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SHORT-TERM CLINICAL OUTCOMES OF SHOULDER FUNCTION FOLLOWING ARTHROSCOPIC ROTATOR CUFF REPAIR

Ahmet Serhat Genç[1i],
Altan Aksu[1],
Yılmaz Önder[2]
[1]Department of Orthopedics and Traumatology,
Samsun Training and Research Hospital,
Samsun, Türkiye
[2]Izmir Katip Celebi University,
Ataturk Training and Research Hospital,
Department of Orthopaedics and Traumatology,
Izmir, Türkiye

Abstract:
Aim: Rotator cuff tears not only cause pain; they can also lead to decreased range of motion in the shoulder joint, weakened muscle strength, and significant limitations in an individual's daily activities. The goal of rotator cuff repair is to improve pain, range of motion, and muscle strength, thereby increasing overall functional capacity. This study aims to compare shoulder function, pain level, and daily living activity level before and after rotator cuff repair in patients who underwent arthroscopic rotator cuff repair, using valid and reliable clinical scales reported by both the patient and evaluated by the physician. **Materials and Methods**: A retrospective cohort consisting of 32 patients (14 females and 18 males) aged between 45 and 66 years who underwent arthroscopic rotator cuff repair was evaluated. Orthomed Turkey surgical implants were used in surgical procedures. Patients' visual analogue scale (VAS) pain scores, American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES), Constant-Murley (CMS) scores, and Simple Shoulder Test (SST) scores were recorded before surgery and 2 years after surgery. **Results:** When comparing the SST, CMS, VAS, and ASES scores of the subjects before and after rotator cuff repair, statistically significant differences were observed in all cases ($p<0.05$).**Conclusion:** Following rotator cuff repair, significant improvements in short-term postoperative VAS, STS, CMS, and ASES scores, along with significant short-term improvements in pain, shoulder function, functional capacity, and range of motion, have been achieved, supporting its effectiveness as a clinical and functional treatment option.

Keywords: rotator cuff, constant score, VAS, shoulder function, arthroscopic rotator cuff repair

[i] Correspondence: email ahmetserhatgenc@hotmail.com

1. Introduction

The shoulder forms one of the most complex joint complexes in the human body due to its wide range of motion in three planes (Goetti et al., 2020). This unique biomechanical structure also makes the shoulder susceptible to numerous degenerative and traumatic dysfunctions (Piper et al., 2018; Yamamoto et al., 2010). Shoulder-related musculoskeletal problems are one of the most common reasons for seeking primary healthcare, and a large proportion of these problems are caused by arthritis, shoulder instability, fractures, and especially rotator cuff tears (Urwin et al., 1998; Thigpen et al., 2016; Best and Tanaka, 2018; Ropars, Thomazeau and Huten, 2017). Rotator cuff tears are one of the most common causes of shoulder pain and loss of function; they can develop as a result of both trauma and degenerative processes (Piper et al., 2018; Yamamoto et al., 2010; Chung et al., 2012).

Rotator cuff tears can cause not only pain, but also a restricted range of motion, decreased muscle strength, and significant limitations in daily living activities. Therefore, the primary goal of rotator cuff rehabilitation is not only to reduce pain, but also to regain range of motion, muscle strength, and functional capacity (Klintberg et al., 2009; Rokito et al., 1996; Chan et al., 2014). Although the treatment approach generally involves conservative methods in the first stage, surgical intervention becomes necessary in cases that do not respond to these methods. Various studies have shown that surgical treatment of full-thickness rotator cuff tears yields more successful results than conservative approaches, demonstrating superiority in both pain control and functional recovery (Davey et al., 2021; Vicenti et al., 2018). Today, minimally invasive and fully arthroscopic surgical techniques are the most commonly used and proven effective methods for repairing rotator cuff tears (Sauerbrey et al., 2005; Kang et al., 2007). While both methods provide good clinical results, arthroscopy offers the advantages of a faster recovery process and shorter rehabilitation period (Tosyali et al., 2024).

