

## COMPARATIVE STUDY OF EFFICACY OF EXERCISE THERAPY VS UST & EXERCISE THERAPY IN THE NON-SURGICAL REHABILITATIVE MANAGEMENT OF ROTATER CUFF TEAR

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### Abstract

**Background:** Rotator cuff tears are a common condition that frequently affects the shoulder. The main cause is typically degeneration associated with age, although trauma or sports injuries can also contribute, albeit less frequently. Injuries can occur suddenly from trauma or develop gradually from chronic overuse and repetitive motions involving the shoulder. This condition significantly impairs daily activities and can hinder an individual's ability to earn wages. Patients typically experience pain, stiffness, weakness, and limited range of motion, resulting in functional impairments. Treatment options include non-surgical rehabilitation (such as physical therapy, home-based exercises, and intra-articular injections) or surgical intervention for severe tears. **Materials and Methods:** This study was a prospective open-level parallel group randomized controlled trial conducted at a single center, specifically the Department of Physical Medicine & Rehabilitation at I.P.G.M.E.R, SSKM Hospital, from March 2009 to August 2010. Sixty-seven patients with rotator cuff tears attending the hospital's outpatient department were randomly assigned to two groups: group 1 received exercise therapy alone, while group 2 received exercise therapy along with ultrasound therapy. **Results:** The study population had a mean age of 49.46 years (SD  $\pm$  9.33), with 56.76% male and 43.24% female participants in each group. At the beginning of the study, all outcome variables were statistically comparable. However, in the follow-up assessments, there was a significant improvement over time at the end of the study period in the CONSTANT-MURLEY SCORE and ADL SCORE. Friedman's ANOVA test showed a p-value of less than 0.001. When comparing within each group between visit 1 and visit 3, as well as visit 1 and visit 5, using Wilcoxon's matched pair signed rank test, consistent improvement over time was observed in the CMS SCORE and ADL SCORE. The statistical analysis did not reveal any significant differences in outcomes between the two groups. **Conclusion:** This study identified several poor prognostic factors for improvement in shoulder function and activities of daily living (ADL), including female sex, bilateral involvement, combined affection of multiple rotator cuff tendons, and initial symptoms such as atrophy, deformity, and catching. Ultrasound therapy in the initial stage of rehabilitation did not provide any additional benefits for patients, whereas therapeutic exercise programs proved beneficial in improving clinical, functional, and ADL scores. Long-term disabilities, psychosocial aspects, and vocational outcomes for non-responders to non-surgical rehabilitation require further long-term follow-up studies.

## INTRODUCTION

Rotator cuff tears are a prevalent condition that affects the shoulder, specifically the tear of one or more of the tendons in the rotator cuff. Among the four tendons, the supraspinatus tendon is the most commonly torn, with the most frequent site being its insertion into the humeral head. Prevalence rates have been determined through post-mortem studies.<sup>[1,2]</sup> Partial thickness tears range from 13-37%.<sup>[3]</sup> while full-thickness tears range from 5-27% (Keyes, 1993; Wilson & Duff, 1943).<sup>[4,5]</sup> Factors associated with an increased incidence of rotator cuff tears include advanced age, repeated overhead activity, sports injuries, trauma, congenital abnormalities of the acromion, and metabolic diseases like chondrocalcinosis and chronic polyarthritis. The tears can be classified based on size (small, medium, large, or massive) and duration of symptoms (acute, subacute, chronic, or old).<sup>[6,7]</sup>

Although many cuff tears may be asymptomatic and painless, symptomatic tears often present with pain over the front and outer aspect of the shoulder, especially when leaning on the elbow or pushing towards the shoulder. Other symptoms include intolerance to overhead activities, night pain while sleeping on the affected side, weakness, limited range of motion, and functional limitations. Diagnosis can be made using various clinical signs and additional information from imaging techniques such as X-rays, ultrasound, and MRI.<sup>[8,9]</sup>

The treatment of rotator cuff tears can be non-operative or operative depending on the severity. Non-operative approaches involve the use of analgesics, anti-inflammatory drugs, subacromial steroid or anesthetic injections if necessary, and short-term sling use for comfort to avoid stiffness. Early physical therapy involving ultrasound therapy and cryotherapy can provide pain relief and help correct biomechanical errors and strength deficiencies through exercise therapy schedules and work modifications.<sup>[8]</sup> Surgical intervention is considered for massive tears, with good outcomes shown if there is no fatty atrophy of the cuff prior to surgery.<sup>[10]</sup>

Rotator cuff tears can cause significant impairment, hindering activities of daily living and earning capacity for self-sufficient individuals who may become progressively dependent.

