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Subscapularis Tear Repair Arthroscopic vs Open Surgery

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Abstract

Background: The largest rotator cuff tendon, the subscapularis, rotates the glenohumeral joint internally. This study's objective was to compare the arthroscopic versus the open technique outcomes in subscapularis tear repair. Methods: This prospective study comprised 30 patients who had a subscapularis tear and needed either arthroscopic or open surgery for repair. The study was done in Benha university hospitals and Ahrar teaching hospital from November 2020 to February 2023. Patients were split into 2 groups: Arthroscopic group: 15 were treated by arthroscopic surgery. Open surgery group: 15 were treated with open surgery. Results: The arthroscopic group had a higher percentage of combined tears and affected the right side more often, while the open surgery group had a higher percentage of isolated tears and affected the left side more often. The arthroscopic group had more postoperative pain, but fewer complications than the open surgery group. Preoperative and postoperative clinical assessments showed substantial changes among groups of the study concerning the constant score, UCLA score, and results of belly press test. The arthroscopic group had more positive results in belly press tests and lift off after operation. The two groups had similar outcomes in terms of post-surgical complications and duration of follow up. Conclusions: In terms of motion range and functional results, arthroscopic treatment may be preferable to open repair. While there are still rare cases when open repair surgery makes sense, particularly when arthroscopic options are restricted.

Keywords: Subscapularis Tear Repair; Arthroscopic and Open Surgery.

1. Introduction

The largest rotator cuff tendon, the subscapularis, rotates the glenohumeral joint internally. It is crucial for maintaining anterior shoulder stability and serves as the force couple only anterior component in the transverse plane that balances the posterior cuff [1].

Smith originally noted single and coupled subscapularis tendon (ST) tears in a postmortem examination in 1834, and Hauser first detailed a healing method in 1954 [2]. Large subscapularis tears cause an imbalanced force pair causing the humeral head to migrate anteriorly. For appropriate glenohumeral joint biomechanics, subscapularis function must be restored [3].

The subscapularis muscle-tendon unit has gotten less consideration than the rest of the rotator cuff, despite the relatively early identification of this lesion. The ST's intrinsic functional and biomechanical qualities, such as the shoulder active internal rotation, force coupling in the transverse plane, and a role in the dynamic anterior stabilization of the glenohumeral joint, make it crucial to surgically correct [4].

The last aspect of arthroscopic rotator cuff surgery to be perfected was arthroscopic subscapularis correction. The subscapularis has three distinctive features that might make it challenging to treat. Firstly, the chronic subscapularis tear mobilization is challenging because it tends to retract considerably more than the rest of the rotator cuff. Second, because the retracted subscapularis tends to scar against the coracoid, adjacent to significant neurovascular systems, mobilizing it might be rather challenging. Third, arthroscopy instrument visualization and handling in the constrained subcoracoid area might be highly difficult undertakings [5].

This research purposed to compare the arthroscopic versus the open technique outcomes in subscapularis tear repair.

2. Methods

This was a prospective study which comprised 30 patients who had a subscapularis tear and need either arthroscopic or open surgery for repair.it was done in Benha university hospitals and Ahrar teaching hospital from November 2020 to February 2023. All participants provided their explicit written consent.

Inclusion criteria were clinically symptomatic isolated ST and concomitant other rotator cuff tear with continuous pain and shoulder weakness.

Exclusion criteria were massive rotator cuff tear with more than 5 cm retraction, Previous shoulder surgery, Pseudoparalysis, History of shoulder infection, Arthrosis of glenohumral joint.

All patients were subjected to the followings: a routine physical evaluation prior and following procedure, taking into account the patient's history (age, sex, and occupation), as well as their current state of health in general. Full laboratory investigations, including CBC, LFTs, RBG, INR and s. creatinine. In order to assess individuals, the Simple Shoulder Test (SST) and the scoring [6] by the age- and gender-adjusted Constant score as well as the absolute Constant score [7]. The University of California at Los Angeles (UCLA) Shoulder Score was used to assess the individuals [8]. Testing the subscapularis muscles involves measuring passive external rotation with the arm at the side and also active and passive internal rotation with the hand on

the back in comparison to the opposite side [9]. The lift-off test and the belly-press test, as reported by Gerber and colleagues, were used to specifically measure subscapularis function [10, 11]. Prior and following surgery, standard radiographs, such as a true-anteroposterior radiograph in neutral rotation and a Y-shaped view radiograph [12]. All patients had access to a preoperative MRI. Regarding MRI grading method, the subscapularis muscle's fatty infiltration grade (FIG) and tear position, size, and tendon retraction were detected on the MRI image.

