



Original Article

Current management of impingement syndrome and repairable rotator cuff tears in South Korea: A web-based survey

Hyungsuk Kim^a, Jae-Hoo Lee^b, Ji Young Yoon^c, Hyojune Kim^d, Jae Soo Kim^e,
Seong Hun Kim^{f,*}^a Department of Orthopedic Surgery, Eunpyeong St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Republic of Korea^b Department of Orthopaedic Surgery, Gangbuk Yonsei Hospital, Seoul, Republic of Korea^c Department of Orthopaedic Surgery, Nowon Eulji Medical Center, Eulji University School of Medicine, Seoul, Republic of Korea^d Department of Orthopedic Surgery, Hospital of Chung-Ang University of Medicine, Dongjak-gu, Seoul, Republic of Korea^e Department of Orthopaedic Surgery, Chung-Ang University Gwangmyeong Hospital, College of medicine, Chung-Ang University, Gyeonggi, Republic of Korea^f Department of Orthopedic Surgery, National Health Insurance Service Ilsan Hospital, Gyeonggi, Republic of Korea

ARTICLE INFO

Keywords:

Arthroscopy
Rotator cuff injuries
Shoulder impingement syndrome
Surgical procedures
Operative
Surveys and questionnaires

ABSTRACT

Background: Despite advances in arthroscopic techniques and accumulating clinical evidence, the management of impingement symptoms without a definite rotator cuff tear and repairable rotator cuff tears remains variable in daily practice. Understanding contemporary practice patterns may help identify areas of consensus and variation and inform future guideline development.**Methods:** A nationwide, cross-sectional, web-based survey was conducted among members of the Korean Arthroscopy Society. The full questionnaire consisted of 110 items; the present study analyzed 37 items addressing impingement symptoms without a definite rotator cuff tear, acromioplasty during rotator cuff repair, management of concomitant long head of the biceps pathology, indications and techniques for partial-thickness tears, repair strategies for repairable full-thickness tears, and decision-making for subscapularis tears. Responses were summarized descriptively. Majority consensus was defined as selection by at least half of respondents. Subgroup analyses were performed according to practice setting, comparing university-based and non-university-based surgeons.**Results:** A total of 100 surgeons completed the survey. Most respondents reported that they rarely consider surgery for impingement symptoms without a definite rotator cuff tear and that escalation to surgery is primarily driven by persistent symptoms rather than imaging findings alone. During rotator cuff repair, acromioplasty was commonly performed, typically limited to spur excision. Management of long head of the biceps pathology showed strong consensus, with treatment decisions guided mainly by patient age and activity level and a preference for tenotomy in older patients. For partial-thickness rotator cuff tears, operative thresholds varied, particularly for lower-grade tears; however, when surgery was selected for partial articular-sided lesions, tear completion followed by repair was the most commonly preferred approach. Suture-bridge constructs were strongly favored for repairable full-thickness tears, with tear size, retraction, and tissue quality identified as the primary determinants of construct selection. Practice-setting differences were observed in the timing of escalation from conservative care and in the selective use of biologic adjuncts, including greater use of bioinductive patches for bursal-sided partial-thickness tears in university-based settings.**Conclusion:** This nationwide survey suggests that Korean shoulder surgeons have generally aligned their practice with contemporary evidence by avoiding routine surgery for impingement without a definite tear and by applying anatomy-driven strategies for repairable rotator cuff tears. Persistent variability in operative thresholds for partial-thickness tears and selective use of biologic adjuncts highlights areas where further evidence synthesis and consensus guidance may help reduce practice variation and support standardized, value-based care.**Level of evidence:** Level IV, Cross-sectional survey study

* Corresponding author.

E-mail address: esmeron@naver.com (S.H. Kim).<https://doi.org/10.1016/j.asmart.2026.05.011>

Received 19 January 2026; Received in revised form 1 April 2026; Accepted 26 May 2026

Available online 11 June 2026

2214-6873/© 2026 The Authors. Published by Elsevier B.V. on behalf of Asia-Pacific Knee, Arthroscopy, Arthroplasty, Shoulder and Sports Medicine Society (APKASS). This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Rotator cuff disease is one of the most common causes of shoulder pain and functional limitation and represents a substantial and growing surgical burden in South Korea. National epidemiologic data have demonstrated increasing surgical trends for rotator cuff pathology in Korea, reflecting population aging and expanding utilization of arthroscopic treatment.^{1,2} Despite the high procedure volume, several aspects of contemporary management remain preference-sensitive, and practice patterns may vary across institutions depending on case mix, resource availability, and surgeon training.

For patients presenting with impingement-type symptoms without a definite rotator cuff tear, the role of operative management such as arthroscopic subacromial decompression, acromioplasty, and/or bursectomy has been debated for decades.^{3–6} Although acromial morphology and subacromial spurs have historically been considered relevant anatomic factors,^{5,6} contemporary evidence suggests that the relationship between these findings, symptoms, and outcomes is complex, and indications for surgery after failed nonoperative care remain inconsistent across surgeons and healthcare systems.^{3,5} Furthermore, the content and duration of initial conservative treatment vary in real-world practice, including the relative use of medication, supervised physiotherapy, injections, and extracorporeal shockwave therapy, reflecting heterogeneity in both physician preference and local resource availability.^{7,8}

Even when rotator cuff repair is performed, substantial variation persists regarding adjunct procedures and technical strategies. The role of routine acromioplasty performed during rotator cuff repair remains controversial, and there is no clear agreement on how much bone should be resected. Clinical studies have reported conflicting results, and debate continues regarding whether acromioplasty meaningfully improves postoperative pain, tendon healing, or retear rates in repairable tears.^{9–11} Similarly, the management of concomitant long head of the biceps pathology is highly variable. Selection of surgical management for long head of the biceps pathology is typically guided by patient-specific factors such as age, activity level, symptoms, and clinical signs of instability, as well as the expected risk of cosmetic deformity. In addition, surgeons vary in whether they recommend operative treatment for isolated biceps pathology when a rotator cuff tear is not present.^{12,13} When tenodesis is performed, the choice of fixation technique further contributes to variation in practice and may reflect differences in surgeon training and institutional preference.^{14–16}

Partial-thickness rotator cuff tears are another area in which indications for surgery and operative strategies vary widely. Many surgeons use the extent of tendon involvement as a practical threshold when deciding between debridement and repair, but there is no uniform approach to applying this concept across different tear patterns. In addition, surgeons differ in how they treat partial articular-sided tendon avulsion (PASTA) lesions, with preferences ranging from preserving the remaining intact tendon and repairing in situ to completing the tear and then performing a standard repair.^{17–20} For repairable full-thickness tears, surgeons select the repair construct based on factors such as tear size, the degree of tendon retraction, and tissue quality, along with patient characteristics and individual surgical preference. As a result, the chosen repair strategy can vary across different practice settings.^{21–26}

Finally, the management of subscapularis tears has advanced with improvements in imaging and arthroscopic techniques, yet important variations remain in both indications and operative approach. Surgeons commonly rely on established classification systems, including the Lafosse system²¹ and the Yoo and Rhee system,²⁷ to describe tear patterns and severity. However, there is no uniform agreement on the severity at which repair should be recommended, where the repair should be performed, or whether additional steps such as comma tissue repair and coracoplasty should be routinely included.^{28–31}

To support guideline development and to benchmark contemporary clinical practice, the Korean Arthroscopy Society (KAS) conducted a

nationwide web-based survey of its members. The purpose of this study was to characterize current management patterns for subacromial pain without a definite rotator cuff tear and for repairable rotator cuff tears among shoulder surgeons in South Korea, to identify areas of majority agreement, and to explore differences by practice setting.