### Objective

The objective of this study was to compare the effectiveness of exercise therapy alone versus

exercise therapy combined with local ultrasound therapy in the non-surgical rehabilitative management of rotator cuff tears.

## MATERIALS AND METHODS

This study was a prospective open-level parallel group randomized controlled trial conducted at a single center, specifically the Department of Physical Medicine & Rehabilitation at I.P.G.M.E.R, SSKM Hospital, from March 2009 to August 2010. Sixty-seven patients with rotator cuff tears attending the hospital's outpatient department were randomly assigned to two groups: group 1 received exercise therapy alone, while group 2 received exercise therapy along with ultrasound therapy.

During the study period, patients who met the inclusion and exclusion criteria and visited the Department of Physical Medicine and Rehabilitation (PMR) at IPGMER, SSKM Hospital were randomly assigned to two groups. A predetermined semi-structured proforma was used to assess the patients. Functional disability was evaluated using the CONSTANT MURLEY assessment scale for shoulder function and the Activities of Daily Living (ADL) scale. The patients were divided into two groups and started on a five-phase rehabilitative exercise program for Group 1, while Group 2 received ultrasound therapy (UST) in addition to the exercises. UST was administered six times a week for two weeks, with an intensity of 1.5 watts/cm<sup>2</sup> for 5 minutes using a 5cm sound head and a frequency of 3MHz (Continuous mode).

Clinical and outcome variables were assessed in each patient at baseline (visit 1) and at two-week intervals for a total of five visits over eight weeks. Statistical analysis was performed using the STATISTICA software version 26 (Stats Soft Inc., Tulsa, Oklahoma, 2001). The data were summarized using descriptive measures such as mean, standard deviation, median, and interquartile range. Parametric and non-parametric analyses were conducted. Numerical variables were compared between the two groups using the Mann-Whitney U test, while categorical variables were compared using the Chi-square test or Fisher's exact test as appropriate. Friedman's ANOVA was used to assess changes in scores over time, followed by Wilcoxon's matched pair signed rank test to evaluate differences between any two time points. All analyses were two-tailed, and a p-value of less than 0.05 was considered statistically significant.

## RESULTS

Table 1: Sex Distribution

Group	Sex F	Sex M	Row Totals
1	16 43.24%	21 56.76%	37
2	16 43.24%	21 56.76%	37
Totals	32	42	74

The table no 1 presents the sex distribution of two groups. In Group 1, there were a total of 37 individuals. Among them, 16 were female, accounting for 43.24% of the group, and 21 were male, representing 56.76% of the group. Similarly, in Group 2, there were also a total of 37 individuals. Among them, 16 were female, making up 43.24% of the group, and 21 were male, accounting for 56.76% of the group.

**Table 2: Distribution of occupation**

Group	Occpt nHW	Occpt nFR	Occpt nRTD	Occpt nCR	Occptn CLR	Occpt nBS	Occptn DRV	Occpt nMN	Occpt nML	Occptn TCH	RowTotal
	14 37.84 %	13.51	8.11%	2 5.41%	8.11%	10.81	1 2.70%	5.41%	2 5.41%	2.70%	37
	15 40.54%	16.22%	5.41%	5.41%	5.41%	3 8.11%	5.41%	5.41%	3 8.11%	0.00%	37

Most of cases in our study population they were housewife i.e. in group-1 37.84% and group-2 40.45% cases respectively. Presented in table no2.

**Table 3: Distribution of socio-economic status [SES]**

Group	SES M	SES L	SES U	Row Total
1	15 40.54%	16 43.24%	6 16.22%	37
2	14 37.84%	19 51.35%	4 10.81%	37
Totals	29	35	10	74

The table no 3 presents the distribution of socio-economic status (SES) among two groups.