Surgery

Arthroscopic operative technique

Anesthesia

All individuals (100%) had endotracheal intubation and general anaesthesia.

Positioning of the patients

All individuals were positioned in the beach chair position, resting 70 degrees from horizontal. The arm is swinging freely and the scapula is totally removed from the table, allowing for full movement of the arm., and the operation site was draped after sterilization.

Position of surgeon

Surgeon and anaesthesiologist stand on opposite sides of the patient's shoulder, and bony landmarks are identified. A 30° 5.5-mm scope is used to evaluate intraarticular lesions. The standard posterior portal is created first, and after a spinal needle experiment, the anterior portal is confirmed. The biceps tendon is inspected, and the tear site is labeled. The subscapularis is evaluated and repaired through the anterior portal using an arthroscopic threaded clear cannula. The tear is then repaired to its bony insertion using Mitek Fasten metal suture anchors. Arthroscopic biceps tenodesis is carried out if needed. Subacromial decompression and the clavicle lateral end resection are performed if necessary. The supraspinatus is repaired through lateral portals developed under direct visualization from the posterior portal.

Surgical technique of open surgery

Anesthesia

This study details the surgical technique for repairing subscapularis tears using either the deltopectoral or anterior deltoid splitting approach with general anesthesia and endotracheal intubation. In both approaches, rotator interval is opened, and careful dissection is done to protect the axillary nerve. Complete tears result in a "bare bone" area between the lesser tuberosity and the humeral head. The surgeon must push the humeral head posteriorly to visualize the superior subscapular tendon margin and isolate and release the tendon from its insertion site. The tendon is then fixed using suture anchors or intraosseous sutures, and glenohumeral ligament release may be necessary for full mobilization. Post-surgery, the surgeon must assess shoulder range of motion and repair stability. The anterior deltoid splitting approach is used for subscapularis tears associated with supraspinatus or infraspinatus, while the deltopectoral approach is used for isolated subscapularis tears.

Postoperative rehabilitation:

The affected arm was immobilized in an abduction brace for 6 weeks. Patients were asked to refrain from any active shoulder range of motion and avoid active elbow flexion if biceps tenodesis was performed. On the first postoperative day, pendulum exercises and self-assisted circumduction exercises were encouraged. Before discharge, patients were educated about their rehabilitation protocol. Patients were followed up at 2 weeks, 6 weeks, 3 months, 6 months, and 1 year postoperatively. At 6 weeks postoperatively, patients were allowed to start active assisted exercises. Three months postoperatively, patients started active range of motion and isotonic strengthening exercises using an elastic band. Six months after surgery, patients were allowed to make a gradual return to their sporting activities.

Postoperative assessment

All patients were evaluated at 3, 6, and 12 months postoperatively applying the same preoperative assessment protocol. **Evaluation:** Degree of pain, Range of motion (ROM), Radiological assessment.

Statistical analysis

Statistical analysis was done by SPSS v26 (IBM Inc., Armonk, NY, USA). Shapiro-Wilks test and histograms were used to evaluate the normality of the distribution of data. Quantitative parametric data were presented as mean and standard deviation (SD). Quantitative non-parametric data were presented as the median and interquartile range (IQR). Qualitative data were presented as frequency and percentage (%). A two tailed P-value was considered statically significant at less than 0.05.

3. Results

Demographic data, medical history, tear characteristics among studied groups were shown in **Table (1).**

Surgery complications and follow up were illustrated in **Table (2)**.

Pre-operative and post-operative assessment were declared in **Table (3)**.

