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ORIGINAL ARTICLE

Arthroscopic Versus Mini-Open Repair of Rotator Cuff Tears: Systematic review

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Abstract

Background: ***The effectiveness of arthroscopic and mini-open rotator cuff surgeries is debated due to their excellent clinical outcomes.***

Objective: ***To assess and estimate the findings of the functional tests. Of mini-open & arthroscopic RCR.***

Methods: ***A comprehensive trial was performed on adult cases aged 47–60 years old with rotator cuff tears (the most affected muscle was supraspinatus), excluding severe or irreparable rips, to compare the clinical results among individuals who underwent all-arthroscopic rotator cuff repair with mini-open rotator cuff repair (RCR) with a mean operative time of 50–70 min. A comprehensive review of pertinent studies published from 2005 to 2023 was performed by systematically searching electronic databases comprising Embase, MEDLINE, Cochrane (CENTRAL), and CINAHL.***

Results: ***Function after three and six months post-operatively was compared in four trials that compared arthroscopic and mini-open approaches. We disclosed a statistically significant alteration in the pooled results concerning clinical outcomes. Rotational Machinations (ROM) across groups (deficient quality, three randomized controlled trials, 462 persons, MD 3.71, 95% CI: 0.14 to 7.28, p = 0.04). Three randomized controlled trials (RCTs) involving 461 participants (MD2.94, 95% CI: -4.55 to 10.44, p=0.44) demonstrated no statistically significant variation in the groups' clinical outcomes related to forward flexion.***

Conclusion: ***At follow-up, differences in discomfort, function, and mobility between arthroscopic and mini-open RCRs are not significant enough to warrant therapeutic consideration, so patient aesthetic priorities, surgeon expertise, and budget should be considered.***

Keywords: Arthroscopy; Mini-Open; Rotator Cuff; Supraspinatus

1. Introduction

A rotator cuff injury is one of the most common reasons people have shoulder discomfort and malfunction. [1]

In most cases, individuals who have cuff tears also suffer from chronic "tendinitis" or "bursitis" of the shoulder. [2]

When deciding whether to operate on a rotator cuff tear, various criteria must be considered, including the person's age, general health, the severity of the tear, the level of discomfort and impairment it has caused, and the severity of the injury. Patients who are young and active and have tears of any size can be considered for surgical repair. There is less to lose by postponing surgical intervention in elderly individuals as well as those with persistent large tears who may find relief from no operative treatment. [3]

The three most common approaches to repairing a rotator cuff are open, mini-open, and arthroscopic. Postoperative stiffness, repair failure, and deltoid avulsion were consequences of the traditional open repair approach. [4]

Although mini-open and full arthroscopic approaches are less intrusive than open operations and preserve the integrity of the origin of the deltoid function while minimizing the amount of incision required, there are distinct advantages and problems associated with each of these treatments. Repair with entirely arthroscopic surgery is characterized by reduced invasiveness; however, it necessitates more comprehensive training. [5]

This systematic review aims to analyze the comparative efficacy of arthroscopic rotator cuff surgery with mini-open RCR.

2. Patients and methods

Study design: A comprehensive evaluation was undertaken on adult individuals with rotator cuff injuries, excluding cases with large or irreversible rips. The Preferred Reporting Items for Systematic Reviews & Meta-Analysis (PRISMA) standards also documented the evaluation.

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Data sources: A comprehensive review of pertinent studies published from 2005 to 2023 was performed by conducting a systematic search of electronic databases comprising Embase, MEDLINE, the Cochrane Central Register of Controlled Studies (CENTRAL), and CINAHL. Trials issued in the English language were located by doing a search utilizing specific phrases such as 'arthroscopy', 'rotator cuff', 'mini-open', and supraspinatus.

Data Extraction & Strategy: The significant results that were of interest comprised the duration of the surgery, operational results after surgery (UCLA, University of California at Los Angeles; ASES, American Shoulder & Elbow Surgeons; Constant-Murley score), the pain score, the feasible range of motion, & anomalies. The study rejected duplicated articles authored by the same individuals unless they provided longer follow-up studies. Additionally, non-English papers and articles needing more clinical information were also excluded.

Methods of the review

Locating and selecting studies: The abstracts of publications recognized through the aforementioned search method were examined. Publications that seemed to meet the inclusion criteria were then obtained in their entirety. In cases of uncertainty, a second reviewer evaluated the article, and a consensus was established.

