

## Research Article

# Effectiveness of Routine Physical Therapy with and without Eccentric Loading Training for the Rehabilitation of Rotator Cuff Tendinopathy

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**Abstract** | To determine and compare the effectiveness of routine physical therapy with and without eccentric strength training in patients with rotator cuff (RC) tendinopathy. This single blinded randomized clinical trial was conducted at University Physical therapy and Rehabilitation clinic, Raiwind road, Lahore. The study included sample size of 50 subjects diagnosed with rotator cuff tendinopathy. Patients included in study were allocated randomly into; *Group-A*: This group was treated with routine physiotherapy treatment. *Group-B*: In this group, subjects were trained with eccentric loading exercises along with routine physiotherapy treatment. The outcome measures were pain intensity measured by using Visual Analogue Scale (VAS) and functional outcome measured by quick Disabilities of arm, shoulder and hand (DASH) questionnaire. The p-values were found to be significant for VAS (0.001) and for DASH (0.000). The paired sample t-test was applied in two sub groups of group A and similarly in group-B. The values were statistically significant i.e., 0.001 for VAS, 0.000 for DASH. P-values obtained for VAS (0.001) and DASH (0.000) when repeated measure analysis of variance (ANOVA) was applied comparing four sub groups. Eccentric exercises give better results in reducing pain intensity and gaining functional outcome with routine physiotherapy maneuvers in subjects having rotator cuff tendinopathy. Eccentric loading training for the cure of shoulder pain due to rotator cuff tendinopathy has confirmed to be more helpful in aiding pain, and fixing functional impairment in patients having rotator cuff tendinopathy than routine physiotherapy treatment methods.

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**Keywords** | Rotator cuff tendinopathy, Eccentric exercises, Visual analogue scale, Disability arm shoulder hand questionnaire

## Introduction

Rotator cuff tendinopathy is characterized by pain and weakness felt in the shoulder, most commonly occurring when performing shoulder lateral rotation and elevation.<sup>(1)</sup> The third most common musculoskeletal problem that affects the activities of daily life of people is glen humeral pain and its prevalence is estimated to be 7-10%.<sup>(2)</sup> The commonest cause for RC tendinopathy is sub acromial impingement syndrome (SIS).<sup>(3)</sup>

RC tendinopathy is potential source of causing pain in shoulder with prevalence calculated to be 14% in the middle-age population<sup>(4)</sup> The incidence of RC tendinopathy is 0.3 to 5.5% and annual prevalence is 0.5 to 7.4%. Limited evidence showed that advanced age and personal, occupational and psychological and social factors are associated with its occurrence.<sup>(5)</sup>

The multi-factorial etiology of RC tendinopathy has involved both extrinsic and intrinsic mechanisms. Extrinsic factors that affect the sub-acromial space

and responsible for bursal side compression of the RC tendons include following; anatomical anomalies of the acromion, postural faults, changes in kinematics of humerus and scapula, deficient RC and scapular muscle performance, and reduced stretch ability of pectoralis minor.

Intrinsic factors that are responsible for RC tendon degeneration with tensile/shear overload include variations in biological, mechanical, morphological properties and vascularity.<sup>(6)</sup> The supraspinatus tendon is the most vulnerable structure because to its location in sub acromial space. In patients with impingement, degenerative changes in the supraspinatus tendon have been shown through histological examinations, similar to those changes found in Achilles and patellar tendinosis.<sup>(7)</sup>

Variety of comorbidities and risk factors for RC disease have been identified much as lateral epicondylitis, trigger finger, carpal tunnel syndrome, Achilles tendinitis, use of oral corticosteroids, and diabetes.<sup>(8)</sup>

Excessive mechanical loading is the main contributing and causative mechanism. The mechano-transduction process which is associated with an adequate mechanical load dose may describe the effectiveness of applying the eccentric load to the tendons by using eccentric exercises. An adequate mechanical load is effective for tendon as it stimulates healing of tendon and an inadequate one can harm its integrity.<sup>(9)</sup>

Evidence related to eccentric exercises have reported beneficial effects on pain intensity and functional activity, and these exercises for chronic tendinopathy are considered the basic treatment.<sup>(10)</sup> Different eccentric training protocols have been used in the few studies conducted for people with rotator cuff tendinopathy. Further, the effects of the eccentric training for rotator cuff tendinopathy were only evaluated on pain, function and strength. Future studies should assess the effects of the eccentric training also on shoulder kinematics and muscle activity.<sup>(11)</sup>

The aim of study is to determine if eccentric exercise program for the RC muscles is superior to routine physical therapy in patients with RC tendinopathy.