Further comparing both groups according to Lift off test results show significant change more in arthroscopic group than open surgery group. 14 patients had positive test change after arthroscopic procedure while only 8 patients showed positive test change in open surgery group. **Fig (1).**

Comparing both groups according to belly press test results show significant change more in arthroscopic group than open surgery group. 14

patients had positive test change after arthroscopic procedure while only 8 patients showed positive test change in open surgery group. **Fig (2).**

Constant score showed a significant difference in pre and post operative assessment of the two groups. Both operations showed near mean levels of constant score after the operation. **Fig (3)**

Pre and post operative measurements of abduction degree showed both groups significant differences. Both operations showed near mean levels of abduction degree after the operation. Table (4)

Pre and post operative measurements of external rotation degree showed both groups significant differences. Both operations showed near mean levels of external rotation after the operation. **Table (5)**

Pre and post operative measurements of external rotation degree showed both groups significant differences. More significance and better results in forward elevation toward the arthroscopic group than the open surgery group. **Table (6)**

Table (1) Comparison of demographic data, medical history, tear characteristics among studied groups.

	Total subjects n=30	Arthroscopic group n=15	Open surgery group n=15	Test	p
Age, M±SD	45.63±11.5	45.33±9.9	45.93±13.35	0.140	0.890
Gender					
Male, n (%)	15(50)	6(40)	9(60)	1.200	0.273
Female, n (%)	15(50)	9(60)	6(40)		
Special habits, n (%)					
Smoker	8(26.66)	3(20)	5(33.33)	0.68	0.40
Non-smoker	22(73.33)	12(80)	10(66.66)		9
Hypertension, n (%)					
Hypertension	8(26.6)	5(33.4)	3(20)	0.68	0.40
Non hypertensive	22(73.٤)	10(66.6)	12(80)		9
Diabetes, n (%)					
Diabetic	6(20)	2(13.3)	4(26.٧)	0.83	0.36
Non-diabetic	24(80)	13(86.7)	11(73.3)		1
Occupation, n (%)					
Employer	13(43.3)	5(33.33)	8(53.3)	2.23	0.32
Housewife	12(40)	8(53.33)	4(26.7)		9
Driver	5(16.7)	2(13.33)	3(20)		
History of trauma					
Yes	25(83.3)	13(86.6)	12(80)	0.240	0.624
No	5(16.7)	2(13.4)	3(20)		
Tendon tear					
Isolated	10(33.3)	2(13.4)	8(53.3)	5.400	0.02*
Combined	20(66.٧)	13(86.6)	7(46.7)		
Side affected					
Right	20(66.٧)	11(73.3)	9(60)	0.600	0.439
Left	10(33.3)	4(26.7)	6(40)		

Table (2): Comparison of surgery complications among studied groups.

	Total subjects n=30	Arthroscopic group n=15	Open surgery group n=15	Test	p
		Post operative pain			
Mild pain	4(13.33)	0(0)	4(26.66)	5.360	0.069
Moderate	1(3.33)	1(6.66)	0(0)		
No pain	25(83.33)	14(93.33)	11(73.33)		
Complications					
No complications	25(83.3)	14(93.3)	11(73.3)	3.360	0.186

Table (2) Continue

Superficial infection	3(10)	0(0)	3(20)		
Infection and rapture	2(6.7)	1(6.7)	1(6.7)		
Duration of follow up (months), M ±SD	20.26±3.24	20.06±3.91	20.46±2.53	0.332	0.742

Table (3): Comparison between groups of study according to preoperative data**.**

	Total subjects n=30	Arthroscopic group n=15	Open surgery group n=15	Test	p
Preoperative Constant score					
	54.36±4.93	57.33±3.82	51.4±4.11	Z=28.500	<0.001*
Preoperative belly press test					
Positive	2(6.66)	0(0)	2(13.33)	2.143	0.143
Negative	28(93.33)	15(100)	13(86.66)		
Preoperative lift off test					
Positive	0(0)	0(0)	0(0)	-	-
Negative	30(100)	15(100)	15(100)		
Preoperative abduction degree					
	111.5±6.45	112±6.49	111±6.6	102.500	.683
Preoperative external rotation					
	31±5.16	30.26±5.41	31.73±4.97	85.500	0.267
Preoperative internal rotation (level of spine)					
L3	17(56.66)	8(53.33)	9(60)	0.136	0.713
L4	13(43.33)	7(46.66)	6(40)		
Preoperative forward elevation					
	148.33±9.31	146±9.67	150.66±8.63	85.000	0.267
Postoperative assessment					
Post operative Constant score					
	85.56±5.96	87.06±7.8	84.06±2.84	Z=35.500	0.001*
Post operative UCLA score					
	30.2±2.2	30.8±2.83	29.6±1.12	Z=34.500	0.001*
Post operative belly press test					
Positive	24(80)	14(93.33)	10(66.66)	3.333	0.068
Negative	6(20)	1(6.66)	5(33.33)		
Post operative lift off test					
Positive	22(73.33)	14(93.33)	8(53.33)	6.136	0.013*
Negative	8(26.66)	1(6.66)	7(46.66)		
Post operative abduction degree					
	164.5±13.79	166±19.01	163±5.27	48.000	0.007*
Post operative internal rotation (level of spine)					
L2	27(90)	14(93.33)	13(86.66)	0.370	0.543
L3	3(10)	1(6.66)	2(13.33)		
Post operative external rotation					
	45.06±6.78	45.13±7.94	45±5.66	110.000	0.935
Post operative forward elevation					
	169.16±11.22	175.66±10.49	162.66±7.76	20.000	<0.001*