2. Material & methods

2.1. Study design

This study was a cross-sectional, web-based survey of KAS members who manage shoulder disorders as a primary or secondary area of practice. The questionnaire was distributed through the KAS official e-mail system, and responses were submitted via an online form. All responses were collected anonymously, and the authors had no access to respondents' names or e-mail addresses. The survey was open for six weeks (August 1 to September 15, 2025). Practice-setting information was required to complete the submission, whereas responses to the remaining items were optional.

2.2. Survey contents

The questionnaire was developed by a specialized survey committee within the KAS, comprising six board-certified orthopedic surgeons specializing in shoulder surgery, each with more than 10 years of clinical experience. The items were established through iterative expert reviews to ensure content validity and were pilot-tested for clarity before final distribution. The full questionnaire comprised 110 items. For the present analysis, we evaluated the “repairable rotator cuff tear” section (37 items; questions 1–36 and 111), covering (1) conservative management and thresholds for considering surgery in subacromial pain/impingement without a definite tear, (2) use and extent of acromioplasty during rotator cuff repair, (3) management of concomitant long head of the biceps pathology, (4) indications and preferred techniques for partial-thickness tears (articular- and bursal-sided), (5) repair constructs and adjunct procedures for repairable full-thickness tears including patch-related strategies, and (6) decision thresholds and technical preferences for subscapularis tears. This thematic selection was prospectively planned to ensure a focused and in-depth clinical discussion, as the remaining items addressed distinct clinical entities such as massive/irreparable tears and postoperative rehabilitation protocols. To minimize respondent burden and survey fatigue, these diverse topics were consolidated into a single comprehensive survey, with results intended for separate reporting based on clinical theme to maintain thematic consistency and avoid excessive manuscript length. [Table 1](#) lists the survey items analyzed in this study.

2.3. Statistical analysis

Responses were exported to Microsoft Excel and analyzed using Python. Categorical variables are presented as counts and percentages. Because some items were optional, denominators varied across questions and are reported accordingly. For single-answer items, an option selected by $\geq 50\%$ of respondents was considered a majority consensus response. For multiple-answer items, each option is summarized by its selection rate, and options selected by $\geq 50\%$ were considered consensus items. Because this study was intended to describe prevailing practice patterns rather than establish a formal consensus through a Delphi process, a threshold of $\geq 50\%$ was pragmatically chosen to indicate majority agreement. For exploratory subgroup comparisons, respondents practicing at university hospitals were classified as Group U, whereas those working in non-university institutions were classified as Group N. Group differences in categorical responses were assessed using the chi-square test or Fisher's exact test, as appropriate. To account for multiple testing across the 37 items, the Benjamini-Hochberg procedure was applied to the 87 individual statistical comparisons

Table 1

Survey items on the current management of impingement syndrome and repairable rotator cuff tears (questions 1–36 and 111).

Question	Survey item (English translation)
1	In patients with impingement syndrome without a definite rotator cuff tear, do you consider surgical interventions such as acromioplasty or bursectomy?
2	If you consider surgical treatment, after how long of a trial of conservative management do you typically make that decision?
3	When initiating conservative treatment, which modality do you consider first? (select all that apply)
4	What are the main factors that lead you to consider surgical treatment? (select all that apply)
5	Do you perform acromioplasty when conducting rotator cuff repair?
6	To what extent do you typically resect during acromioplasty?
7	What are the main factors influencing your decision to perform acromioplasty? (select all that apply)
8	What are the main factors influencing your decision to treat biceps pathology? (select all that apply)
9	What factors do you consider when deciding between biceps tenodesis and tenotomy? (select all that apply)
10	If you perform tenodesis, which fixation method do you use?
11	In cases of isolated biceps pathology without a concomitant rotator cuff tear, do you still perform surgery?
12	In patients >65 years of age undergoing rotator cuff repair, which method do you prefer for managing the biceps?
13	In cases of partial-thickness articular-sided tears (PASTA lesions) requiring surgical treatment, which repair technique do you prefer?
14	For a PASTA lesion involving <50% of tendon thickness, do you consider surgical treatment?
15	For a PASTA lesion involving >50% of tendon thickness, do you consider surgical treatment?
16	What is the most important factor influencing your decision to proceed with surgery for a PASTA lesion?
17	When considering surgical treatment for a PASTA lesion, after how long of a trial of conservative management do you typically make the decision?
18	When considering surgical treatment for a bursal-sided partial-thickness rotator cuff tear (PTRCT), after how long of a trial of conservative management do you typically make the decision?
19	What is the most important factor influencing your decision to proceed with surgery for a bursal-sided PTRCT?
20	For a bursal-sided PTRCT involving <50% of tendon thickness, do you consider surgical treatment?
21	For a bursal-sided PTRCT involving >50% of tendon thickness, do you consider surgical treatment?
22	When performing surgical treatment for a bursal-sided PTRCT, which repair technique do you prefer?
23	In the surgical treatment of a bursal-sided PTRCT, do you perform any additional adjunct procedures? (select all that apply)
24	For a bursal-sided PTRCT, do you use a bioinductive patch (e.g., Regeneten®, acellular dermal matrix (ADM), collagen)?
25	For repairable full-thickness rotator cuff tears, which repair technique do you prefer?
26	What factors do you consider when selecting a repair technique for a repairable full-thickness tear? (select all that apply)
27	What is the most important factor in your decision to proceed with surgery for a repairable full-thickness tear?
28	In surgical treatment of a repairable full-thickness tear, do you perform any additional adjunct procedures? (select all that apply)
29	For small- to medium-sized full-thickness rotator cuff tears, do you use a bioinductive patch (e.g., Regeneten)?
30	For small- to medium-sized full-thickness rotator cuff tears, do you perform patch augmentation (e.g., ADM)?
31	What is the most important factor influencing your decision to proceed with surgery for a subscapularis tear?
32a	At which stage would you consider surgical treatment for a subscapularis tear (Yoo and Rhee classification)?
32b	At which stage would you consider surgical treatment for a subscapularis tear (Lafosse classification)?
33	For a Type IIB subscapularis tear according to the Yoo and Rhee classification, how often do you consider surgical treatment?
34	In subscapularis tear repair, which surgical approach do you prefer?
35	When performing subscapularis repair, do you also repair the comma tissue?
36	When performing subscapularis repair, do you perform coracoplasty?
111	If the results of this survey differ from your current clinical practice, would you be willing to modify your treatment protocol accordingly?

Regeneten® is a bioinductive collagen implant (Smith & Nephew, Andover, MA, USA).

(including separate binary analyses for each option in multiple-choice questions). To assess the magnitude of observed differences, effect sizes were calculated using Cramer's V, with values of 0.1, 0.3, and 0.5 representing small, medium, and large effects, respectively. Both unadjusted and adjusted p-values were reported to provide a comprehensive view of the exploratory findings, and statistical significance was defined as an adjusted p-value <0.05. Following the overall chi-square test, adjusted standardized residuals were calculated as post hoc analyses to identify category-specific differences. A value greater than ± 1.96 was considered indicative of a meaningful contribution to the overall association.

3. Results

3.1. Respondent characteristics

The survey was specifically sent to 140 KAS members who identified shoulder surgery as their primary specialty, and 100 surgeons completed the survey (response rate: 71.4%). Respondents most practiced at university hospitals (40/100, 40%), followed by specialty hospitals (23/100, 23%), general hospitals (17/100, 17%), community hospitals (16/100, 16%), and clinics (4/100, 4%). Because some items were optional, denominators varied across questions and are reported accordingly. Majority consensus responses/items ($\geq 50\%$ selection rate) across the survey are summarized in Table 2.

