4.81 vs 32.37 ± 4.70 years; $p = 0.955$) and follow-up duration (17.98 ± 3.74 vs 18.24 ± 3.72 months; $p = 0.735$) were similar between groups. There were also no significant differences in sex distribution ($p = 0.263$), tear category ($p = 0.966$), or smoking status ($p = 0.408$). Fatty infiltration was present in 4/40 patients (10.0%) in the SB group and 5/49 (10.2%) in the SBMA group (Fisher's exact $p = 1.000$). All four cases in the SB group were Goutallier grade 3; in the SBMA group, one was grade 2 and four were grade 3. The total number of anchors was also similar (3.95 ± 0.22 vs 3.94 ± 0.24 ; $p = 0.820$). Rates of acromioplasty and biceps procedures were comparable. Operative time was longer in the SBMA group (82.49 ± 4.61 vs 59.85 ± 6.23 minutes; $p < 0.001$) (Table 1).

Table 1
Baseline and surgical characteristics

Variable	SB (n = 40)	SBMA (n = 49)	p
Male, n (%)	29 (72.5)	30 (61.2)	0.263
Partial-thickness tear	7 (17.5)	9 (18.4)	
Medium-sized full-thickness tear	31 (77.5)	37 (75.5)	0.966*
Massive/retracted tear	2 (5.0)	3 (6.1)	
Smoking	21 (52.5)	30 (61.2)	0.408
Diabetes mellitus	0	0	—
Obesity	3 (7.5)	2 (4.1)	—
Acromioplasty	5 (12.5)	4 (8.2)	0.726
Any biceps procedure	6 (15.0)	12 (24.5)	0.301
Goutallier fatty infiltration, n (%)	4 (10.0)	5 (10.2)	1.000†
Goutallier grade 2 / grade 3	0 / 4	1 / 4	Descriptive
Total number of anchors	3.95 ± 0.22	3.94 ± 0.24	0.820
Operative time, min	59.85 ± 6.23	82.49 ± 4.61	< 0.001
Age, years	32.43 ± 4.81	32.37 ± 4.70	0.955
Follow-up, months	17.98 ± 3.74	18.24 ± 3.72	0.735
*Overall comparison across the three tear categories. †Fisher's exact test for the presence versus absence of fatty infiltration. Continuous variables are presented as mean ± SD.			

Clinical outcomes

Baseline scores were similar between groups. Preoperative VAS was 8.45 ± 1.06 in the SB group and 8.51 ± 1.08 in the SBMA group ($p = 0.793$); ASES scores were 40.17 ± 6.18 and 40.12 ± 6.29 ($p = 0.969$), and Constant-Murley scores were 29.83 ± 6.18 and 30.65 ± 5.95 ($p = 0.524$), respectively.

All three clinical measures improved over time in both groups. The group-by-time interaction was significant for VAS ($\chi^2=100.03$, $p < 0.001$), ASES ($\chi^2=108.05$, $p < 0.001$), and Constant-Murley scores ($\chi^2=31.57$, $p < 0.001$). At 6 months, VAS was lower and ASES was higher in the SBMA group. Although the Constant-Murley score was also higher in the SBMA group at 6 months, the between-group difference in change from baseline was borderline. By 12 months, all three scores favored the SBMA group (Table 2).

Table 2
Clinical scores

Score	Time	SB mean $\pm$ SD	SBMA mean $\pm$ SD	p
VAS	Preoperative	8.45 $\pm$ 1.06	8.51 $\pm$ 1.08	0.793
VAS	6 months	6.00 $\pm$ 0.78	4.00 $\pm$ 0.79	< 0.001
VAS	12 months	3.00 $\pm$ 0.78	2.00 $\pm$ 0.79	< 0.001
ASES	Preoperative	40.17 $\pm$ 6.18	40.12 $\pm$ 6.29	0.969
ASES	6 months	49.88 $\pm$ 6.23	67.51 $\pm$ 4.61	< 0.001
ASES	12 months	77.83 $\pm$ 5.06	90.82 $\pm$ 5.87	< 0.001
Constant-Murley	Preoperative	29.83 $\pm$ 6.18	30.65 $\pm$ 5.95	0.524
Constant-Murley	6 months	45.00 $\pm$ 12.13	49.92 $\pm$ 6.22	0.024
Constant-Murley	12 months	76.10 $\pm$ 8.95	88.84 $\pm$ 8.19	< 0.001

Structural outcomes, revisions, and complications

At 12-month MRI, retear was identified in 11/40 patients (27.5%) in the SB group and 3/49 (6.1%) in the SBMA group (Fisher's exact $p = 0.008$). The risk of retear in the SB group was 4.49 times that in the SBMA group (RR 4.49, 95% CI 1.34–15.01). All five massive/retracted tears reteared. The remaining nine retears occurred in medium-sized full-thickness tears; no retears were observed among tears that were initially partial thickness and completed to full thickness before repair.