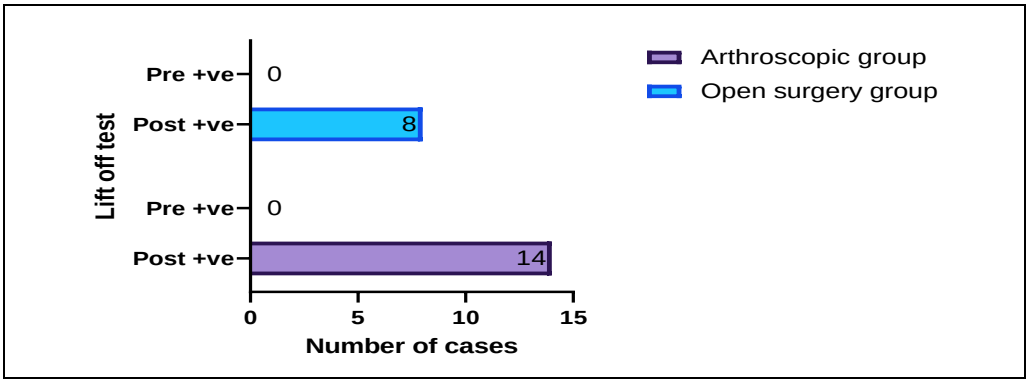

Fig (1): Preoperative and post operative lift off test

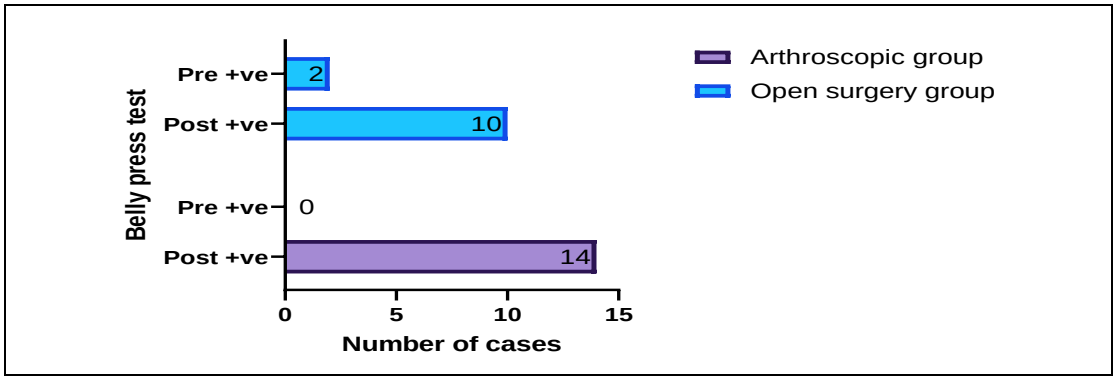

Fig (2): Preoperative and post operative belly press test

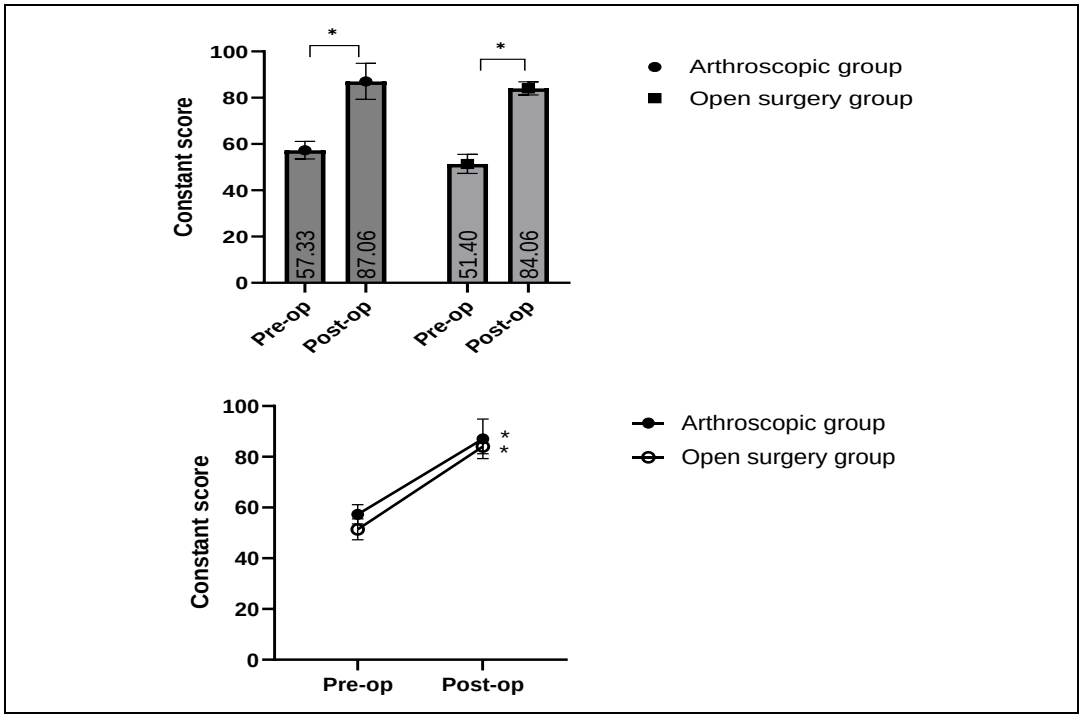

Fig (3): Preoperative and post operative Constant score.

Table (4): Preoperative and post operative Abduction degree.

	Preoperative	Post operative	Test	p
Arthroscopic gr. Abduction degree	112±6.49	166±19.01	-3.334	0.001*
Open surgery gr. Abduction degree	111±6.6	163±5.27	-3.424	0.001*

Table (5) : Preoperative and post operative External rotation.

	Preoperative	Post operative	Test	p
Arthroscopic gr. External rotation	30.26±5.41	45.13±7.94	-3.330	0.001*
Open surgery gr. External rotation	31.73±4.97	45±5.66	-3.420	0.001*

Table (6): Preoperative and post operative forward elevation.

	Preoperative	Post operative	Test	p
Arthroscopic gr. Forword elevation	146±9.67	175.66±10.49	-3.316	0.001*

4. Discussion

Smith originally identified tears of ST in a cadaver investigation in 1834. In 1954, Hauser conducted the initial investigation into ST repair. Despite the fact that ST injuries have been documented historically, there aren't many studies on how to treat them because to the tendon's proximity to vital neurovascular systems and its lower risk of injury compared to the other tendons that make up the rotator cuff [13].

Regarding tear characteristics, Parallel to our results, **Gedikbas et al. (2022)** revealed that Before experiencing symptoms, 28 patients in group A and 23 individuals in group O both had a trauma history. 33 (47.1%) patients and 18 (25.7%) individuals, respectively, each suffered a fall from a standing height. The remaining 19 (27.1%) individuals who reported shoulder issues did not previously sustain any injuries. They observed that the side impacted was substantially different among both groups (P-value 0.007), which was contrary to our observations. They noted that tendon tear was considerably different among both studied groups; isolated were substantially lower in AS than open group (1:7) but combined were considerably higher in AS than open group (35:27) (P-value = 0.026) [13].

Regarding the post operative pain and complications. Confirming our findings, **Gedikbas et al. (2022)** documented that no substantial changes was present among open and AS groups regarding the follow-up period and the post-operative complications (P-value > 0.05) [13]. Interestingly, **Nové-Josserand et al.** reported that the open group's clinical and imaging follow-up lasted an average of 47.8 months (with a range of 36 to 57 months) and this was far longer than that was done in current research [14].