3.2. Management of subacromial pain without a definite rotator cuff tear

For subacromial pain/impingement syndrome without a definite rotator cuff tear ($n = 100$), a majority consensus response was “extremely rarely” considering surgical treatment such as acromioplasty or bursectomy (51/100, 51.0%). When surgery was considered, no majority consensus was observed regarding the duration of conservative management before decision-making; however, the most common responses were ≥ 3 months (37%) and ≥ 6 months (35%). In subgroup analysis, the distribution of “time before considering surgery” differed between university-hospital (Group U) and non-university (Group N) respondents (unadjusted $p = 0.001$, Cramer's V = 0.354). Group U more commonly selected ≥ 6 months (20/40, 50.0%) than Group N (15/60, 25.0%), whereas Group N more commonly selected ≥ 3 months (29/60, 48.3%) than Group U (8/40, 20.0%) (Fig. 1). Post hoc analysis indicated that the ≥ 3 months category was more frequent in Group N, whereas the ≥ 6 months category was more frequent in Group U.

As initial conservative modalities (multiple responses allowed; $n = 100$), majority consensus items were injection therapy (75/100, 75.0%) and medication (60/100, 60.0%). Among factors prompting consideration of surgery (multiple responses allowed; $n = 98$), a majority consensus item was persistent pain (87/98, 88.8%).

3.3. Concomitant procedures during rotator cuff repair: acromioplasty and biceps management

For acromioplasty during rotator cuff repair ($n = 100$), a majority consensus response was “actively performed” (53/100, 53.0%). When acromioplasty was performed, a majority consensus response for resection extent was “spur excision only” (63/99, 63.6%). The most frequently selected determinant for performing acromioplasty (multiple responses allowed; $n = 99$) was spur presence, which met the majority consensus item criterion (79/99, 79.8%).

Regarding concomitant biceps pathology, majority consensus items for deciding whether to treat the biceps (multiple responses allowed; $n = 100$) were age (63%), pain (59%), and tear severity (59%). For choosing between tenodesis and tenotomy (multiple responses allowed;

Table 2
Survey items that reached majority consensus ($\geq 50\%$ agreement).

Survey item	Item type	Majority consensus response/item ($\geq 50\%$)	n/N (%)
Consider surgery for impingement without definite tear?	Single choice	Extremely rarely	51/100 (51.0)
Initial conservative modality	Multiple-choice	Medication	60/100 (60.0)
Factors prompting surgery	Multiple-choice	Persistent pain	87/98 (88.8)
Perform acromioplasty during RCR?	Single choice	Actively	53/100 (53.0)
Extent of acromioplasty resection	Single choice	Spur excision only	63/99 (63.6)
Determinants for acromioplasty	Multiple-choice	Spurs presence	79/99 (79.8)
Determinants to treat biceps pathology	Multiple-choice	Age	63/100 (63.0)
Determinants to treat biceps pathology	Multiple-choice	Pain	59/100 (59.0)
Determinants to treat biceps pathology	Multiple-choice	Tear severity	59/100 (59.0)
Factors for tenodesis vs tenotomy	Multiple-choice	Age	90/100 (90.0)
Factors for tenodesis vs tenotomy	Multiple-choice	Activity level	71/100 (71.0)
Preferred tenodesis fixation method	Single choice	A/S suprapectoral – suture anchor	71/100 (71.0)
Operate for isolated biceps pathology without rotator cuff tear?	Single choice	Almost never	51/100 (51.0)
Preferred biceps management in patients >65 years during RCR	Single choice	Tenotomy	60/100 (60.0)
Preferred technique for PASTA lesions requiring surgery	Single choice	Take down and repair	65/99 (65.7)
Key factor prompting surgery for PASTA lesions	Single choice	Pain	54/99 (54.5)
Conservative treatment duration before surgery for PASTA lesions	Single choice	3 months	52/100 (52.0)
Conservative treatment duration before surgery for bursal-sided PTRCT	Single choice	3 months	57/100 (57.0)
Key factor prompting surgery for bursal-sided PTRCT	Single choice	Pain	63/99 (63.6)
Preferred repair technique for bursal-sided PTRCT	Single choice	Suture-bridge repair	54/100 (54.0)
Adjunct procedures for bursal-sided PTRCT	Multiple-choice	Collagen injection	77/96 (80.2)
Preferred technique for repairable full-thickness tears	Single choice	Suture-bridge repair	77/100 (77.0)
Factors for selecting repair technique	Multiple-choice	Tear size	70/100 (70.0)
Factors for selecting repair technique	Multiple-choice	Retraction extent	64/100 (64.0)
Factors for selecting repair technique	Multiple-choice	Tissue quality	61/100 (61.0)
Adjunct procedures for repairable full-thickness tears	Multiple-choice	Collagen injection	79/99 (79.8)
Use bioinductive patch for small–medium full-thickness tears?	Single choice	Almost never	60/100 (60.0)
Use patch augmentation (e.g., ADM) for small–medium full-thickness tears?	Single choice	Almost never	56/100 (56.0)
Threshold for subscapularis surgery (Yoo & Rhee classification)	Single choice	Type IIB	58/99 (58.6)
Threshold for subscapularis surgery (Lafosse classification)	Single choice	Stage 2	62/99 (62.6)
Perform coracoplasty during subscapularis repair?	Single choice	Almost never	77/100 (77.0)
Willingness to change practice if survey differs from current practice	Single choice	Would consider changing	64/99 (64.6)

n = 100), majority consensus items were age (90%) and activity level (71%). For tenodesis fixation (n = 100), a majority consensus response was arthroscopic suprapectoral fixation using a suture anchor (71/100, 71.0%).

For isolated biceps pathology without a concomitant rotator cuff tear (n = 100), a majority consensus response was “almost never” performing surgery (51/100, 51.0%). In patients older than 65 years undergoing rotator cuff repair (n = 100), a majority consensus response was tenotomy (60/100, 60.0%).

3.4. Management of partial- and full-thickness rotator cuff tears and subscapularis tears

For PASTA lesions requiring operative treatment (n = 99), a majority consensus response was take-down and repair (65/99, 65.7%). For articular-sided partial-thickness tears involving <50% thickness (n = 100), no majority consensus was observed regarding whether to consider surgery; however, subgroup distributions differed between university-hospital and non-university respondents (unadjusted p = 0.012, Cramer's V = 0.263). Group U more frequently selected “extremely rarely” (22/40, 55.0%) than Group N (22/60, 36.7%), while Group N more frequently selected “case-by-case” (26/60, 43.3%) than Group U (6/40, 15.0%). For the main factor driving surgical decision-making for PASTA lesions (n = 99), a majority consensus response was pain (54/99, 54.5%). For the duration of conservative treatment before considering surgery for PASTA lesions (n = 100), a majority consensus response was 3 months (52/100, 52.0%), with subgroup differences observed between practice settings (unadjusted p = 0.004, Cramer's V = 0.319). Group U more commonly selected ≥ 6 months (22/40, 55.0%) than Group N (15/60, 25.0%), whereas Group N more commonly selected 3 months (35/60, 58.3%) than Group U (17/40, 42.5%).

For bursal-sided partial-thickness tears, a majority consensus response for preferred repair technique was suture-bridge repair (54/100, 54.0%). For adjunct procedures during operative treatment of bursal-sided partial tears (multiple responses allowed; n = 96), a majority consensus item was collagen injection (77/96, 80.2%). Subgroup analysis showed a difference in selection rates for bioinductive patch use as an adjunct. Group U selected bioinductive patch use more frequently than Group N (18/39, 46.2% vs 14/57, 24.6%, p = 0.046) (Fig. 2).