In Group-1. 15 individuals (40.54%) were categorized as SES M (Medium socio-economic status).

- 16 individuals (43.24%) were categorized as SES L (Low socio-economic status).
- 6 individuals (16.22%) were categorized as SES U (Upper socio-economic status).

In Group -2, The distribution of SES among them was as follows:

- 14 individuals (37.84%) were categorized as Medium socio-economic status.
- 19 individuals (51.35%) were categorized as Low socio-economic status.
- 4 individuals (10.81%) were categorized as Upper socio-economic status.

**Table 4: Distribution of handedness (DOMINANT HAND)**

Group	Yes	No	Row Total
1	35 94.59%	2 5.41%	37
2	37 100%	0 0.00%	37
Totals	72	2	74

The table no 4 presents the distribution of handedness (dominant hand) among two groups. In Group 1, 35 (94.59%) had a dominant hand. 2 (5.41%) did not have a dominant hand. In group-2. There was 100% had a dominant hand.

**Table 5: Distribution of affected side**

Group	Side affect L	Side affect R	Side affect BL	Row Total
1	9 24.32%	20 54.05%	8 21.62%	37
2	9 24.32%	21 56.76%	7 18.92%	37
Totals	18	41	15	74

The table no 5 presents the distribution of the affected side among group 1. 9 cases (24.32%) had the left side affected. 20 cases (54.05%) had the right side affected. 8 cases (21.62%) had both sides affected (bilateral). On the other hand in group-2. 9 Cases (24.32%) had the left side affected. 21 Cases (56.76%) had the right side affected. 7 cases (18.92%) had both sides affected (bilateral).

**Table 6: Distribution of affected tendon**

Group	Tendon Affect SUP	Tendon Affect INF	Tendon Affect SUP/SUB	Tendon Affect SUP/INF	Tendon Affect SUB	Row Total
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1	27 72.97%	5 13.51%	1 2.70%	1 2.70%	3 8.11%	37
2	28 75.68%	3 8.11%	3 8.11%	2 5.41%	1 2.70%	37
Totals	55	8	4	3	4	74

In table no 6. Combining the two groups, the table shows that there were a total of 55 individuals with the supraspinatus tendon affected, 8 cases with the infraspinatus tendon affected, 4 cases with the supraspinatus/subscapularis tendon affected, 3 cases with the supraspinatus/infraspinatus tendon affected, and 4 cases with the subscapularis tendon affected respectively.

Constant murlay composite score of shoulder function : CMS pain

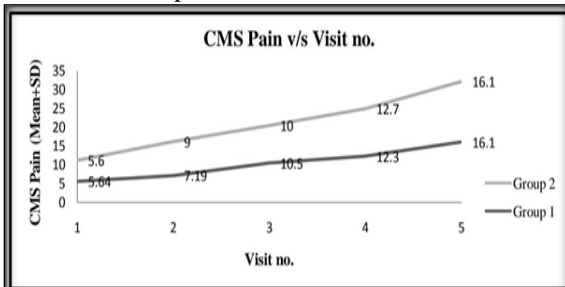


Chart 1 shows consistent improvement of pain score over time in both the groups.

### CMS work

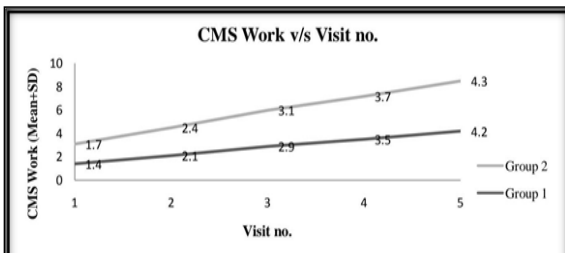


Chart 2 shows consistent improvement of work score over time in both the groups.