Statistical considerations: The results from the trials were aggregated by the systematic review management software and carefully examined to determine if they met the criteria for inclusion. A PRISMA flowchart was generated utilizing the search outcomes, the requirements for being included and the exclusion conditions. [6]

3. Results

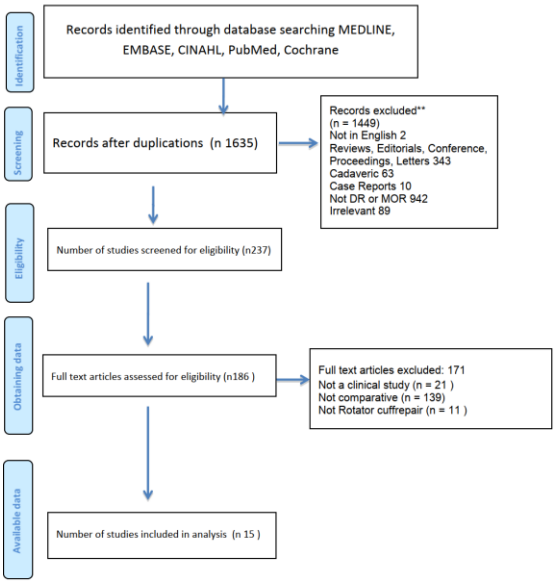

Figure 1. Preferred Reporting Items for Systematic Reviews & Meta-analysis flow diagram for trial selection.

Table 1. Type of included studies

AUTHOR	YEAR	TYPE OF STUDY	
MIGLIORINI ET AL [7]	2023	MA	Mini-open
			Arthroscopic
MONTASER ET AL [8]	2021	SR	Mini-open
			Arthroscopic
KARAKOC Y, ATALAY ÏB [9]	2020	Retrospective	Mini-open
			Arthroscopic
MACDERMID ET AL [10]	2019	Prospective	Mini-open
			Arthroscopic
KHOLIEF A ET AL [11]	2018	Prospective	Mini-open
			Arthroscopic
VICENTI G ET AL [12]	2018	retrospective	Mini-open
			Arthroscopic
LIU J [13]	2017	RCT	Mini-open
			Arthroscopic
FINK BARNES LA ET AL [14]	2017	prospective	Mini-open
			Arthroscopic
ZHANG Z [15]	2014	prospective	Mini-open
			Arthroscopic
VAN DER ZWAAL P ET AL [16]	2013	RCT	Mini-open
			Arthroscopic
KASTEN P ET AL [17]	2011	prospective	Mini-open
			Arthroscopic
KÖSE K.Ç ET AL [18]	2008	prospective	Mini-open
			Arthroscopic
PEARSALL AW [19]	2007	prospective	Mini-open
			Arthroscopic
VERMA NN ET AL [20]	2006	Retrospective	Mini-open
			Arthroscopic
YOUM T ET AL [21]	2005	Retrospective	Mini-open
			Arthroscopic

A total of fifteen studies evaluating the efficacy of arthroscopy & mini-open surgery for rotator-cuff repair were incorporated. The indication provided was derived from comparative studies that evaluated clinical outcomes or presented subgroup statistics on results of interest in cases with rotator-cuff tear.

Table 2. Patient demographics

AUTHOR	METHODS	NUMBER	AGE	FEMALE
MIGLIORINI ET AL [7]	Mini-open	ND	ND	ND
	Arthroscopic	ND	ND	ND
MONTASER ET AL [8]	Mini-open	ND	ND	ND
	Arthroscopic	ND	ND	ND
KARAKOC Y & ATALAY ÏB [9]	Mini-open	20	46.9	13
	Arthroscopic	20	52.45	8
MACDERMID ET AL [10]	Mini-open	136	54.6	53
	Arthroscopic	138	55.8	56
KHOLIEF A ET AL [11]	Mini-open	15	54.4	5
	Arthroscopic	15	52.5	7
VICENTI G ET AL [12]	Mini-open	21	60.1	8
	Arthroscopic	20	62.3	11
LIU J [13]	Mini-open	49	52.5	25
	Arthroscopic	50	53.5	25
FINK BARNES LA ET AL [14]	Mini-open	22	66.8	10
	Arthroscopic	128	64.4	63
ZHANG Z [15]	Mini-open	53	54.2	26
	Arthroscopic	55	53.9	27
VAN DER ZWAAL P ET AL [16]	Mini-open	48	57.8	20
	Arthroscopic	47	57.2	18
KASTEN P ET AL [17]	Mini-open	17	60.1	5
	Arthroscopic	17	60.1	8
KÖSE K.Ç ET AL [18]	Mini-open	25	62	4
	Arthroscopic	25	55	7
PEARSALL AW [19]	Mini-open	25	55	17
	Arthroscopic	27	58	14
VERMA NN ET AL [20]	Mini-open	33	60.73	10
	Arthroscopic	38	59.45	16
YOUM T ET AL [21]	Mini-open	42	60	ND
	Arthroscopic	42	57.9	ND

There were not significant variations in

preoperative patient characteristics among the two groups in terms of patient count, gender, as well as age.