For repairable full-thickness tears (n = 100), a majority consensus response was suture-bridge repair (77/100, 77.0%). When selecting a repair technique (multiple responses allowed; n = 100), majority consensus items were tear size (70%), retraction extent (64%), and tissue quality (61%). For adjunct procedures during operative treatment of full-thickness tears (multiple responses allowed; n = 99), a majority consensus item was collagen injection (78/99, 78.8%). For small-to-medium full-thickness tears, a majority consensus response was “almost never” using a bioinductive patch (60/100, 60.0%) and “almost never” performing patch augmentation (56/100, 56.0%); the distribution for patch augmentation differed between practice settings in subgroup analysis (unadjusted p = 0.031, Cramer's V = 0.223). Group U more commonly selected “case-by-case” (19/40, 47.5%) than Group N (16/60, 26.7%), whereas Group N more commonly selected “almost never” (40/60, 66.7%) than Group U (16/40, 40.0%) (Fig. 3).

For subscapularis tears, no majority consensus was observed regarding the single most important determinant for repair (n = 100). However, the most common thresholds for considering surgery met the majority consensus response definition: Type IIB in the Yoo and Rhee classification (58/99, 58.6%) and Stage 2 in the Lafosse classification (62/99, 62.6%). For coracoplasty, a majority consensus response was “almost never performed” (77/100, 77.0%).

3.5. Willingness to change practice

When asked whether they would change their practice if the survey

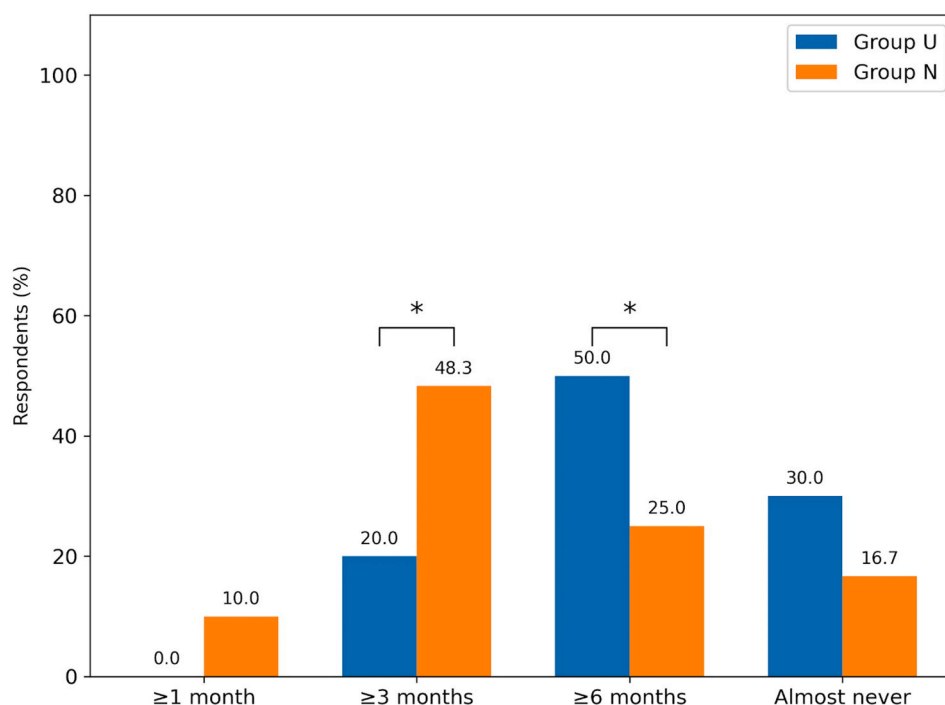


Fig. 1. Duration of conservative treatment before considering surgery for subacromial pain without a definite rotator cuff tear, by practice setting (Group U vs Group N).

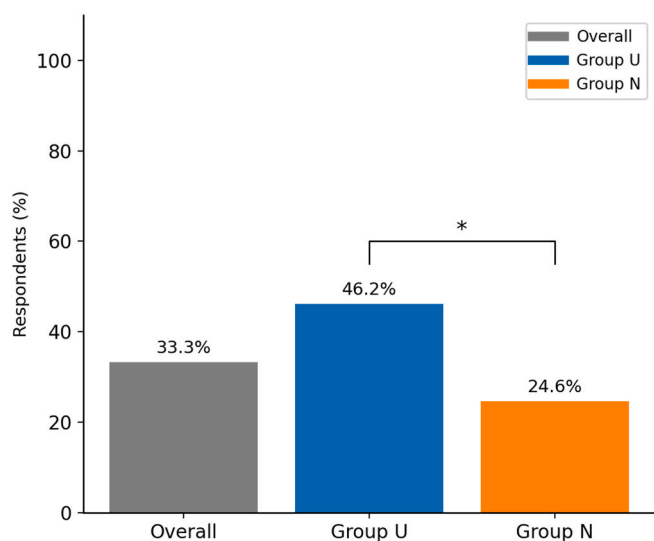


Fig. 2. Selection rate of a bioinductive patch as an adjunct procedure for bursal-sided partial-thickness rotator cuff tears, overall and by practice setting (Group U vs Group N).

results differed from their current practice ($n = 99$), a majority consensus response was “would consider changing” (64/99, 64.6%), followed by “very willing” (26/99, 26.3%) and “not willing” (9/99, 9.1%).

4. Discussion

This nationwide web-based survey of KAS members showed that Korean shoulder surgeons rarely consider surgery for impingement symptoms without a definite rotator cuff tear, while demonstrating majority consensus in several aspects of repairable rotator cuff tear management. In particular, surgeons commonly performed limited

acromioplasty during rotator cuff repair, favored age- and activity-guided biceps treatment, and preferred suture-bridge constructs for repairable full-thickness tears. Practice-setting differences were mainly observed in thresholds for escalation from conservative care and in selected adjunct preferences.

The finding that surgery is rarely considered for impingement symptoms without a definite rotator cuff tear is consistent with high-level evidence from placebo-controlled trials that failed to demonstrate a clinically meaningful advantage of routine subacromial decompression over nonoperative treatment.^{3,5} These studies challenged long-standing assumptions regarding mechanical impingement as the primary pain generator and emphasized the multifactorial nature of subacromial pain. The present survey suggests that these concepts have translated into real-world clinical practice in Korea, with escalation decisions largely driven by persistent symptoms rather than imaging findings alone. Variation in the duration of conservative management prior to reconsidering surgery, particularly between university and non-university institutions, likely reflects differences in access to structured nonoperative care, patient expectations, and institutional treatment pathways rather than fundamental disagreement regarding treatment principles.^{32,33}

Despite skepticism toward decompression for isolated impingement, acromioplasty remains commonly performed during rotator cuff repair. This pattern mirrors the ongoing debate in the literature. Randomized trials and meta-analyses have reported similar clinical outcomes with and without acromioplasty in repairable rotator cuff tears,^{9–11,34} yet anatomical studies linking acromial morphology and lateral extension to cuff pathology continue to influence surgical thinking.^{35,36} The preference for limited, spur-focused resection observed in this survey suggests that many surgeons attempt to reconcile these conflicting data by applying acromioplasty selectively rather than routinely. Interestingly, 53.0% of Korean surgeons reported actively performing acromioplasty during rotator cuff repair, which is relatively higher than the 36.1% reported among members of the American Shoulder and Elbow Surgeons (ASES) in a 2015 survey.³⁷ While international guidelines and recent trials emphasize the lack of clinical benefit for routine decompression, the preference for limited spur excision in this study suggests that