Thirteen of the 14 patients who developed a retear were smokers. Retear occurred in 13 of 51 smokers (25.5%) and in 1 of 38 nonsmokers (2.6%) (Fisher's exact $p = 0.003$). Nine retears (64.3%) were associated with a new postoperative traumatic event. Because of the small number of events, both analyses were considered exploratory (Table 3).

Table 3
Structural outcomes and complications

Outcome	SB	SBMA	Statistic
Retear	11/40 (27.5%)	3/49 (6.1%)	p = 0.008; RR 4.49 (95% CI 1.34–15.01)
Intact repair	29/40 (72.5%)	46/49 (93.9%)	
Retear with new trauma	7/11 (63.6%)	2/3 (66.7%)	Descriptive
Retear without new trauma	4/40 (10.0%)	1/49 (2.0%)	Descriptive
Frozen shoulder	1 (2.5%)	1 (2.0%)	—
Transient motion restriction	5 (12.5%)	8 (16.3%)	0.765
Infection	0	0	—

All 14 patients with retear underwent reoperation. In the SB group, nine underwent revision rotator cuff repair, one tendon transfer, and one shoulder arthroplasty; in the SBMA group, two underwent revision rotator cuff repair and one tendon transfer. One case of frozen shoulder occurred in each group. Transient limitation of motion occurred in 5/40 patients (12.5%) in the SB group and 8/49 (16.3%) in the SBMA group. No patient had persistent motion restriction at one year. No infection, hematoma, neurovascular complication, or anchor-related complication was observed.

Discussion

The principal finding of this study was that, with similar anchor use and the same rehabilitation protocol, SBMA was associated with a lower one-year MRI-confirmed retear rate than conventional SB. Retear occurred in 27.5% of the SB group and 6.1% of the SBMA group. Although baseline clinical scores were comparable, the trajectories of VAS, ASES, and Constant-Murley scores differed between groups, with better 12-month outcomes in the SBMA group. These findings suggest that the Mason-Allen modification may be associated with improved structural integrity and clinical recovery; however, the retrospective, non-randomized design does not allow a causal claim of superiority.

Our structural findings are strikingly consistent with the direct SB-SBMA comparison reported by Itoigawa et al. In 50 conventional SB and 52 SBMA repairs, they reported retear rates of 28.0% and 7.7%, respectively [12]. The corresponding rates in our series, 27.5% and 6.1%, were similar in both direction and magnitude. The fact that our cohort consisted of patients aged 25–40 years with predominantly traumatic tears is noteworthy, as a similar structural pattern was observed in a different clinical population.

To understand a possible advantage of SBMA, the mechanical points of failure in rotator cuff repair should be considered. Until tendon-to-bone healing is established, repair integrity depends on the mechanical behavior of the sutures, anchors, and tendon-suture interface. Gerber et al. showed that the modified Mason-Allen configuration can provide greater mechanical strength than simple sutures [9]. Biomechanical comparisons of arthroscopic rotator cuff stitches have likewise shown that suture geometry can substantially influence tissue hold [10].

Nevertheless, our findings should not be interpreted simply as evidence that a medial knot is better. Ansah-Twum et al. reported that knotted transosseous-equivalent constructs may be superior for some time-zero biomechanical parameters [13]. By contrast, a meta-analysis of 1.411 shoulders by Prasathaporn et al. found no significant difference in overall retear rates between knot-tying and knotless techniques [14]. Nemirov et al. similarly reported comparable clinical and functional outcomes for knotted and knotless medial-row transosseous-equivalent repairs [15]. The arthroscopic feasibility of combining a modified Mason-Allen stitch with a transosseous-equivalent construct has also been described [16]. The difference observed in our cohort may therefore be related less to the presence of a knot itself than to the suture geometry and load distribution created by the Mason-Allen configuration within the tendon.

The development of constructs that provide broader footprint contact and compression has long been aimed at improving structural healing after rotator cuff repair. In a systematic review of 2.048 repairs, Hein et al. reported lower retear rates with double-row and suture bridge techniques than with single-row repair across several tear-size categories [6]. Ren et al. found that suture bridge repair may have advantages over double-row repair for some structural outcomes, while differences in most clinical scores were limited [7]. Taken together, these data suggest that not only the number of anchor rows but also the way the tendon is captured within a given construct may be important.