Table 3. Follow up period and smoking history

AUTHOR	METHODS	FOLLOW-UP\MN	SMOKER
MIGLIORINI ET AL [7]	Mini-open	ND	ND
	Arthroscopic	26.7	ND
MONTASER ET AL [8]	Mini-open	26.7	ND
	Arthroscopic	26.7	ND
KARAKOC Y & ATALAY ÏB [9]	Mini-open	25.9	ND
	Arthroscopic	25	ND
MACDERMID ET AL [10]	Mini-open	24	ND
	Arthroscopic	24	ND
KHOLIEF A ET AL [11]	Mini-open	6	ND
	Arthroscopic	6	ND
VICENTI G ET AL [12]	Mini-open	23.5	ND
	Arthroscopic	23.5	ND
LIU J [13]	Mini-open	16.6	ND
	Arthroscopic	16.6	ND
FINK BARNES LA ET AL [14]	Mini-open	24	0
	Arthroscopic	24	4
ZHANG Z [15]	Mini-open	29.4	ND
	Arthroscopic	28.8	ND
VAN DER ZWAAL P ET AL [16]	Mini-open	12	7
	Arthroscopic	12	12
KASTEN P ET AL [17]	Mini-open	6	3
	Arthroscopic	6	2
KÖSE K.Ç ET AL [18]	Mini-open	31	ND
	Arthroscopic	30.6	ND
PEARSALL AW [19]	Mini-open	21.56	ND
	Arthroscopic	31.2	ND
VERMA NN ET AL [20]	Mini-open	2.9	7
	Arthroscopic	3.2	3
YOUM T ET AL [21]	Mini-open	29	ND
	Arthroscopic	29	ND

Follow up period & smoking history: was mentioned in Table 3.

Table 4. Tear characters

AUTHOR	METHODS	SIDE RT\LT AFFECTED	SIZE OR TYPE OF TEAR
MIGLIORINI ET AL [7]	Mini-open	ND	ND
	Arthroscopic		ND
MONTASER ET AL [8]	Mini-open	ND	ND
	Arthroscopic		ND
KARAKOC Y & ATALAY ÏB [9]	Mini-open	ND	ND
	Arthroscopic		ND
MACDERMID ET AL [10]	Mini-open	ND	full thickness (n 18)
	Arthroscopic		full thickness (n 27)
KHOLIEF A ET AL [11]	Mini-open	ND	full thickness (n15) Three individuals had tears that were under a centimeter in size, nine people had tears that were among one and three centimeters in size, as well as three individuals had tears that were among three and five centimeters in size.
	Arthroscopic	ND	full thickness (n15) Two individuals had tears that were fewer than a centimeter in size, nine people had tears that were among one and three centimeters in size & four individuals had tears that were amongst three and five centimeters in size.
VICENTI G ET AL [12]	Mini-open	10\11	full thickness (n21)
	Arthroscopic	13\7	full thickness (n20)
LIU J [13]	Mini-open	36\13	full thickness (n49)
	Arthroscopic	31\19	full thickness (n50)
FINK BARNES LA ET AL [14]	Mini-open	ND	full thickness (n9),Partial thickness (n3)
	Arthroscopic	ND	full thickness (n64),Partial thickness (n16)
ZHANG Z [15]	Mini-open	41/12	Partial thickness (n33) full thickness(n20)
	Arthroscopic	43/12	Partial thickness (n 32) full thickness (n23)
VAN DER ZWAAL P ET AL [16]	Mini-open	ND	full thickness (n48) small to medium-sized tear
	Arthroscopic	ND	full thickness (n47) small to medium-sized tear
KASTEN P ET AL [17]	Mini-open	12\5	full thickness (n17)
	Arthroscopic	9\8	full thickness (n17)
KÖSE K.Ç ET AL [18]	Mini-open	ND	full thickness (n32) ≤ 3cm tear
	Arthroscopic	ND	full thickness (n32) ≤ 3cm tear
PEARSALL AW [19]	Mini-open	ND	Full thickness (n25) Average tear size 2.89cm
	Arthroscopic	ND	Full thickness (n25) Average tear size 2.71cm
VERMA NN ET AL [20]	Mini-open	ND	Full thickness (n25) 1_5cm tear
	Arthroscopic	ND	Full thickness (n27) 1_5cm tear
YOUM T ET AL [21]	Mini-open	24\9	Full thickness (n33)
	Arthroscopic	23\15	Full thickness (n38)
YOUM T ET AL [21]	Mini-open	28 \14	Full thickness (n12) small, medium or large
	Arthroscopic	28 \14	Full thickness (n19) small, medium or large