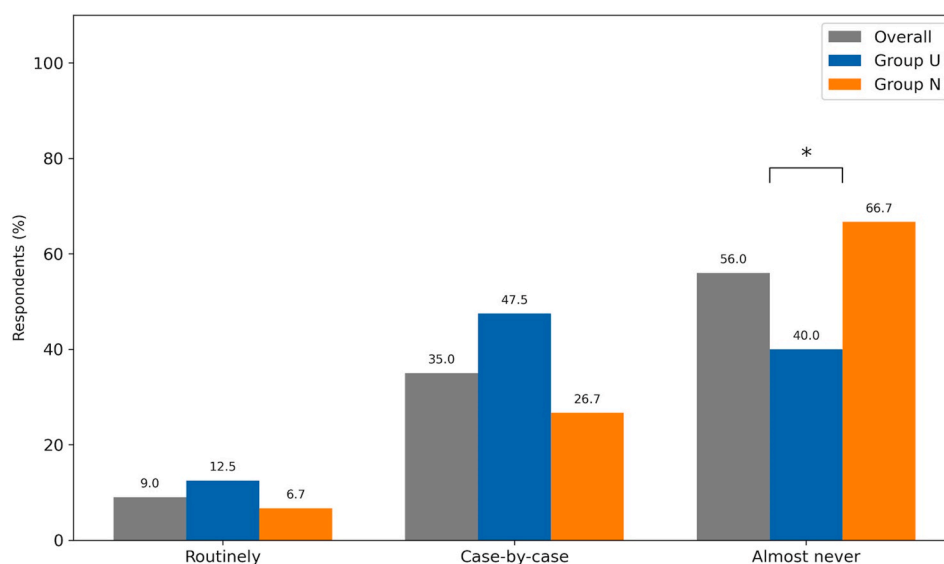


Fig. 3. Frequency of patch augmentation (e.g., acellular dermal matrix) for small-to-medium full-thickness rotator cuff tears, overall and by practice setting (Group U vs Group N).

Korean surgeons still value mechanical clearance in selected cases to protect the repaired tendon. This approach reflects an interpretation that focal mechanical factors may still be relevant in selected cases, even if routine decompression is not universally beneficial.

Management of long head of the biceps pathology demonstrated relatively strong consensus and aligns well with prior clinical evidence. The emphasis on patient age and activity level when selecting between tenotomy and tenodesis is consistent with randomized and comparative studies showing that both procedures can reliably improve pain and function, while differences in cosmetic outcomes and patient expectations often guide selection.^{12,13} The concentration of practice around a limited number of tenodesis fixation strategies is also in line with data indicating that complication profiles vary by fixation location and method, encouraging surgeons to favor techniques perceived as reproducible and lower risk.^{14,38} Regarding biceps management, Korean surgeons showed a strong preference for tenotomy in patients older than 65 years (60.0%), identifying age as the primary determinant (90.0%). This practice pattern is closely associated with the historical reimbursement structure of the South Korean National Health Insurance (NHI) system, which until recently did not provide coverage for biceps tenodesis in patients aged 65 or older. While these insurance restrictions have been partially mitigated, the established habit of opting for tenotomy in the elderly remains prevalent, likely because it avoids potential reimbursement disputes and minimizes operative time in a population where cosmetic deformity is often perceived as a secondary concern. This contrasts with trends in the United States, where members of the ASES have shown an increasing preference for tenodesis regardless of age, driven by higher patient demands for cosmetic preservation.³⁹ Consequently, our findings suggest that the clinical decision-making of Korean surgeons is a product of both surgical pragmatism and long-standing domestic healthcare policies.

Partial-thickness rotator cuff tears remain an area of greater heterogeneity, particularly with respect to operative thresholds.^{40,41} Once surgery is selected for PASTA lesions, many surgeons prefer tear completion followed by repair, which is consistent with literature supporting reliable footprint restoration using this approach.^{17,20} However, the absence of consensus for lower-grade partial tears mirrors the longstanding debate regarding debridement-based strategies versus repair and the difficulty of defining clear thresholds for intervention.^{19,42} This uncertainty is well documented in prior studies and reflects the complex interplay between structural findings, symptom severity, functional demands, and patient expectations. The observed

institutional differences in timing of escalation from conservative care further emphasize that decision-making in partial-thickness tears is strongly context dependent. For PASTA lesions, 65.7% of respondents preferred the take-down and repair technique, reflecting a focus on anatomical footprint restoration. This alignment with "tear completion" is consistent with the recent SECEC Delphi consensus, which acknowledges the ongoing debate between in situ and take-down repairs but notes a trend toward completion for high-grade partial tears to ensure robust mechanical fixation.⁴³

For bursal-sided partial-thickness tears and repairable full-thickness tears, the strong preference for suture-bridge constructs aligns with biomechanical and clinical literature supporting transosseous-equivalent concepts and footprint restoration.^{22,23,44,45} The emphasis on tear size, retraction, and tissue quality as drivers of construct selection is consistent with established prognostic frameworks and imaging-based assessments of muscle quality and fatty degeneration.^{46–48} These findings indicate that, in Korea, repair strategy selection is largely anatomy- and tissue-driven rather than purely surgeon-dependent, which may facilitate future standardization efforts.

With respect to biologic augmentation, the present survey revealed selective rather than routine use of bioinductive patches such as collagen-based implants. In particular, bioinductive patch use for bursal-sided partial-thickness tears was more frequently reported by surgeons in university-based settings compared with those in non-university institutions, whereas the majority of respondents reported that they almost never use bioinductive patches or formal patch augmentation for small to medium repairable full-thickness tears. This pattern is noteworthy because bioinductive patches, including resorbable collagen implants such as Regeneten (Smith & Nephew, Andover, MA, USA), have been proposed to promote tendon healing by inducing new tissue formation, particularly in partial-thickness tears with preserved native tendon continuity.^{49–53} The observed institutional difference likely reflects variations in access, cost considerations, and exposure to emerging technologies, as well as differing thresholds for adopting newer implants in routine clinical practice. This selective adoption of bioinductive patches in Korea contrasts with the latest 2025 American Academy of Orthopaedic Surgeons (AAOS) Clinical Practice Guidelines, which issued a "Strong Recommendation" for bioinductive implants in specific tear patterns based on emerging global evidence.⁵⁴ The discrepancy suggests that while global trends shift toward patch-based augmentation, Korean practice remains more influenced by institutional feasibility and reimbursement considerations.

At the same time, the survey demonstrated frequent use of collagen injection as an adjunct in both partial-thickness tears and small to medium repairable full-thickness tears. This preference suggests that many surgeons favor less invasive biologic strategies that can be applied without altering repair constructs or substantially increasing surgical complexity. While clinical evidence supporting injectable collagen formulations is often described as limited or heterogeneous in a global context, its frequent use in Korea is notably supported by a robust and growing body of evidence from domestic investigators.^{55–57} These recent Korean studies have demonstrated that intraoperative injections of collagen can enhance radiographic tendon integrity and improve clinical outcomes, including postoperative pain reduction. This suggests that the preference for injectable formulations among Korean surgeons is grounded in both locally generated clinical data and the pursuit of surgical efficiency. The widespread use of collagen injection observed in this survey highlights a pragmatic approach in which surgeons selectively integrate biologic adjuncts perceived as low risk and relatively accessible, while reserving more resource-intensive patch-based augmentation for carefully selected scenarios.

Overall, the differential adoption of bioinductive patches and injectable collagen across tear types and practice settings underscores the cautious and selective integration of biologic technologies in contemporary rotator cuff surgery in Korea. These findings suggest that future consensus efforts should distinguish between partial-thickness and full-thickness pathology when discussing biologic augmentation and should consider institutional feasibility and cost-effectiveness alongside emerging clinical evidence.