### CMS Recreation

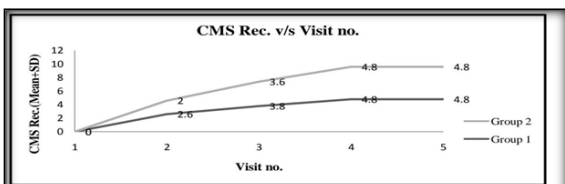


Chart 3 shows consistent improvement of recreation score over time in both the groups.

### CMS Sleep Disturbance

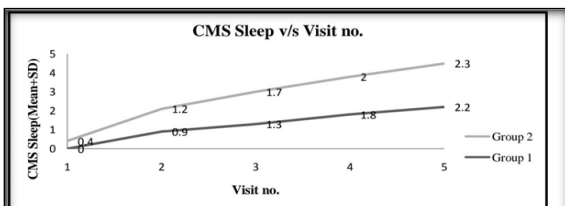


Chart 4 shows consistent improvement of sleep disturbance score over time in both the groups.

### CMS ARM position score during work

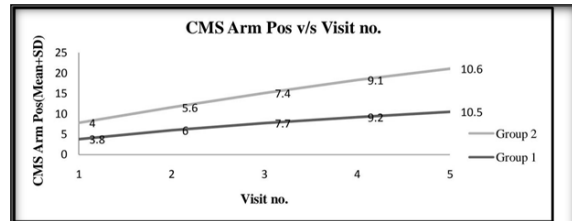


Chart 5 shows consistent improvement of arm position score over time in both the groups.

### CMS ROM flexion

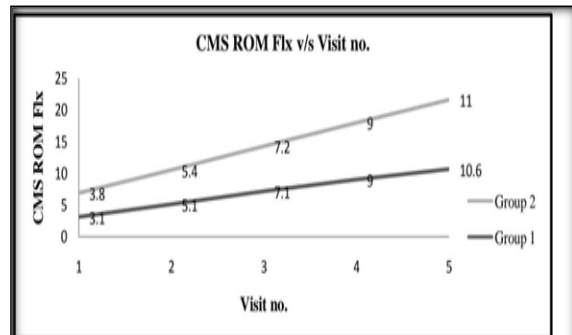


Chart 6 shows consistent improvement of ROM flexion score over time in both the groups.

### CMS ROM abduction

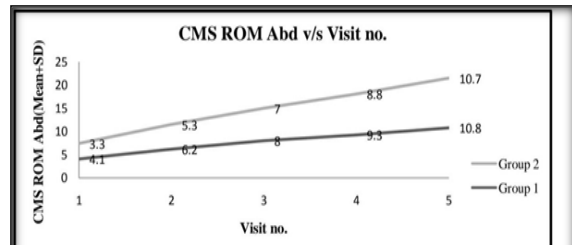


Chart 7 shows consistent improvement of ROM abduction score over time in both the groups.

### CMS ROM EXT. ROT. Score

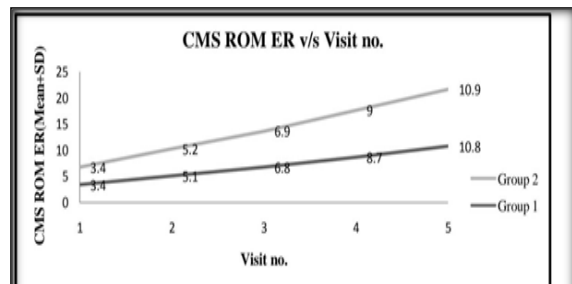


Chart 8 shows consistent improvement of ROM ext. rot. score over time in both the groups.

### CMS ROM INT. ROT. Score

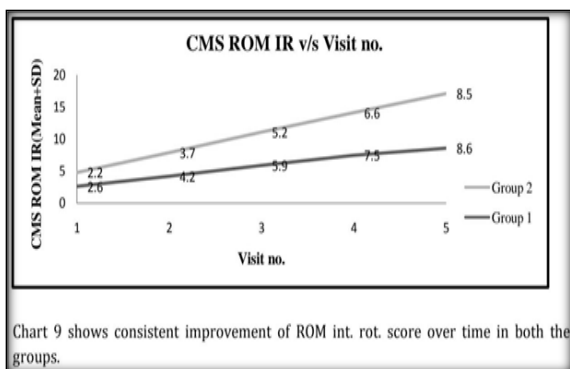


Chart 9 shows consistent improvement of ROM int. rot. score over time in both the groups.

