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# Assessment and Functional Evaluation of Shoulder Following Mini Open Rotator Cuff Repair

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**KEYWORDS**
Rotator cuff tear, mini-open repair, shoulder function, UCLA score, DASH score, shoulder mobility.

**ABSTRACT**:

**Background:** Rotator cuff tears are a common cause of shoulder pain and dysfunction, particularly in older adults and individuals performing repetitive overhead activities. While conservative management is effective in partial tears, surgical repair is often required for full-thickness tears. Mini-open rotator cuff repair has gained popularity for offering both adequate visualization and less invasiveness compared to traditional open surgery.

**Objective:** To assess the functional outcome and shoulder mobility following mini-open rotator cuff repair using validated clinical scoring systems over a 6-month follow-up period.

**Materials and Methods:** A prospective observational study was conducted on 40 patients diagnosed with rotator cuff tears confirmed clinically and radiologically. Functional outcomes were assessed using the University of California Los Angeles (UCLA) shoulder score and Disabilities of the Arm, Shoulder and Hand (DASH) score. Shoulder range of motion was measured preoperatively and at follow-ups at 6 weeks, 3 months, and 6 months. Statistical analysis was performed using SPSS version 21 with significance set at $p \leq 0.05$.

**Results:** The mean age of subjects was 48.5 ± 14.79 years; 60% were male. The majority had degenerative or traumatic tears. UCLA scores showed a significant increase from a preoperative mean of 9.22 to 27.07 at 6 months ($p < 0.001$), while DASH scores significantly decreased from 72.9 to 29.15 ($p < 0.001$), indicating improved function and reduced disability. Shoulder range of motion also significantly improved across all planes by 6 months postoperatively ($p < 0.001$ for all movements).

**Conclusion:** Mini-open rotator cuff repair leads to significant improvement in functional outcome and shoulder mobility, as evidenced by favorable UCLA and DASH scores and enhanced range of motion. It is a

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safe and effective surgical option for patients with full-thickness rotator cuff tears..

## INTRODUCTION

Rotator cuff injuries are among the most prevalent causes of shoulder pain and dysfunction, particularly in individuals engaged in repetitive overhead activities or those of advancing age. The rotator cuff comprises four tendons—supraspinatus, infraspinatus, subscapularis, and teres minor—that stabilize the glenohumeral joint and facilitate a wide range of shoulder movements [1]. Tears in the rotator cuff may result from acute trauma or degenerative changes and are a significant cause of morbidity, affecting both the quality of life and functional independence [2].

The global prevalence of rotator cuff tears has been estimated to range from 7% to 25% in the general population, with a higher incidence noted among older adults and athletes involved in overhead sports [3,4]. Patients typically present with pain, weakness, and restricted range of motion, leading to difficulty in performing daily activities and work-related tasks [5].

Management of rotator cuff tears includes both conservative and surgical options, with the choice largely influenced by factors such as tear size, chronicity, patient age, activity level, and response to initial therapy [6]. While conservative management (including physiotherapy, NSAIDs, and corticosteroid injections) is often effective in partial or small tears, surgical repair remains the mainstay for full-thickness or large tears that do not respond to non-operative measures [7].

Among surgical techniques, the mini-open rotator cuff repair has gained popularity due to its balance between the comprehensive visualization of the open technique and the minimal invasiveness of arthroscopy [8]. This approach involves limited deltoid splitting and allows for better tendon mobilization and secure repair, particularly in medium to large-sized tears [9]. Several studies have reported favorable outcomes using mini-open techniques in terms of pain relief, functional improvement, and patient satisfaction [10,11].

Functional outcomes following rotator cuff repair are typically evaluated using standardized scoring systems such as the Disabilities of the Arm, Shoulder, and Hand (DASH) score and the University of California, Los Angeles (UCLA) shoulder score [12]. These tools help in quantifying improvements in mobility, strength, pain, and overall functional capacity post-intervention.

In light of the clinical relevance of rotator cuff injuries and the evolving surgical techniques for their repair, this study was undertaken to assess the functional outcome of mini-open rotator cuff repair using validated clinical scoring systems and shoulder movement assessments over a follow-up period of 6 months.

## MATERIALS AND METHODS

### Study Design and Duration

This prospective observational study was conducted over a period of 18 months in the Department of Orthopaedics at B.L.D.E. (Deemed

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to be University), Shri B.M. Patil Medical College, Hospital and Research Centre, Vijayapura.