In the present study, preoperative clinical assessments was done with specific scores and tests. The **constant score** mean level was 54.36 in the arthroscopic group and 51.4 in the open surgery group with a substantial change among two groups (P-value <0.001).

In contrast to our findings, **Gedikbas et al. (2022)** reported that the Constant-Murley Score was substantially better in the open surgery group than the AS group (53.7 ± 4.6 vs 48.9 ± 6.8; P = 0.001) [13].

In agreement with our findings, **Gedikbas et al. (2022)** reported a significantly better postoperative CM score in AS group than open group (88.7 ± 4.7 vs 84.6 ± 2.9; P < .001) [13]. Furthermore, **Nové-Josserand et al.** found that The Constant-Murley score increased in the arthroscopic group, going from an average of 66 points preoperatively to 85 points after surgery (p < 0.05).

Our results agree with those documented by **Gedikbas et al. (2022)** who found substantially higher postoperative abduction outcomes (P = 0.005) and forward increase (P = 0.005) in Arthroscopic Repair group than Open surgery group. They also reported non-significant changes in internal and external rotations in both studied groups [13]. While **Nové-Josserand et al.** declared that both active external rotation and forward elevation were insignificantly different in both studied groups between pre-and post-operatively (P-value > 0.05) [14].

CM ratings, forward elevation, and external rotation of the patients all rose during the course of other studies evaluating open surgeries of ST tears, whereas the outcomes of the liftoff tests changed from positive to negative [15-17].

Further comparing both groups according to Lift off test results show significant change more in arthroscopic group than open surgery group. 14 patients had positive test change after arthroscopic procedure while only 8 patients showed positive test change in open surgery group.

In disagreement with our findings, **Gedikbas et al. (2022)** reported no significant change between both studied groups regarding the Lift off test results (P-value 0.155) [13].

Similarly, 13 patients who underwent operation for isolated ST rips were followed up on after two years, according to Deutsch et al. The patients were 39 years old on average (range, 18 to 64). All 13 patients were male, and 8 had injuries to their right, 6 to their left shoulders. All patients' internal rotation strength raised, and the liftoff tests produced negative outcomes at the end of the investigation [18].

Comparing both groups according to belly press test results show significant change more in arthroscopic group than open surgery group. 14 patients had positive test change after arthroscopic procedure while only 8 patients showed positive test change in open surgery group.

In harmony with our findings, **Gedikbas et al. (2022)** documented that when comparing both groups according to belly press test results show significant change more in AS group than open surgery group. 15 patients had positive test change after AS procedure while only 3 patients showed positive test change in open surgery group [13].

In the present work, Constant score showed a significant difference in pre and post operative assessment of the two groups. Both operations showed near mean levels of constant score after the

operation. Pre and post operative measurements of abduction degree showed both groups significant differences. Both operations showed near mean levels of abduction degree after the operation.

Our results are supported by **Bartl et al.** who found that Constant score elevated from 51.3 prior to surgery to 82.2 following surgery (P <0.01). 27 individuals gave an excellent or good rating to their postoperative outcome [15].

Additionally, **Nové-Josserand et al.** showed improvement in the results of CM score reported in pre and post assessment in the AS group [14].

Pre and post operative measurements of external rotation degree showed both groups significant differences. Both operations showed near mean levels of external rotation after the operation. Pre and post operative measurements of external rotation degree showed both groups significant differences. More significance and better results in forward elevation toward the arthroscopic group than the open surgery group.

Nové-Josserand et al. declared that Clinical testing was greatly enhanced, although incorrect changes were still frequently made. The majority of clinical data, postoperative subscapularis testing outcomess, and structural findings were equivalent between the arthroscopic repair and the open repair groups, despite the fact that open surgery produced higher subjective shoulder ratings and superior strength scores [15].

5. Conclusion

Subscapularis injuries are unusual but significant injuries that can lead to prolonged disability because of the difficulty in diagnosing affected patients. The study findings showed that when a subscapularis tear is evaluated in terms of its degree, satisfactory results can be achieved via arthroscopic repair even if the tear size is large. Arthroscopic repair may be a more advantageous method than open repair in terms of range of motion and functional outcomes. while open repair surgery remains a valid option and has some appeal in specific indications and in settings where arthroscopic resources are limited.

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