At the same time, the survey demonstrated frequent use of collagen injection as an adjunct in both partial-thickness tears and small to medium repairable full-thickness tears. This preference suggests that many surgeons favor less invasive biologic strategies that can be applied without altering repair constructs or substantially increasing surgical complexity. Although clinical evidence supporting injectable collagen formulations remains limited and heterogeneous, experimental and early clinical studies have suggested potential benefits in modulating the tendon healing environment and reducing postoperative pain.^{55–58} The widespread use of collagen injection observed in this survey highlights a pragmatic approach in which surgeons selectively integrate biologic adjuncts perceived as low risk and relatively accessible, while reserving more resource-intensive patch-based augmentation for carefully selected scenarios.

Overall, the differential adoption of bioinductive patches and injectable collagen across tear types and practice settings underscores the cautious and selective integration of biologic technologies in contemporary rotator cuff surgery in Korea. These findings suggest that future consensus efforts should distinguish between partial-thickness and full-thickness pathology when discussing biologic augmentation and should consider institutional feasibility and cost-effectiveness alongside emerging clinical evidence.

At the same time, the survey demonstrated frequent use of collagen injection as an adjunct in both partial-thickness tears and small to medium repairable full-thickness tears. This preference suggests that many surgeons favor less invasive biologic strategies that can be applied without altering repair constructs or substantially increasing surgical complexity. Although clinical evidence supporting injectable collagen formulations remains limited and heterogeneous, experimental and early clinical studies have suggested potential benefits in modulating the tendon healing environment and reducing postoperative pain.^{55–57} The widespread use of collagen injection observed in this survey highlights a pragmatic approach in which surgeons selectively integrate biologic adjuncts perceived as low risk and relatively accessible, while reserving more resource-intensive patch-based augmentation for carefully selected scenarios.

Overall, the differential adoption of bioinductive patches and injectable collagen across tear types and practice settings underscores the cautious and selective integration of biologic technologies in

contemporary rotator cuff surgery in Korea. These findings suggest that future consensus efforts should distinguish between partial-thickness and full-thickness pathology when discussing biologic augmentation and should consider institutional feasibility and cost-effectiveness alongside emerging clinical evidence.

Management of subscapularis tears remains an evolving domain with incomplete consensus. While classification systems are widely used to describe tear severity, thresholds for repair and associated technical steps vary. The tendency to consider operative treatment at moderate severity stages and to avoid routine coracoplasty is consistent with available clinical literature emphasizing careful tear characterization and selective adjunct use.^{21,27,28,30,59} These findings suggest gradual convergence toward more conservative and anatomy-guided strategies, while acknowledging that subscapularis decision-making remains multifactorial.

Taken together, this survey demonstrates that Korean shoulder surgeons have largely aligned their practice with contemporary evidence questioning routine surgery for impingement without a definite tear, while adopting selective, anatomy-driven strategies for repairable rotator cuff pathology. Areas of persistent variation, particularly in partial-thickness tear thresholds and adjunct use, highlight where further evidence synthesis and consensus guidance may be most valuable. By distinguishing domains of convergence from those of uncertainty, the present findings provide a practical foundation for future guideline development tailored to real-world clinical practice. In particular, treatment thresholds for partial-thickness tears and the use of biologic adjuncts represent areas where greater standardization may improve consistency of care. These findings may also inform future guideline development and help align residency and fellowship training with contemporary practice patterns. Future studies incorporating prospective audit data or formal Delphi-based consensus processes may further validate these findings and help reduce unwarranted variation in clinical practice. Although the question regarding readiness to change clinical practice was presented at the end of the larger comprehensive survey, the high rate of positive responses (90.9%) indicates a strong willingness among Korean surgeons to adopt consensus-driven findings. This receptivity suggests that the insights provided in this study regarding standard repairable pathologies are likely to be actively integrated into clinical practice, further supporting the value of developing national practice guidelines.

Beyond specific surgical techniques, our findings reveal significant institutional disparities that underscore the structural characteristics of the South Korean healthcare system. The longer duration of conservative management reported by university-hospital surgeons can be attributed to distinct referral patterns. Tertiary hospitals primarily treat patients who have already failed long-term conservative care in primary or secondary clinics, leading to a higher cumulative duration before surgery is considered. Furthermore, institutional variations in biologic adoption highlight the influence of resource availability and reimbursement structures. The significantly higher utilization of bioinductive patches in university settings reflects greater access to emerging technologies and a patient population with higher expectations for advanced care. Because these patches are currently high-cost and non-reimbursable, they are more readily adopted in academic centers where patients may be more willing to accept such expenses for potential biological advantages. In contrast, non-university surgeons appear to prioritize surgical efficiency and cost-effectiveness, favoring intraoperative collagen injections that are technically accessible and relatively affordable. These findings suggest that clinical practice in Korea is a pragmatic synthesis of evidence-based medicine and the economic realities of a tiered healthcare system.

5. Limitation

This study has several limitations that should be considered when interpreting the results. First, the survey-based design relies on self-

reported practice patterns and preferences, which may be subject to recall bias and may not fully reflect actual day-to-day clinical decision-making. As with all questionnaire-based studies, responses may represent intended or perceived practice rather than objectively measured behavior. Second, although 100 members of the KAS participated in the survey, the sample may not be fully representative of all surgeons managing rotator cuff disease in South Korea. Participation was voluntary, and selection bias is possible, as surgeons with a particular interest in rotator cuff pathology or academic activity may have been more likely to respond. While the survey achieved a high response rate of 71.4% among 140 invited shoulder specialists, the results may still be subject to selection bias, as those with a particular interest in academic activity might have been more likely to respond. Third, some survey items were optional, resulting in varying denominators across questions. Although this reflects real-world variability in clinical experience and interest, it may limit direct comparison across all items and should be considered when interpreting specific results. Fourth, this cross-sectional survey captures practice patterns at a single time point. Surgical techniques, implant availability, rehabilitation resources, and supporting clinical evidence continue to evolve, and the observed trends may change over time. Longitudinal surveys would be required to assess temporal shifts in practice and adoption of emerging strategies. Finally, this study did not assess clinical outcomes. Accordingly, no conclusions can be drawn regarding the comparative effectiveness, safety, or cost-effectiveness of the reported management strategies. In addition, subgroup analyses based on practice setting may have been underpowered to detect more subtle differences, and the findings should therefore be interpreted with caution. Future studies incorporating additional stratification variables, such as surgeon experience or surgical volume, may provide more detailed insights into practice variation. The findings should therefore be interpreted as descriptive of current practice patterns rather than prescriptive recommendations for optimal treatment.

6. Conclusion

This nationwide survey of KAS members suggests that contemporary management of impingement symptoms and repairable rotator cuff tears in South Korea has generally aligned with current evidence, particularly in avoiding routine surgery for impingement without a definite tear and adopting anatomy-driven strategies for repairable rotator cuff pathology. While majority consensus was observed in several key areas, including repair construct selection and biceps management, meaningful variation persists in operative thresholds for partial-thickness tears and in the selective use of biologic adjuncts across practice settings. These findings provide a practical overview of current clinical trends and highlight specific areas where further evidence synthesis and consensus guidance may help reduce variability and support standardized, value-based care.

Fund of this study

No financial support was received for this study.

Ethical review committee statement

This study was conducted as a professional consensus and practice-pattern survey of orthopedic surgeons and did not involve patient data, human biological materials, or identifiable personal information. According to institutional and national regulations, ethical approval and informed consent were not required for this type of survey-based study. All responses were collected anonymously and analyzed in aggregate.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence

the work reported in this paper.