**Source of Data**

The study included patients attending the outpatient department of Orthopaedics who were diagnosed clinically and radiologically with a rotator cuff tear.

**Sample Size**

The sample size was calculated based on an anticipated prevalence of shoulder pain and rotator cuff tear ranging from 7% to 25%, with a 95% confidence level and 8% absolute precision.
The formula used was:

n=Z2·p·qd2n = \frac{{Z^2 \cdot p \cdot q}}{{d^2}}n=d2Z2·p·q

Where:

- *n* = required sample size
- *Z* = Z statistic corresponding to the 95% confidence level
- *p* = estimated proportion (prevalence)
- *q* = 100 - p
- *d* = absolute precision (8%)

Using this formula, the minimum required sample size was estimated to be 40 patients.

**Inclusion Criteria**

- Patients aged above 18 years
- Diagnosed cases of rotator cuff tear (degenerative, traumatic, or sports-related), confirmed clinically and radiologically

**Exclusion Criteria**

- Associated fracture of the proximal one-third of the humerus
- History of previous surgery on the affected shoulder
- Severe glenohumeral osteoarthritis

**Ethical Consideration**

Ethical clearance was obtained from the Institutional Ethics Committee prior to the initiation of the study. Written informed consent was obtained from all patients fulfilling the inclusion criteria, confirming their willingness to participate and undergo necessary investigations.

**Data Collection Procedure**

Data was systematically recorded in a structured Case Record Form (CRF), which included the following components:

**A. Demographic Characteristics:**

- Name, age, sex, address, contact details, monthly income, occupation, educational level, place of residence (urban/rural), religion, and languages known.

**B. Patient History:**

- History of trauma or fractures, personal and family history, and prior treatment details.

**C. Clinical Details:**

- Presenting complaints and their duration, mode of injury, and associated symptoms.

**D. Clinical Examination:**

- General physical examination including vital signs (BP, PR, RR)

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- Systemic and local examination of the shoulder assessing for deformity, swelling, skin changes, tenderness, bony irregularity, and range of motion (flexion, extension, abduction, adduction, internal rotation).
- Muscle strength testing and special orthopedic tests such as the Empty Can Test, Gerber's Lift-off Test, Belly Press Test, and Drop Arm Sign.

**E. Treatment Details:**

- Information regarding treatment date, type of treatment, follow-up, and any observed side effects.

**F. Assessment Tools:**

- Functional outcomes were evaluated using the Disabilities of the Arm, Shoulder, and Hand (DASH) score and the University of California Los Angeles (UCLA) Shoulder Score.

**Statistical Analysis**

Data were entered into Microsoft Excel and analyzed using SPSS software version 21. Categorical variables were summarized using frequency and percentage tables. Continuous variables were presented as mean ± standard deviation (SD) or median with minimum and maximum values, depending on the data distribution.

Normality of continuous variables was assessed using the Shapiro-Wilk test. For normally distributed data, paired t-tests and Repeated Measures Analysis of Variance (RM-ANOVA) were applied to compare pre- and post-treatment scores. A p-value ≤ 0.05 was considered statistically significant.

**RESULTS AND OBSERVATIONS;**

Data "contains measurements of 40 subjects with radiologically and clinically with rotator cuff tear of the shoulder."

The following tables provides the details.

**Table 1: Distribution of subjects according to Socio-demographic details**

| Variable | Subcategory | Number of subjects (%) |
|---|---|---|
| Age | Mean ± SD<br>Median (Min, max) | 48.5 ± 14.79<br>50 (21, 70) |
| Gender | Female | 16 (40%) |
| | Male | 24 (60%) |
| Occupation | Homemaker | 7 (17.5%) |
| | Labourer | 8 (20%) |
| | Office worker | 3 (7.5%) |
| | Retired | 16 (40%) |

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| | | |
|---|---|---|
| | Sports person | 6 (15%) |

The mean age was 48.5 ± 14.79 years. 24 (60%) subjects were male. Sixteen (40%) subjects were retired professionals, and 6 (15%) were sports persons.