### CMS ABDUCTION FORCE Score

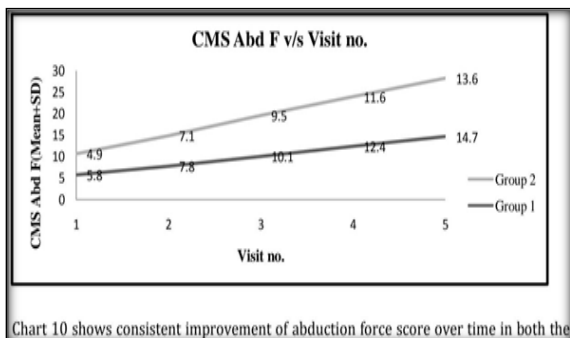


Chart 10 shows consistent improvement of abduction force score over time in both the

### ADL total score

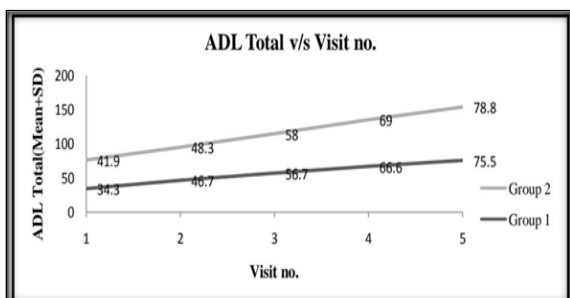


Chart 11 shows consistent improvement of Total ADL score over time in both the groups.

A total of 67 patients were selected and randomly assigned to two groups, with 37 subjects in each group. However, there were 4 dropouts in Group 1 and 5 dropouts in Group 2. Two of the dropouts in each group occurred during the first and second visits, and their data were excluded from the statistical analysis.

The mean age of the patients was 49.46 years (SD±9.33), with a median age of 46 years (QR±16). In both groups.

The most frequently affected tendon in both groups was the supraspinatus, with 72.97% in Group 1 and 75.68% in Group 2. The infraspinatus tendon was the second most affected, while the subscapularis tendon was the least commonly affected. The study identified catching during movement, modification of activities of daily living (ADL) due to pain, and sleep disturbances as the most common presenting symptoms. Deformity, weakness, atrophy, stiffness,

and instability were reported as the least common presenting symptoms.

Functional assessment of the patients was performed using the CONSTANT-MURLEY COMPOSITE SCORE of shoulder function from the initial visit (visit1, V1) to the final visit (visit5, V5). The mean pain score (CMS Pain) in both groups at the initial visit ranged from 2.58 (SD±3.06) to 2.8 (SD±2.9) and consistently increased to 13.14 (SD±2.99) in Group 1 and 13.38 (SD±2.7) in Group 2 at the final visit. The CMS work score and CMS recreation score also showed consistent improvement over the visits.

The scores for arm position during work, range of motion (ROM) in flexion, abduction, external rotation, and internal rotation, as well as abduction force and total ADL score, all demonstrated improvement from the initial visit to the final visit in both groups.

## DISCUSSION

In the present study, the maximum age group affected was 70 yrs & minimum was 40 yrs in gr. 1 & 2 which was corroborative with previous studies. The annual incidence is estimated at 10 cases per 1000 population, peaking at 25 cases per 1000 population in the age category of 42-46 years. In the population aged 70 years or more, 21% of persons were found to have shoulder symptoms, most of which were attributed to the rotator cuff. In cadaver studies, the incidence of full thickness tears varies from 18-26%. The incidence of partial thickness tears varies from 32-37% after age 40 years. Before 40, tears rarely are observed. After 60 years, 26% of patients have partial thickness tears, and 28% demonstrate full thickness tears (André Roy et. al, 2009).

In our study, it has been seen that male and female almost have equal incidence of cuff tears which was consistent with previous studies. Housewives were most frequently affected among all different occupations even greater than all the other occupations. In one study, there is a predominance of male patients (66%) seeking consultation for rotator disease, but, in other studies, the male-to-female ratio is 1:1 (André Roy et. al, 2009).