Jeong et al. compared suture bridge repair with a double-row modified Mason-Allen technique and found similar clinical outcomes, with no significant difference in retear rates [17]. Although this appears to differ from our findings, the constructs being compared were not identical. In our study, anchor use was similar between groups, and the main distinction was the addition of the medial Mason-Allen configuration. This makes the technical contrast more specific, but it does not eliminate the potential for bias inherent in a retrospective comparison.

Tear size was a notable feature in relation to structural failure in our cohort: all five patients with a massive/retracted tear at baseline developed a retear. McElvany et al. reported that factors such as large tear size and fatty infiltration are associated with repair integrity [3]. In a meta-analysis of 5.693 patients, Zhao et al. also identified tear size and retraction among factors associated with retear [4]. Because our cohort included only five massive/retracted tears, this finding should be regarded as an observation within the cohort rather than an estimate of risk.

One important feature of our cohort is the young age of the patients. Meta-regression data have shown that the risk of retear after rotator cuff repair increases with age [18]. Mean age was nearly identical in

our groups (32.43 ± 4.81 and 32.37 ± 4.70 years; $p = 0.955$), making age an unlikely explanation for the difference in outcomes between techniques. On preoperative MRI, fatty infiltration according to the Goutallier classification was present in 4/40 patients (10.0%) in the SB group and 5/49 (10.2%) in the SBMA group (Fisher's exact $p = 1.000$). All four cases in the SB group were grade 3, whereas the SBMA group included one grade 2 and four grade 3 cases. This similar distribution makes it less likely that fatty infiltration alone accounts for the difference in structural outcomes between groups; however, the small number of events precluded assessment of its independent effect.

Smoking was one of the most prominent patient-related findings in our cohort. Thirteen of the 14 patients with a retear were smokers, corresponding to a retear rate of 25.5% among smokers and 2.6% among nonsmokers. Fan et al. reported that smoking is associated with higher risks of retear and reoperation after rotator cuff repair [19]. A more recent imaging-based meta-analysis also supports an association between smoking and structural failure [20]. Although the difference observed in our cohort was substantial, only 14 retear events occurred, and smoking should therefore not be presented as an independent risk factor on the basis of these data.

Diabetes mellitus is another patient-related factor that may affect rotator cuff healing. Yang et al. reported that structural failure may be more frequent in patients with diabetes [21], and Hong et al. also demonstrated an association between diabetes and the risk of tendon retear [22]. A more recent meta-analysis suggested that better perioperative glycemic control may reduce the risk of retear [23]. The absence of patients with diabetes in our cohort reduces the influence of this potential confounder in the between-group comparison, but it also limits the generalizability of our findings to patients with diabetes.

New postoperative trauma should also be considered when interpreting the retears. Nine of the 14 retears were associated with a new traumatic event, and this proportion was similar between groups. It would therefore be inappropriate to regard every structural failure as a failure of primary tendon-to-bone healing. Among patients without a new traumatic event, the retear rate was 10% in the SB group and 2% in the SBMA group; however, with only five atraumatic events, no reliable inference can be drawn from this subgroup.

The relationship between clinical scores and structural integrity remains debated. Haque and Singh reported better scores for some functional outcomes and less pain in patients with an intact repair [24]. In contrast, Russell et al. showed that the relationship between structural integrity and patient function is not always clinically meaningful in magnitude [25]. In our study, the combination of a lower retear rate and better 12-month VAS, ASES, and Constant-Murley scores in the SBMA group indicates that structural and clinical outcomes moved in the same direction. The retrospective design, however, does not allow us to determine how much of the clinical difference was attributable to tendon integrity, the repair technique, or unmeasured patient characteristics.

The 6-month findings also merit consideration. Differences in VAS and ASES were already evident at this time point, whereas the difference in Constant-Murley score was more modest. Because the Constant-Murley score incorporates range of motion and strength in addition to pain and activities of daily living, it

may be influenced by the early rehabilitation process. Mazuquin et al. reported that early rehabilitation can improve early range of motion, whereas longer-term functional differences are more limited [26]. Reviews of early versus delayed motion protocols by Houck et al. similarly suggest that rehabilitation timing can influence early outcomes [27]. The use of the same rehabilitation protocol in both groups in our study reduces confounding from this source.

Concomitant acromioplasty and biceps procedures are additional surgical variables that may affect clinical outcomes; however, their frequencies did not differ significantly between our groups. In a systematic review comparing tenotomy and tenodesis performed with rotator cuff repair, Leroux et al. found that overall clinical differences were limited [28]. A meta-analysis by Shang et al. likewise showed similar results for many clinical outcomes between the two approaches [29]. It is therefore unlikely that the distribution of biceps procedures in our cohort alone explains the difference in the primary structural outcome.