This study aims to evaluate shoulder function, pain, and the patient's ability to perform daily living activities before and after surgery in patients who have undergone rotator cuff repair using arthroscopic techniques, based on valid and reliable clinical scales derived from patient reports and clinician assessments. Our hypothesis is that there will be a statistically significant improvement in shoulder function following arthroscopic rotator cuff repair.

2. Material and Methods

2.1. Participants

The study included 32 patients aged 45-66 years (14 females and 18 males) who underwent rotator cuff repair by two experienced shoulder surgeons between January 2022 and May 2023. The optimal number of subjects to participate in the study was determined using the GPower 3.1.3 program. Patients underwent surgical intervention (implant) using the Suture Screw Anchor 5mm (n=11) (Orthomed Turkey), PEEK Suture

Anchor 5 mm (n=13) (Orthomed Turkey), and Soft Knot Anchor 3 mm (n=8) (Orthomed Turkey) methods. Patients were excluded from the study if they had a lesion on the anterior or posterior aspect of the rotator cuff, had sustained another injury to the affected upper extremity, had previously undergone shoulder surgery, had stiffness prior to surgery, or were unable to properly follow rehabilitation recommendations. All patients were included in the study after obtaining written informed consent.

2.2. Study Design

The indication for surgical treatment was clinical suspicion of a rotator cuff tear, along with pain and weakness in the affected shoulder. Contraindications included stiffness, severe radiographic osteoarthritis (Kellgren-Lawrence grade 3 or higher), rotator cuff arthropathy, poor compliance, and severe internal diseases. The necessary findings and procedures, such as the type and size of the rotator cuff tear and the type of reconstruction, were obtained from the database recorded during surgery. Patients completed visual analogue scale (VAS) pain scores, American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES), Constant-Murley score (CMS), and Simple Shoulder Test (SST) scores before surgery and 2 years after surgery, and the records were used retrospectively. All patients included in the study were enrolled in the same rehabilitation program after surgery. In addition, all patients were evaluated by an independent physician before and after surgery. Evaluations were conducted at the same time of day (2:00–4:00 p.m.) for all patients.

2.3. Procedures

The American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form (ASES): The ASES was used as the patient-reported outcome measure in the assessment of shoulder function. The form provides an assessment based on pain and daily living activities, with a total score of 100 points (Michener et al., 2002).

Visual Analogue Scale (VAS): The VAS pain score is a patient-reported outcome measure that allows the pain in the affected shoulder to be rated on a Likert scale from 0 to 10; 0 points represent no pain, while 10 points represent the worst pain felt (Zeng et al., 2024).

Constant-Murley scores (CMS): The CMS is a multi-item functional measure that assesses shoulder pain, daily living activities, joint range of motion, and strength. The score ranges from 0 to 100 points and represents the worst and best shoulder function, respectively (Vrotsou et al., 2018).

Simple Shoulder Test (SST) score: The SST consists of 12 questions regarding shoulder condition and function, with response options of yes (1) or no (0). Responses are scored on a scale of 0 to 12, with the maximum score indicating normal shoulder function. SST has good evidence for internal consistency, reliability, construct validity, hypothesis testing, and responsiveness (Huang et al., 2015).

2.4. Statistical Analysis

Statistical analysis was performed using the SPSS 21.00 package program. Descriptive statistics were presented as the mean, standard deviation, median, minimum, and maximum. The data were checked for normality using the Shapiro-Wilk test, and it was determined that the variables were normally distributed ($p > 0.05$). A paired sample t-test was used to compare ASES, VAS, CMS, and SST scores before and after surgery in a normal distribution.

3. Results

Table 1: Descriptive statistics of the groups

Variables	Mean	SD	Min	Max
Age (year)	56.72	6.32	45.0	66.0
Height (cm)	170.97	6.20	160.0	180.0
Weight (kg)	78.59	7.77	65.0	91.0
BMI (kg/m²)	26.80	1.07	24.5	28.4

SD standard deviation; Min minimum; Max maximum; BMI body mass index.