Though, not so much of studies support the predominant incidence in housewives, one cross-sectional Indian study evaluating gender related factors such as expectations and participation limitations have an independent impact on disability in patients with rotator cuff tear. In our study, middle and lower SES patient were mostly affected. This observation was corroborative with previous studies; in one study of cuff tear in manual labour, showed predominant involvement of low SES.

In the present study, though, dominant side involvements were seen in most of the cases but there was significant involvement of non-dominant side in both the groups. This is seen most commonly

in housewives as also the bilateral involvement. This finding of our study was corroborative with an Indian study but not so much study agrees with this statement, in those studies, people whose occupation demands repetitive overhead activities were mostly affected bilaterally. Supraspinatus was the most frequently affected tendon followed by Infraspinatus, combined affection of Supraspinatus & subscapularis and subscapularis only has equal incidence and combined affection of supra & Infraspinatus was least common.

The result is corroborative with other studies. Therapeutic use of UST during early phase of rehabilitation doesn't prove to be of added advantage for improvement of function and patient's symptoms adding extra cost to the therapy. This observation of our study is consistent with other studies. Effectiveness of UST was seen only in cases associated with calcific tendinitis of the involved tendon. This view is corroborative with the study done by Ebenbichler et al.<sup>[11]</sup>

As per our study, therapeutic exercise schedule were proved to be equally effective for improving functional outcomes in both groups of patient. Initial emphasis in passive ROM with stretching progressing to strengthening exercise after attaining full passive ROM followed by neuro muscular retraining, proprioceptive & ADL training were shown to be associated with consistent improvement in function and early return to work and community participation. Publications on rotator cuff disease are rare. Despite the fact that the effectiveness of nonoperative treatment was recognized many years ago and that many authors have emphasized its importance, only 1 randomized controlled study has been published.<sup>[12]</sup>

Other studies on the nonoperative treatment of rotator disease have shown satisfactory and unsatisfactory results, but they were all retrospective uncontrolled trials.<sup>[13]</sup>

Therefore, on the basis of the Brox study, a supervised exercise program should be part the conservative treatment of rotator cuff disease. It is this author's opinion that an exercises program is the basis of the conservative treatment and no therapeutic modality will provide long-term relief of pain and increased functional status unless it is complemented by an exercise program. The goal of this program is to restore shoulder ROM, enhance glenohumeral and scapulothoracic function to normalize the scapulohumeral motion, and improve the shoulder stability. However, more randomized controlled studies are necessary to support this author's opinion, as well as the findings of the Brox study.<sup>[14]</sup> Studies by Kuhlman JR et. al (1992), Blackburn et. al (1990), Davis GJ et. al (1989) and van der Heijden et. al (1997) also support this view.

## CONCLUSION

- The unique caregiving roles of women in society make them more vulnerable to disability compared to men, as they have additional responsibilities and expectations to fulfill.
- The use of ultrasound therapy (UST) during the early phase of rehabilitation does not provide additional benefits for improving function and symptoms, and it adds extra cost to the therapy.
- UST is only effective in cases associated with calcific tendinitis of the involved tendon.
- The author believes that an exercise program is essential for conservative treatment, as no other therapeutic modality can provide long-term pain relief and improved function without complementing it.
- In our study, poor prognostic factors for improvement in shoulder function and activities of daily living (ADL) were identified, including the affection of the supraspinatus and infraspinatus tendons, initial symptoms of atrophy, deformity, crepitus, and instability, predominant restriction of internal rotation, X-ray features of type 3 acromion with high riding humeral head, AC joint sclerosis, and ultrasound findings of large tears (3-5cm) along with calcific tendinitis and bicipital tendinitis. These findings are consistent with other studies.
- However, long-term disabilities, psychosocial outcomes, and vocational outcomes in patients with poor response to nonsurgical rehabilitative measures could not be studied due to a short follow-up period. The impact of residual deficits on long-term disability is unknown, although nonsurgical rehabilitative measures have been beneficial for patients.

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