A potential disadvantage of SBMA is its greater technical complexity and longer operative time. Mean operative time was 59.85 ± 6.23 minutes in the SB group and 82.49 ± 4.61 minutes in the SBMA group ($p < 0.001$). The additional 22.64 minutes on average in the SBMA group may reflect the time required to prepare the Mason-Allen passes and tie the medial knots. In contrast, total anchor use was nearly identical between groups (3.95 ± 0.22 and 3.94 ± 0.24 ; $p = 0.820$), making it unlikely that the observed difference was related to greater implant use. Because this study was not designed as a cost-effectiveness analysis, it cannot determine whether the longer operative time is offset by a lower need for retear-related revision.

Strengths of this study include the fact that all procedures were performed by a single surgeon, anchor use was similar between groups, the same rehabilitation protocol was followed, preoperative fatty infiltration was assessed using the Goutallier classification, and 12-month MRI was available for every patient included in the analysis. Mean follow-up was also similar between groups (17.98 ± 3.74 and 18.24 ± 3.72 months; $p = 0.735$). Scheduled 12-month MRI across the entire cohort reduces verification bias that might arise if imaging were obtained only in symptomatic patients. In addition, Wu et al. have reported clinical use of a modified Mason-Allen approach across different rotator cuff tear patterns [30].

This study has several important limitations. First, the retrospective design and non-randomized, chronologically sequential use of the two techniques introduce the possibility of temporal confounding and a surgeon learning-curve effect. Because SB was used in the earlier part of the study period and SBMA thereafter, the entire difference in outcomes cannot be attributed solely to the suture configuration. Second, with only 14 retear events, a reliable multivariable model could not be constructed. Third, although Goutallier fatty infiltration grades were recorded, muscle atrophy, exact tear size in centimeters, and retraction distance were not documented in a standardized manner for all patients. Fourth, the structural MRI outcome was assessed as a binary retear/no-retear measure rather than by the Sugaya classification. Fifth, clinical assessments were performed by the same physician and

may therefore be subject to observer bias. Finally, follow-up was limited to 12–24 months; systematic reviews have shown that retear rates may change over time [5].

Taken together, these limitations mean that the present study demonstrates an association between SBMA and a lower retear rate and better clinical scores in a young, predominantly traumatic cohort rather than proving definitive superiority over conventional SB. Stronger study designs are needed before claims of technical superiority can be made. Future studies should include randomized or prospectively defined technique selection, standardized muscle-specific assessment of Goutallier grade and atrophy, quantitative measurement of retraction, blinded MRI assessment using the Sugaya classification, quantitative documentation of smoking exposure, and longer follow-up. Such an approach would allow the independent effect of the Mason-Allen configuration to be assessed more reliably.

Conclusion

In this retrospective cohort of young patients with predominantly traumatic rotator cuff tears, adding a medial Mason-Allen configuration to suture bridge repair was associated with a lower 12-month MRI-confirmed retear rate and greater clinical improvement. Retear occurred in 27.5% of conventional SB repairs and 6.1% of SBMA repairs. Massive/retracted tears nevertheless remained at high risk of failure, and smoking showed a strong exploratory association with retear. Because of the non-randomized retrospective design, these findings require confirmation in prospective comparative studies using standardized imaging.

Abbreviations

ASES

American Shoulder and Elbow Surgeons

CI

confidence interval

MRI

magnetic resonance imaging

NSAIDs

nonsteroidal anti-inflammatory drugs

PRP

platelet-rich plasma

RR

risk ratio

SB

suture bridge

SBMA

suture bridge–Mason-Allen

SD

standard deviation
VAS
Visual Analog Scale.

Declarations

Ethics approval and consent to participate

The study was approved by the Harran University Non-Interventional Clinical Research Ethics Committee on 9 June 2026 (Session 03; Decision No. HRÜ/26.03.43; Protocol No. HÜ-GOEK-2026-00115). The study was conducted in accordance with the Declaration of Helsinki and all relevant guidelines and regulations. Due to the retrospective nature of the study and the use of existing medical records, the requirement for informed consent to participate was waived by the Harran University Non-Interventional Clinical Research Ethics Committee.

Consent for publication

; Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

A.L. contributed to the study conception and design, patient management, surgical procedures, clinical evaluation, interpretation of the findings, and critical revision of the manuscript. V.K. contributed to data collection, statistical analysis, interpretation of the findings, literature review, and drafting and revision of the manuscript. Both authors read and approved the final manuscript.

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Data Availability

The anonymized datasets analyzed in this study are available from the corresponding author on reasonable request, subject to institutional and ethical restrictions.

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