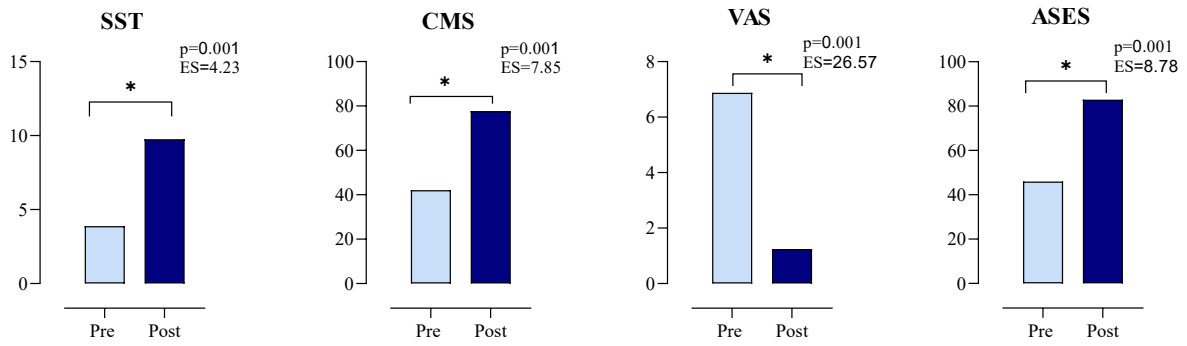
Table 1 presents the descriptive data of the subjects.

Table 2: Comparison of pre- and post-operative SST, CMS, VAS, and ASES scores

	PRE	POST	t	p		%95 CI	
	Mean ± SD	Mean ± SD			ES	LB	UB
SST	3.88±1.31	9.75±1.46	-98.908	0.001*	4.23	-6.00	-5.76
CMS	42.06±4.49	77.72±4.59	-184.082	0.001*	7.85	-36.05	-35.26
VAS	6.88±0.26	1.24±0.15	147.355	0.001*	26.57	5.55	5.71
ASES	45.97±5.11	82.94±3.06	-209.232	0.001*	8.78	-37.33	-36.61

*p<0.05. SD standard deviation; ES effect size; LB lower lower bound; UB upper bound; SST, simple shoulder test; CMS, constant-murley scores; VAS, visual analog scale; ASES, American shoulder and elbow surgeons standardized shoulder assessment form.

Figure 1: Comparison of pre- and post-operative SST, CMS, VAS, and ASES scores



*p<0.05; SST, simple shoulder test; CMS, constant-murley scores; VAS, visual analog scale; ASES, American shoulder and elbow surgeons standardized shoulder assessment form

Table 2 compares the pre- and post-operative SST, CMS, VAS, and ASES scores of the subjects. STS (p=0.001, ES:4.23), CMS (p=0.001, ES:7.85), VAS (p=0.001, ES: 26.57), and ASES (p=0.001, ES: 8.78) scales showed statistically significant differences in pre- and post-scores ($p<0.05$) (Figure 1).

4. Discussion

The major findings of the study were as follows: statistically significant differences were observed in all functional and clinical parameters in the pre- and post-assessments. The significant increase in STS, CMS, and ASES scores indicated improved shoulder function, functional capacity, and range of motion. The decrease in the VAS score, which enables the assessment of pain levels, demonstrated that the treatment administered was statistically and clinically effective.