Tear size or type either full thickness, partial thickness and side affected were detailed in Table 4 also if there was pathology in tendon.

Table 5. Post-operative result measures by (University of California at Los Angeles & American Shoulder & Elbow Surgeons score)

AUTHOR	METHODS	ASES PRE	ASES POST	UCLA PRE	UCLA POST
MIGLIORINI ET AL [7]	Mini-open	ND	ND	ND	ND
	Arthroscopic	ND	ND	ND	ND
MONTASER ET AL [8]	Mini-open	36.1	90.7	11.51	26.75
	Arthroscopic	34.2	88.89	11.73	26.9
KARAKOC Y & ATALAY ÏB [9]	Mini-open	ND	ND	ND	ND
	Arthroscopic	ND	ND	ND	ND
MACDERMID ET AL [10]	Mini-open	48.9	92.2	ND	ND
	Arthroscopic	46.5	89.6	ND	ND
KHOLIEF A ET AL [11]	Mini-open	ND	91.2	ND	ND
	Arthroscopic	ND	92.6	ND	ND
VICENTI G ET AL [12]	Mini-open	ND	ND	ND	ND
	Arthroscopic	ND	ND	ND	ND
LIU J [13]	Mini-open	ND	ND	ND	ND
	Arthroscopic	ND	ND	ND	ND
FINK BARNES LA ET AL [14]	Mini-open	ND	91	ND	ND
	Arthroscopic	ND	82.7	ND	ND
ZHANG Z [15]	Mini-open	42.3	89.9	9.94	28.4
	Arthroscopic	39.55	91.34	10.01	30.94
VAN DER ZWAAL P ET AL [16]	Mini-open	ND	ND	ND	ND
	Arthroscopic	ND	ND	ND	ND
KASTEN P ET AL [17]	Mini-open	48.26	86.9	ND	ND
	Arthroscopic	44.3	81	ND	ND
KÖSE K.Ç ET AL [18]	Mini-open	ND	ND	ND	11
	Arthroscopic	ND	ND	ND	11
PEARSALL AW [19]	Mini-open	ND	ND	10.6	28.8
	Arthroscopic	ND	ND	11.2	29.76
VERMA NN ET AL [20]	Mini-open	ND	ND	14	27
	Arthroscopic	ND	ND	14	24
YOUM T ET AL [21]	Mini-open	ND	90.2	ND	32.3
	Arthroscopic	ND	91.1	ND	33.2

Table 5. Continued result measures (operative time & visual analog scale score)

AUTHOR	METHODS	OPERATIVE TIME\MIN	VAS(PAIN) SCORE PRE	VAS(PAIN) SCORE AFTAR
MIGLIORINI ET AL [7]	Mini-open	48.2	6.7	3.2
	Arthroscopic	55.9	6.2	2.4
MONTASER ET AL [8]	Mini-open	50.5	6	3
	Arthroscopic	60.9	6.5	2.6
KARAKOC Y & ATALAY ÏB [9]	Mini-open	ND	6.3	4.2
	Arthroscopic	ND	5.7	3.6
MACDERMID ET AL [10]	Mini-open	51.5	ND	ND
	Arthroscopic	66.2	ND	ND
KHOLIEF A ET AL [11]	Mini-open	ND	ND	4.6
	Arthroscopic	ND	ND	1.73
VICENTI G ET AL [12]	Mini-open	35.4	ND	6.9
	Arthroscopic	55.7	ND	6.1