## Patients and Methods

The single blinded randomized clinical trials (RCTs)

study design was used. The study was completed within 6 months after the approval of synopsis conducted at University Physical therapy & Rehabilitation clinic, Raiwind road, Lahore.

Sample size: A sample of 50 subjects was included in study. Sample size 'n' was calculated using hypothesis tests for 2 population proportions (two-sided test), having level of significance ' $\alpha$ ' 10%, power of the test '1- $\beta$ ' 80%, anticipated population proportion 1 'P<sub>1</sub>' 0.5, and anticipated population proportion 2 'P<sub>2</sub>' 0.74 by this formula:

$$n = \frac{\left\{ Z_{1-\frac{\alpha}{2}} \sqrt{2P(1-P)} + Z_{1-\beta} \sqrt{P_1(1-P_1) + P_2(1-P_2)} \right\}^2}{(P_1 - P_2)^2}$$

**Group-A:** In this group, 25 patients were treated with routine physiotherapy; **Group-B:** In this group, 25 patients were treated by eccentric loading exercises along with routine physiotherapy treatment.

## Data collection procedure

The patients having diagnosed rotator cuff tendinopathy have been considered to participate in the study, and then the patients who fulfilled the inclusion and exclusion criteria have been selected. The consent has been taken from the subjects to participate in the study, after which the subjects are randomly allocated into two groups. Randomization has been performed by using computer generated design adaptive allocation. After allocating them into groups, data has been collected from University Physical therapy and Rehabilitation Clinic, Raiwind road, Lahore. The therapist had applied treatment and collect data at baseline, and before and after treatment at the end of 6<sup>th</sup> and 12<sup>th</sup> week. The intensity of pain that occur during horizontal shoulder movement is measured by VAS and for the assessment of functional outcome, quick DASH questionnaire<sup>(12)</sup> is used to measure progress.

## Statistical analysis

Statistics software used was SPSS 20. Frequency table, mean and standard deviations were used to present the quantitative data, while the qualitative one was presented as frequencies. Paired sample T-test and repeated measure ANOVA were used to check the effects of two techniques and compare the interventions within the groups respectively. Computer software used was windows 7.

Results and Discussion

Mean age of the patients in group A was 51.8±11.53 years, the minimum age was 35 years and maximum was 68 years. On the other side, the mean age of the patients in group B was 50.92±7.91, the minimum age was 35 years and maximum was 70 years.

**Table 1:** Comparison of means for vas of two groups at all three follow-ups.

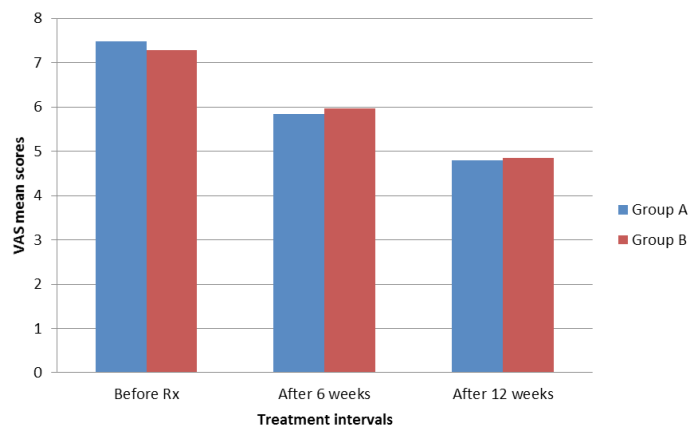
Descriptive Statistics					
	Group	Mean	Std. Deviation	N	p-value
VAS (Baseline)	Group A	7.4800	1.15902	25	0.001
	Group B	7.2800	1.45831	25	
VAS (week 6 <sup>th</sup> )	Group A	5.8400	1.54596	25	
	Group B	5.9600	1.17189	25	
VAS (week 12 <sup>th</sup> )	Group A	4.8000	2.32737	25	
	Group B	4.8400	2.09523	25	