The decrease in the VAS score, which enables the assessment of pain levels, demonstrated that the treatment administered was statistically and clinically effective. Paxton et al., (2013), reported functional improvement but continued radiological progression after 10 years of follow-up of ASES, SST, VAS, and CMS in 15 patients. Roy et al., (2010), have stated that the SST is a sensitive and clinically applicable patient-reported measure for assessing changes following shoulder arthroplasty. Huang et al. (2015), also supported the findings demonstrating the high structural validity and responsiveness of the SST. Although our follow-up period was short in our current study, postoperative improvement in SST scores was observed, similar to the literature. Tosyalı et al. (2024), reported that clinical outcomes showed similar improvement based on ASES, CMS, and VAS results obtained from 59 patients at 6 and 12 months, but no significant difference was observed in terms of repair integrity. Galatz et al. demonstrated that functional improvement in ASES and CMS scores persisted at 2 and 10-year follow-ups after rotator cuff repair, and that shoulder function was preserved despite structural deterioration. Ardnt et al. (2012), who conducted a 5-year CMS assessment following rotator cuff repair in 100 patients, similarly reported sustained functional improvement, but noted that radiographic improvement remained limited in some patients. There are methodological differences between our current study and the literature, arising from our lack of radiological evaluation and long-term follow-up.Although this affects the generalizability of our findings, our findings are similar to those obtained in the literature in short-term follow-ups. Kukkonen et al. (2013) reported statistically significant improvement in CMS scores at 3 and 12 months post-op in their large-scale study involving 781 patients. In another study, 306 patients were evaluated using the CMS score before surgery and 1 year after surgery, and it was noted that postoperative functional outcomes were better in small and medium tears, but limited in large and massive tears (Kukkonen et al., 2015). Although we were unable to assess the tear sizes, consistent with all these findings, our current study also demonstrated a significant improvement in postoperative functional outcomes, as assessed by ASES, CMS, and VAS scores, consistent with the clinical gains reported in the literature. Additionally, our findings that

the pre-post VAS score difference was greater than 5 are supported by the findings reported by Zeng et al. (2024) regarding the minimal clinically important difference (MCID) threshold and that high preoperative VAS values predicted reaching the MCID. This situation indicates that the decrease in the VAS score is both clinically and statistically significant. Chen et al. (2024) reported in their study that the recovery process following rotator cuff repair is influenced by individual biological variables such as age, tear size, and muscle quality, and that these factors may be decisive for postoperative functional outcomes. Additionally, it has been reported that patient-reported outcome measures after rotator cuff repair show a significant correlation with patient age; specifically, functional improvement and quality of life scores are more limited in older patients compared to younger patients (Vajapeyajula et al., 2019). Therefore, it is known that the results obtained in our current study may vary depending on patient characteristics.

This study has some limitations. First, the study sample was applied only to individuals aged 45-60, which limits the generalizability of the results. In our study, functional assessments were performed only before surgery and in the second postoperative year. Therefore, possible fluctuations that may occur during the recovery process could not be observed, the course of long-term clinical outcomes could not be adequately followed, and the permanence of the achieved improvement could not be evaluated. The presence of different types of surgical anchors in the patient group may complicate the comparison of results and the clear definition of the surgical effect. Additionally, the surgery itself may create a significant placebo effect. Due to the retrospective design of the study, patient demographic information such as smoking status, dietary habits, physical activity levels, and other medical conditions could not be obtained. The traumatic etiological classification of rotator cuff tears has not been considered, which may lead to overlooking potential differences in the healing process and functional outcomes. Additionally, the correlation between the structural integrity of repaired rotator cuffs and clinical scale results could not be evaluated. To overcome these limitations, future research should focus on prospective, long-term studies that include multiple postoperative assessment points, detailed demographic and etiological data, and an evaluation of the correlation between structural repair integrity and clinical outcomes. Such studies will be crucial for more accurately determining the sustainability of functional improvement and better guiding clinical practice.

5. Conclusions

In this study, significant improvement was observed in VAS, STS, CMS, and ASES scores following preoperative and short-term postoperative assessments of rotator cuff repair. The findings indicate that surgical treatment has positive effects on pain control, shoulder function, functional capacity, and joint range of motion. These results support the notion that rotator cuff repair is an effective treatment option in the short term, both clinically and functionally.

Conflict of Interest Statement
The authors declare no conflict of interest.

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About the Author(s)
Ahmet Serhat Genç, Training and Research Hospital, Samsun, Türkiye. Research areas: Orthopedics and Traumatology.
Altan Aksu, Training and Research Hospital, Samsun, Türkiye. Research areas: Orthopedics and Traumatology.
Yılmaz Önder, Izmir Katip Celebi University, Ataturk Training and Research Hospital, Department of Orthopaedics and Traumatology, Izmir, Türkiye. Research areas: Orthopedics and Traumatology.

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