LIU J [13]	Mini-open	64.7	ND	2.6
	Arthroscopic	71.9	ND	2.9
FINK BARNES LA ET AL [14]	Mini-open	ND	ND	0.84
	Arthroscopic	ND	ND	1.54
ZHANG Z [15]	Mini-open	ND	ND	ND
	Arthroscopic	ND	ND	ND
VAN DER ZWAAL P ET AL [16]	Mini-open	ND	7	3.74
	Arthroscopic	ND	6.9	3.28
KASTEN P ET AL [17]	Mini-open	ND	ND	4.7
	Arthroscopic	ND	ND	3.3
KÖSE K.Ç ET AL [18]	Mini-open	32	ND	ND
	Arthroscopic	31	ND	ND
PEARSALL AW [19]	Mini-open	ND	ND	ND
	Arthroscopic	ND	ND	ND
VERMA NN ET AL [20]	Mini-open	ND	7.8	4.8
	Arthroscopic	ND	7.8	3.9
YOUM T ET AL [21]	Mini-open	ND	ND	0.4
	Arthroscopic	ND	ND	0.7

Table 6. Continued result measures (Murley score)

AUTHOR	METHODS	MURLEY SCORE PRE	MURLEY SCORE AFTER	FORWARD FLEXION	EXTERNAL ROTATION	INTERNAL ROTATION
MIGLIORINI ET AL[7]	Mini-open	ND	ND	92.1	57.6	39.1
	Arthroscopic	ND	ND	77.6	60.1	44.3
MONTASER ET AL [8]	Mini-open	42.3	61.7	ND	ND	ND
	Arthroscopic	42.4	63.5	ND	ND	ND
KARAKOC Y & ATALAY İB [9]	Mini-open	ND	ND	91.7	ND	ND
	Arthroscopic	ND	ND	76.8	ND	ND
MACDERMID ET AL [10]	Mini-open	ND	ND	128.2	58.2	38.2
	Arthroscopic	ND	ND	136.1	62.3	40.1
KHOLIEF A ET AL [11]	Mini-open	ND	ND	ND	ND	ND
	Arthroscopic	ND	ND	ND	ND	ND
VICENTI G ET AL [12]	Mini-open	39.5	75	ND	ND	ND
	Arthroscopic	39	74	ND	ND	ND
LIU J [13]	Mini-open	ND	50.9	159.1	69.2	ND
	Arthroscopic	ND	52.8	160.7	68.2	ND
FINK BARNES LA ET AL [14]	Mini-open	ND	ND	ND	ND	ND
	Arthroscopic	ND	ND	ND	ND	ND
ZHANG Z [15]	Mini-open	ND	ND	ND	ND	ND
	Arthroscopic	ND	ND	ND	ND	ND
VAN DER ZWAAL P ET AL [16]	Mini-open	42	62	107 ± 38	47 ± 23	ND
	Arthroscopic	42	65.8	107 ± 38	46 ± 22	ND
KASTEN P ET AL [17]	Mini-open	ND	20.8	150	70	ND
	Arthroscopic	ND	25.2	170	90	ND
KÖSE K.Ç ET AL [18]	Mini-open	ND	ND	157	126	38
	Arthroscopic	ND	ND	157	125	38
PEARSALL AW [19]	Mini-open	45.6	79.56	ND	ND	ND
	Arthroscopic	46.2	83.56	ND	ND	ND
VERMA NN ET AL [20]	Mini-open	ND	ND	ND	ND	ND
	Arthroscopic	ND	ND	ND	ND	ND
YOUM T ET AL [21]	Mini-open	ND	ND	169.4	70.2	9.2
	Arthroscopic	ND	ND	170.5	68.2	9.8

The main outcomes that were considered were the following: pain score, range of motion, details of the operating time, and postoperative functional outcomes (American Shoulder & Elbow Surgeons, University of California at Los Angeles; Constant-Murley score), as illustrated in Table 5.

The arthroscopic group required 60.9 minutes for the procedure, whereas the micro-open group required 50.5 minutes.

With an average preoperative score of 36.1 for the micro-open group & 34.2 for the arthroscopic group, the eight studies that used American shoulder & elbow surgeons indicated that both groups' scores improved after surgery.

7 studies utilized University of California at Los Angeles; the mean preoperative scores for the micro-open group were 11.51 as well as the arthroscopic group were 11.73; postoperative scores for these groups were 26.75 & 26.9, respectively.

In twelve investigations, pain was evaluated via a visual analogue scale (VAS). The mean score before surgery was 6.5 for the micro-open group & 3.0 for the arthroscopic group, respectively.