References

- Jo Y-H, Lee K-H, Kim S-J, Kim J, Lee B-G. National trends in surgery for rotator cuff disease in Korea. *J Kor Med Sci*. 2017;32(2).
- Kim JH, Cho NS, Park JY, et al. Doctor shopping trend of patients before undergoing rotator cuff repair in Korea: a multicenter study. *Clin Shoulder Elb*. Sep 2024;27(3): 338–344. <https://doi.org/10.5397/cise.2024.00381>.
- Beard DJ, Rees JL, Cook JA, et al. Arthroscopic subacromial decompression for subacromial shoulder pain (CSAW): a multicentre, pragmatic, parallel group, placebo-controlled, three-group, randomised surgical trial. *Lancet*. 2018;391: 329–338, 10118.
- Neer CS. 2nd. Impingement lesions. *Clin Orthop Relat Res*. Mar 1983;173:70–77.
- Paavola M, Malmivaara A, Taimela S, et al. Subacromial decompression versus diagnostic arthroscopy for shoulder impingement: randomised, placebo surgery controlled clinical trial. *bmj*. 2018;362.
- Lee KS, Kim DH, Chung SW, Yoon JP. Current concepts in arthroscopic rotator cuff repair. *Clin Shoulder Elb*. Mar 2025;28(1):103–112. <https://doi.org/10.5397/cise.2025.00010>.
- Chang K-V, Hung C-Y, Han D-S, Chen W-S, Wang T-G, Chien K-L. Early versus delayed passive range of motion exercise for arthroscopic rotator cuff repair: a meta-analysis of randomized controlled trials. *Am J Sports Med*. 2015;43(5):1265–1273.
- van der Meijden OA, Westgard P, Chandler Z, Gaskill TR, Kokmeyer D, Millett PJ. Rehabilitation after arthroscopic rotator cuff repair: current concepts review and evidence-based guidelines. *Int J Sports Phys Ther*. 2012;7(2):197.
- Abrams GD, Gupta AK, Hussey KE, et al. Arthroscopic repair of full-thickness rotator cuff tears with and without acromioplasty: randomized prospective trial with 2-year follow-up. *Am J Sports Med*. 2014;42(6):1296–1303.
- MacDonald P, McRae S, Leiter J, Mascarenhas R, Lapner P. Arthroscopic rotator cuff repair with and without acromioplasty in the treatment of full-thickness rotator cuff tears: a multicenter, randomized controlled trial. *JBJS*. 2011;93(21):1953–1960.
- Sayampathan AA, Silva AN, Chye ATH. Rotator cuff repairs with and without acromioplasties yield similar clinical outcomes: a meta-analysis and systematic review. *Arthrosc J Arthrosc Relat Surg*. 2021;37(6):1950–1957.
- Boileau P, Baqué F, Valerio L, Ahrens P, Chuinard C, Trojani C. Isolated arthroscopic biceps tenotomy or tenodesis improves symptoms in patients with massive irreparable rotator cuff tears. *JBJS*. 2007;89(4):747–757.
- MacDonald P, Verhulst F, McRae S, et al. Biceps tenodesis versus tenotomy in the treatment of lesions of the long head of the biceps tendon in patients undergoing arthroscopic shoulder surgery: a prospective double-blinded randomized controlled trial. *Am J Sports Med*. 2020;48(6):1439–1449.
- McCrum CL, Alluri RK, Batech M, Mirzayan R. Complications of biceps tenodesis based on location, fixation, and indication: a review of 1526 shoulders. *J Shoulder Elb Surg*. 2019;28(3):461–469.
- Ozalay M, Akpinar S, Karaeminogullari O, et al. Mechanical strength of four different biceps tenodesis techniques. *Arthrosc J Arthrosc Relat Surg*. 2005;21(8): 992–998.
- Lee DH, Lee GM, Park HB. Factors associated with long head of the biceps tendon tear severity and predictive insights for grade II tears in rotator cuff surgery. *Clin Shoulder Elb*. Jun 2024;27(2):149–159. <https://doi.org/10.5397/cise.2023.01053>.
- Gonzalez-Lomas G, Kippe MA, Brown GD, et al. In situ transtendon repair outperforms tear completion and repair for partial articular-sided supraspinatus tendon tears. *J Shoulder Elb Surg*. Sep–Oct 2008;17(5):722–728. <https://doi.org/10.1016/j.jse.2008.01.148>.
- Snyder SJ, Bond JL. Partial articular supraspinatus Tendon Avulsion (PASTA) lesions of the rotator cuff. *The Athlete's Shoulder*. 2008:143.
- Weber SC. Arthroscopic debridement and acromioplasty versus mini-open repair in the treatment of significant partial-thickness rotator cuff tears. *Arthrosc J Arthrosc Relat Surg*. 1999;15(2):126–131.
- Yang Y, Hu D, Chen S, Guan S, Shang X. Transtendon technique versus repair after completion of the tear for articular-sided partial rotator cuff tear: a meta-analysis of comparative studies. *J Orthop Surg Res*. May 22 2023;18(1):378. <https://doi.org/10.1186/s13018-023-03831-4>.
- Lafosse L, Lanz U, Saintmard B, Campens C. Arthroscopic repair of subscapularis tear: surgical technique and results. *Orthopaedics & Traumatology: Surgery & Research*. 2010;96(8):S99–S108.
- Park J-Y, Lee S-Y, Chung SW, Zulkifli H, Cho J-H, Oh K-S. Clinical comparison between double-row and transosseous-equivalent repairs for medium to large size rotator cuff tears. *Arch Orthop Trauma Surg*. 2013;133(12):1727–1734.
- Park MC, Tibone JE, ElAttrache NS, Ahmad CS, Jun B-J, Lee TQ. Part II: biomechanical assessment for a footprint-restoring transosseous-equivalent rotator cuff repair technique compared with a double-row repair technique. *J Shoulder Elb Surg*. 2007;16(4):469–476.
- Sohn HJ, Cho CH. Acellular dermal matrix patch augmentation combined with rotator cuff repair. *Clin Shoulder Elb*. Dec 2025;28(4):401–402. <https://doi.org/10.5397/cise.2025.01102>.
- Park JH, Kim JH, Koo HJ. Effects of tear size on outcomes after acellular dermal matrix-augmented rotator cuff repair. *Clin Shoulder Elb*. Dec 2025;28(4):437–445. <https://doi.org/10.5397/cise.2025.00745>.
- Kim JH, Min YK, Jang YC, Seo WS. Serial changes of fatty degeneration and clinical outcomes after repair of medium-sized rotator cuff tears. *Clin Orthop Surg*. Feb 2024; 16(1):95–104. <https://doi.org/10.4055/cios23146>.
- Yoo JC, Rhee YG, Shin SJ, et al. Subscapularis tendon tear classification based on 3-dimensional anatomic footprint: a cadaveric and prospective clinical observational