**Table 2: Distribution of subjects according to different variables of functional evaluation**

| **Variables** | **Subcategory** | **Number of subjects (%)** |
|---|---|---|
| Side affected | Left | 21 (52.5%) |
| | Right | 19 (47.5%) |
| Dominant side | No | 18 (45%) |
| | Yes | 22 (55)% |
| Duration of symptoms (months) | Mean ± SD<br>Median (Min, max) | 12.75 ± 7.08<br>14 (3, 24) |
| Mechanism of injury | Degeneartive | 15 (37.5%) |
| | Sports | 12 (30%) |
| | Traumatic | 13 (32.5%) |
| Pre op VAS for pain | Mean ± SD<br>Median (Min, max) | 4.6 ± 3.12<br>4 (0, 10) |
| Tear size | Large | 12 (30%) |
| | Massive | 6 (15%) |
| | Medium | 9 (22.5%) |
| | Small | 13 (32.5%) |
| Complications | No | 37 (92.5%) |
| | Yes | 3 (7.5%) |
| Type of complication | None | 40 (100%) |

21 (52.5%) subjects had left side affected. The duration of symptoms was 12.75 ± 7.08 months. 15 (37.5%) subjects had degenerative type of injury. The mean of Pre OP VAS was 4.6 ± 3.12. 13 (32.5%) subjects had small tear size. 3 (7.5%) subjects had complications.

**Table 3: Distribution of subjects according to UCLA and DASH over intervals of time**

| **Variable** | **Subcategory** | **Time intervals** | | | | **p-value** |
|---|---|---|---|---|---|---|
| | | **Pre OP** | **6 weeks** | **3 months** | **6 months** | |
| UCLA | Mean ± SD<br>Median (Min, max) | 9.22 ± 1.65<br>9 (6, 13) | 17.55 ± 3.18<br>17.5 (11, 23) | 23.4 ± 3.6<br>24 (15, 30) | 27.07 ± 3.36<br>27.5 (15, 32) | **<0.001*[RA]** |
| DASH | Mean ± SD<br>Median (Min, max) | 72.9 ± 8.31<br>72 (60, 85) | 54.67 ± 10.53<br>56 (35, 74) | 39.17 ± 11.21<br>39 (15, 64) | 29.15 ± 11.76<br>29.5 (5, 54) | **<0.001*[RA]** |

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*Abbreviation: RM-ANOVA, *- indicates statistical significance*

From RM-ANOVA test, it can be observed that UCLA score significantly improves over time ($p < 0.001$). This suggests steady functional improvement over time. The DASH score significantly decreases over time ($p < 0.001$), indicating reduced disability. This confirms progressive recovery in arm, shoulder, and hand function.

From post hoc analysis, there were statistically significant differences in all comparisons in both the UCLA and DASH.

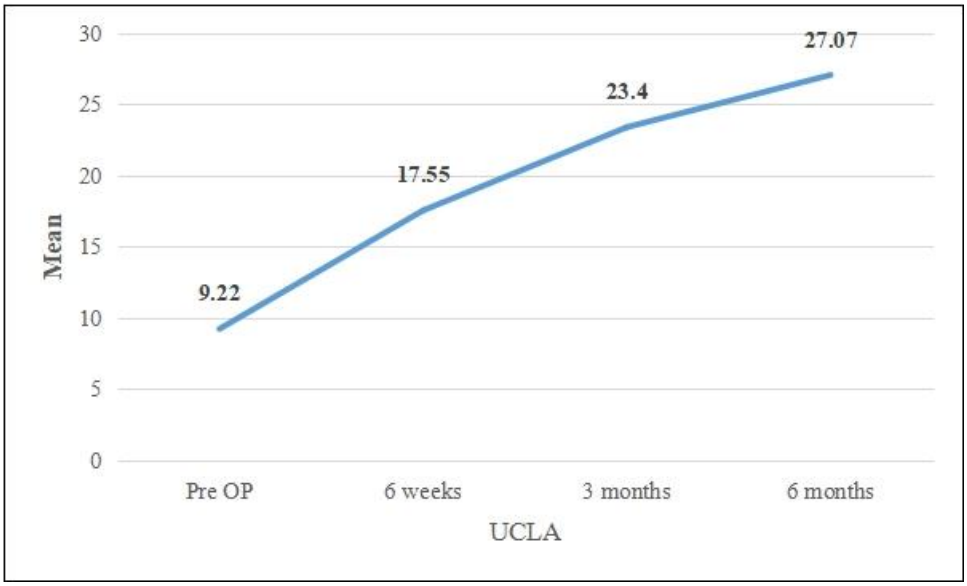


**Figure 1: Mean plot of UCLA over time intervals**


**Figure 2: Mean plot of DASH over time intervals**

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**Table 4: Pair wise comparision of means**