Seven studies employed the Constant-Murley score; the average score before surgery was 42.3 for the micro-open group & 42.4 for the arthroscopic group; after surgery, the scores rose to 61.7 as well as 63.5, respectively.

4. Discussion

This research examines the impact of arthroscopic vs. mini-open surgery on function at three and six months post-operatively by pooling data from four separate trials. A very low-quality meta-analysis of four randomized controlled trials, counting 495 individuals, found no statistically significant variance in postoperative function among the arthroscopic and mini-open approaches to rotator cuff surgery (95% CI: -0.18 to 0.18, p = 0.98).

Similar to our study, Migliorini et al.[7] demonstrated there was no significant distinction between ASR and MOR in terms of the following variables: constant score (P = 0.2), surgical duration (P = 0.05), American shoulder in addition to Elbow Surgeons shoulder (P = 0.5), UC Los Angeles shoulder (P = 0.3), forward flexion (P = 0.3), visual analogue scale (P = 0.2), abduction (P = 0.3), internal rotation (P = 0.7), external rotation (P = 0.2), retear (P = 0.9), and adhesive capsis (P = 0.5).

In line with this study, Huang et al.[22] all-arthroscopic and mini-open RCR operating approaches demonstrated similar clinical findings of function in a review of 18 studies (4 RCTs, 12 retrospective studies, and two prospective studies). The reviewers also found that the two surgical procedures can be used interchangeably depending on individual and rotator tear characteristics.

A very low-quality study with three randomized controlled trials and 254 participants found no statistically significant variance in pain scores at six and twelve months following a rotator cuff repair operation (MD = -0.21, 95% CI: -0.91 to 0.50, p = 0.56).

According to Verma et al.[20], the results of the visual analogue scale measure and the ASES score did not change among the intact and failed repair groups, suggesting that significant symptomatic alleviation is possible irrespective of tendon healing.

In line with this study, Huang et al.[22] clinical outcomes of pain from all-arthroscopic and mini-open RCR operations are similar, according to a meta-analysis of 18 trials (12 retrospective studies, four randomized controlled trials, and 2 prospective studies). The specifics of the tear dictate the selection of operating performance.

The high rate of rotator cuff can be attributed to various factors, including the extent of the tear, the duration of symptoms before the operation, the degree of cuff degeneration, the technique used for

fixation, and the hardware used. Nevertheless, results were not compared based on tear size in the current study.

In contrast, Sakha et al. [23], Ji et al.[24], Nazari et al. [25], Shan et al. [26] and Huang et al. [22] initiated that there is no statistical alteration regarding the range of motion. e.g., external rotation) ($p > 0.05$).

This existing trial exposed that the pooled outcomes presented no significant variance regarding clinical findings regarding forward flexion among groups of deficient quality (461 patients, 3 RCTs, MD). 2.94, 95% CI: -4.55 to 10.44, $p = 0.44$.

In agreement with this trial, Huang et al.[22], Sakha et al. [23], Nazari et al.[25], Shan et al. [26], and Ji et al.[24] displayed no significant variance concerning the extent of movement (e.g., forward flexion).

By the time the follow-up duration was three months, the percentage of rotator cuff retear after surgery had increased to 15, 21, 16, 21 percent, as well as 16 percent, respectively, according to the results of a meta-analysis and systematic review published in BMC Musculoskeletal Disorders by Longo et al.[27]. Certain patient-related factors, for example, bigger rip size, age, & fatty infiltration, as well as non-patient-related ones, for instance, surgery methods, postoperative rehabilitation protocols, & procedures, primarily impact RC healing.

Clinical results of individuals receiving all-arthroscopic versus mini-open rotator cuff surgery were evaluated in a systematic analysis of adults with rotator cuff tears other than major or irreparable tears 3. According to the research by Montaser et al.[8], results were similar for both methods.

Another trial by MacDermid[10] discovered that both groups benefited from the surgery, and the effect sizes were quite considerable; yet, at no point were there any clinically or statistically significant changes in WORC ratings among the groups. Similar trends emerged in the improvement of WORC scores as well as additional outcomes.

4. Conclusion

At the three, six, twelve, 24—and 30-month follow-up, there is no therapeutically meaningful variance amongst arthroscopic and mini-open RCR with respect to function, pain, and mobility. The patient's cosmetic goals, the surgeon's experience, and the patient's financial situation should all be taken into account prior to surgical procedure selection.

Disclosure

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There are no conflicts of interest.

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