- study. *Arthroscopy*. Jan 2015;31(1):19–28. <https://doi.org/10.1016/j.arthro.2014.08.015>.
28. Ayanaoglu T, Ataoglu B, Özer M, Çetinkaya M, Kaptan AY, Kanath U. Is Routine Coracoplasty Necessary in Isolated Subscapularis Tears?. 2019.
 29. Lo IK, Burkhart SS. The comma sign: an arthroscopic guide to the torn subscapularis tendon. *Arthrosc J Arthrosc Relat Surg*. 2003;19(3):334–337.
 30. Saltzman BM, Collins MJ, Leroux T, et al. Arthroscopic repair of isolated subscapularis tears: a systematic review of technique-specific outcomes. *Arthrosc J Arthrosc Relat Surg*. 2017;33(4):849–860.
 31. Wang SI. Improving arthroscopic subscapularis repair: the essential role of surgical anatomical landmarks. *Clin Shoulder Elb*. Sep 2024;27(3):269–271. <https://doi.org/10.5397/cise.2024.00577>.
 32. Dierckx R, Bron C, Dorrestijn O, et al. Guideline for diagnosis and treatment of subacromial pain syndrome: a multidisciplinary review by the Dutch Orthopaedic Association. *Acta Orthop*. 2014;85(3):314–322.
 33. Vandvik PO, Lähdeoja T, Ardern C, et al. Subacromial decompression surgery for adults with shoulder pain: a clinical practice guideline. *Bmj*. 2019;364.
 34. Baig M, Mohan K, Groarke P, Mullet H. Does acromioplasty enhance arthroscopic rotator cuff repair? A systematic review and meta-analysis of randomized trials. *Clin Shoulder Elb*. Dec 2025;28(4):457–463. <https://doi.org/10.5397/cise.2025.00458>.
 35. Bigliani L. The morphology of the acromion and rotator cuff impingement. *Ortop Trans*. 1986;10:228.
 36. Nyffeler RW, Werner CM, Sukthankar A, Schmid MR, Gerber C. Association of a large lateral extension of the acromion with rotator cuff tears. *JBS*. 2006;88(4):800–805.
 37. Paxton ES, Matzon JL, Narzikul AC, Beredjiklian PK, Abboud JA. Agreement among ASES members on the AAOS Clinical Practice Guidelines. *Orthopedics*. Mar 2015;38(3):e169–e177. <https://doi.org/10.3928/01477447-20150305-53>.
 38. Nho SJ, Reiff SN, Verma NN, Slabaugh MA, Mazzocca AD, Romeo AA. Complications associated with subpectoral biceps tenodesis: low rates of incidence following surgery. *J Shoulder Elb Surg*. 2010;19(5):764–768.
 39. Corpus KT, Garcia GH, Liu JN, et al. Long head of Biceps Tendon Management: a Survey of the American shoulder and elbow surgeons. *HSS J*. Feb 2018;14(1):34–40. <https://doi.org/10.1007/s11420-017-9575-3>.
 40. Radhakrishnan R, Goh J, Tan AHC. Partial-thickness rotator cuff tears: a review of current literature on evaluation and management. *Clin Shoulder Elb*. Mar 2024;27(1):79–87. <https://doi.org/10.5397/cise.2022.01417>.
 41. Lapner P, Henry P, Athwal GS, et al. Treatment of rotator cuff tears: a systematic review and meta-analysis. *J Shoulder Elb Surg*. Mar 2022;31(3):e120–e129. <https://doi.org/10.1016/j.jse.2021.11.002>.
 42. Zhang Y, Zhai S, Qi C, et al. A comparative study of arthroscopic débridement versus repair for Ellman grade II bursal-side partial-thickness rotator cuff tears. *J Shoulder Elb Surg*. 2020;29(10):2072–2079.
 43. Hurley ET, Calvo E, Collin P, et al. European Society for Surgery of the Shoulder and Elbow (SECEC) rotator cuff tear registry Delphi consensus. *JSES Int*. May 2024;8(3):478–482. <https://doi.org/10.1016/j.jseint.2024.01.015>.
 44. Cho NS, Yi JW, Lee BG, Rhee YG. Retear patterns after arthroscopic rotator cuff repair: single-row versus suture bridge technique. *Am J Sports Med*. 2010;38(4):664–671.
 45. Park J-Y, Lhee S-H, Choi J-H, Park H-K, Yu J-W, Seo J-B. Comparison of the clinical outcomes of single-and double-row repairs in rotator cuff tears. *Am J Sports Med*. 2008;36(7):1310–1316.
 46. Fuchs B, Weishaup D, Zanetti M, Hodler J, Gerber C. Fatty degeneration of the muscles of the rotator cuff: assessment by computed tomography versus magnetic resonance imaging. *J Shoulder Elb Surg*. Nov–Dec 1999;8(6):599–605. [https://doi.org/10.1016/s1058-2746\(99\)90097-6](https://doi.org/10.1016/s1058-2746(99)90097-6).
 47. Goutallier D, Postel JM, Bernageau J, Lavau L, Voisin MC. Fatty muscle degeneration in cuff ruptures. Pre- and postoperative evaluation by CT scan. *Clin Orthop Relat Res*. Jul 1994;304:78–83.
 48. Thomazeau H, Boukobza E, Morcet N, Chaperon J, Langlais F. Prediction of rotator cuff repair results by magnetic resonance imaging. *Clin Orthop Relat Res*. Nov 1997;344:275–283.
 49. Benthani Kbibbi M, Verhaegen F, Debeer P. The clinical efficacy of the regeneten bioinductive implant in Rotator Cuff Repair: a systematic review. *Acta Orthop Belg*. Dec 2024;90(4):777–788. <https://doi.org/10.52628/90.4.13834>.
 50. Bushnell BD, Bishai SK, Krupp RJ, et al. Treatment of partial-thickness Rotator Cuff tears with a resorbable bioinductive Bovine Collagen implant: 1-Year results from a prospective multicenter registry. *Orthop J Sports Med*. Aug 2021;9(8), 23259671211027850. <https://doi.org/10.1177/23259671211027850>.
 51. Thon SG, O'Malley L, O'Brien MJ, Savoie IIIIF. Evaluation of healing rates and safety with a bioinductive collagen patch for large and massive rotator cuff tears: 2-year safety and clinical outcomes. *Am J Sports Med*. 2019;47(8):1901–1908.
 52. Yoo J, Lee D. The clinical outcomes of a bioinductive collagen implant in bursal-sided partial-thickness Rotator Cuff tears. *Medicina*. 2025;61(6):988.
 53. Tian J, Ding F, Wang Z, et al. Resorbable bio-inductive collagen implant for Rotator Cuff Repair: what we know, what we need to know, and the path forward. *Orthop Surg*. Sep 2025;17(9):2541–2557. <https://doi.org/10.1111/os.70141>.
 54. American Academy of Orthopaedic Surgeons. *Management of Rotator Cuff Injuries Evidence-based Clinical Practice Guideline*; 2025. <https://www.orthoguidelines.org/to pic?id=1051>. Accessed March 9, 2026.
 55. Aldhafian OR, Choi K-H, Cho H-S, Alarishi F, Kim Y-S. Outcome of intraoperative injection of collagen in arthroscopic repair of full-thickness rotator cuff tear: a retrospective cohort study. *J Shoulder Elb Surg*. 2023;32(9):e429–e436.
 56. Kim H, Cho Y-S, Jung Y, Song HS. Effect of porcine-derived absorbable Patch-Type Atelocollagen for arthroscopic rotator cuff repair: a prospective randomized controlled trial. *Am J Sports Med*. 2024;52(6):1439–1448.
 57. Kim HG, Kim SC, Park JH, et al. Atelocollagen injection during Arthroscopic Rotator Cuff Repair for Small-to medium-sized subacute or chronic Rotator Cuff Tears enhances radiographic Tendon integrity: a propensity score-matched comparative Study. *Arthrosc J Arthrosc Relat Surg*. 2024;40(11):2669–2677.
 58. Kim JH, Rhee SM, Hwang JT, Jo CH. Rationale and methodology for injection therapy to treat rotator cuff disease: a scoping review. *Clin Shoulder Elb*. Jun 2025;28(2):223–241. <https://doi.org/10.5397/cise.2024.01053>.
 59. Kim JH, Kim YS, Cho SH, Hong SA, Lee HJ. The destiny of the Subscapularis Tendon after Arthroscopic Supraspinatus repair. *Clin Orthop Surg*. Aug 2024;16(4):594–601. <https://doi.org/10.4055/cios23389>.