| Variable | Subcategory | Time intervals | | p-value |
|---|---|---|---|---|
| | | Pre OP | After 6 months | |
| Flexion | Mean ± SD<br>Median (Min, max) | 116.05 ± 14.78<br>116.5 (90, 140) | 151.05 ± 19.49<br>152.5 (113, 180) | **<0.001*pt** |
| Extension | Mean ± SDuu<br>Median (Min, max) | 28.97 ± 6.51<br>28.5 (20, 40) | 40.07 ± 7.04<br>39 (27, 55) | **<0.001*pt** |
| Abduction | Mean ± SD<br>Median (Min, max) | 97.45 ± 15.79<br>97.5 (72, 118) | 143.05 ± 17.09<br>144 (112, 175) | **<0.001*pt** |
| Internal rotation | Mean ± SD<br>Median (Min, max) | 36.35 ± 7.65<br>36 (20, 50) | 55.27 ± 9.79<br>39 (32, 77) | **<0.001*pt** |
| External rotation | Mean ± SD<br>Median (Min, max) | 24.97 ± 7.14<br>25 (11, 39) | 53.67 ± 11.12<br>55 (33, 74) | **<0.001*pt** |

*Abbreviation: pt- paired t test, *- indicates statistical test*

From paired t test, it can be observed that, all shoulder movement parameters showed statistically significant improvement at 6 months postoperatively (**$p < 0.001$** for all).

## DISCUSSION

Rotator cuff injuries are a significant source of shoulder pain and functional limitation, especially among middle-aged and elderly populations [1,2]. In our study, the mean age of patients was 48.5 years, consistent with previously reported data suggesting that degenerative changes in the rotator cuff tend to increase with age [3,4]. The male predominance (60%) in our sample also reflects the findings of earlier epidemiological studies [3,5].

In terms of injury characteristics, degenerative tears were most common (37.5%), aligning with findings by Minagawa et al., who emphasized the high prevalence of asymptomatic degenerative tears in older individuals [6]. The majority of subjects in our study presented after a relatively prolonged duration of symptoms (mean: 12.75 months), which might be attributed to delayed diagnosis or trial of conservative treatment prior to surgical consideration.

The mini-open rotator cuff repair approach was chosen in this study due to its established efficacy in managing full-thickness tears while minimizing deltoid trauma [8]. Previous studies have supported the mini-open technique for medium to large tears, citing improved visualization and tendon mobilization with favorable outcomes [9,10]. Ji et al. [17] and Grasso et al. [19] both demonstrated comparable or superior functional results with mini-open techniques when compared to arthroscopy in terms of strength recovery and patient satisfaction.

Our results corroborate these findings. The UCLA score showed a statistically significant improvement from a preoperative mean of 9.22 to 27.07 at 6 months postoperative ($p < 0.001$), indicating marked functional gains. Similarly, the DASH score improved from 72.9 preoperatively to 29.15 at 6 months, denoting a substantial reduction in disability. These improvements are consistent with previous reports by Moosmayer et al. [13] and Gummesson et al. [23], who used these scoring systems to evaluate outcomes following tendon repair and reported significant functional recovery over time.

Objective measurements of shoulder range of motion (ROM) also reflected positive postoperative progress. There were statistically significant improvements in flexion, abduction, internal rotation, and external rotation ($p < 0.001$ for all), in line with studies by Jost et al. [15] and Seitz et al. [9], which emphasized the role of successful repair in restoring glenohumeral mechanics and muscular coordination.

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A low complication rate was observed (7.5%), which aligns with other studies showing that mini-open techniques maintain a favorable safety profile [18,20]. Verma et al. [21] also reported similar postoperative complication rates and highlighted the durability of outcomes with this method over a 2-year follow-up.

Our study further supports the utility of validated outcome measures such as DASH and UCLA scores in tracking recovery postoperatively. These tools provide a comprehensive assessment of both objective function and patient-reported outcomes, as also emphasized by Gummesson et al. [23].

**Limitations of the Study**

This study has several limitations. The sample size was modest (n=40), and the follow-up period was limited to 6 months. Long-term durability of repair and recurrence rates were not assessed. Additionally, comparisons with other surgical techniques such as full arthroscopic repair were not made, which could have added further insight into the relative effectiveness of mini-open repair.

## CONCLUSION

Mini-open rotator cuff repair is a reliable surgical approach for managing symptomatic rotator cuff tears, offering significant improvements in shoulder function and pain reduction over a 6-month period. The use of standardized scoring systems confirms progressive recovery, supporting the effectiveness of this technique in routine orthopedic practice.

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