VAS: Visual analogue scale; \*p-value <0.05 is considered significant

For Visual Analogue scale as shown in Table 1, Group A (routine physiotherapy) showed mean pain score on VAS before treatment 7.4800 (SD=1.15902), where as in group B (Eccentric loading exercises + routine physiotherapy) showed mean score on VAS before treatment 7.2800(SD=1.45831). After six weeks of treatment, group A showed mean score 5.8400 (SD=1.54596) and group B showed mean score 5.9600 (SD=1.17189). After 12 weeks of treatment, group A showed mean score on VAS is 4.8000 (SD=2.32737), whereas patients in group B showed mean score on VAS after 12 weeks of treatment was 4.8400 (SD=2.0952). For VAS the results indicate that there was averagely notable variation among the mean post treatment scores and pre-treatment scores in both groups (p=.001). As p=.001 was less than p =.05 so we reject our null hypothesis and accept research hypothesis. Both groups confirmed that there was absolute betterment in their intensity of pain (P<0.001), at 12 week follow-up points. So eccentric loading training is more effective than routine physiotherapy treatment methods for patients of RC tendinopathy. (Figure 1).

For Disabilities of arm, shoulder and hand questionnaire as in Table 2, Group A (routine physiotherapy) showed mean score on DASH before treatment 58.5 (SD=11.26603), where as in group B (Eccentric load-

ing exercises + routine physiotherapy) showed mean DASH score before treatment 54.2 (SD=9.60469).



**Figure 1:** Comparison of means for vas of two groups at all three follow-ups.

**Table 2:** Comparison of means dash of two groups at all three follow-ups.

Descriptive statistics					
	Group	Mean	Std. Deviation	N	P-value
DASH (Baseline)	Group A	58.5	11.26603	25	0.000
	Group B	54.2	9.60469	25	
DASH (week 6 <sup>th</sup> )	Group A	48.08	10.73903	25	
	Group B	36.24	11.21116	25	
DASH (week 12 <sup>th</sup> )	Group A	43.28	10.18790	25	
	Group B	27.48	13.11526	25	

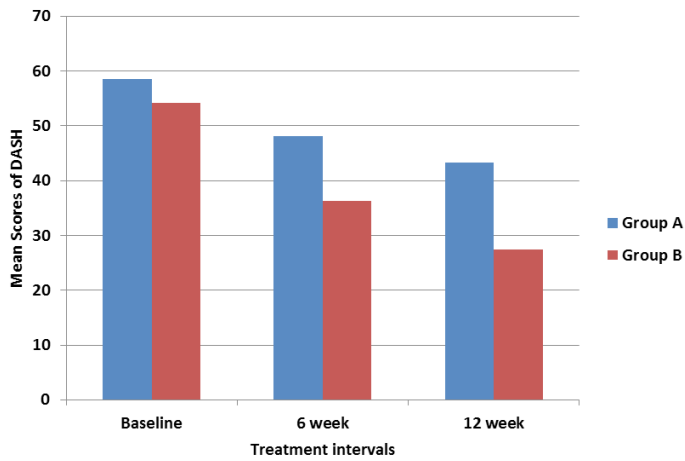
DASH: Disabilities of arm, shoulder and hand questionnaire; \*p-value <0.05 is considered significant.

After six weeks of treatment, group A showed mean score 48.08 (SD=10.739) and group B showed mean DASH score 36.24 (SD=11.2111).

After 12 weeks of treatment, group A showed mean score on DASH is 43.28 (SD=10.1879), whereas patients in group B showed mean score on DASH after 12 weeks of treatment was 27.48 (SD=13.115).

For DASH the results indicated significant difference between mean DASH post- and pre-treatment scores (p = .000).

As p=.000 was less than p =.05 so we reject our null hypothesis and accept research hypothesis. So eccentric loading training is more effective than routine physiotherapy treatment methods for patients of RC tendinopathy. (Figure 2).



**Figure 2:** Comparison of means dash of two groups at all three follow-ups.

Eccentric loading exercise studies have shown good results by reducing pain and improving activity in patients with tendinopathy, and these exercises are often considered basic treatment for chronic tendinopathy.<sup>(10)</sup>

According to an RCT, applying EE produced positive results in isometric strength at 90° shoulder abduction, but these exercises were not superior to others for reducing pain and improving shoulder movements. This study showed that the combination of a limited amount of physiotherapy sessions combined with a home exercise program (HEP) is highly effective in patients with SIS. However, RC tendinopathy is mostly treated with low load exercises for shoulder medial and lateral rotation, with focus on rotator cuffs. Evidence focused on high load EE and have showed better effects on both pain and functional activity in patients of SIS.<sup>(7)</sup>

Limited evidence is there that suggests that EE has a beneficial effects on pain and movements in comparison to other interventions such as concentric exercise (CE), stretching exercise and ultrasonic therapy.<sup>(13)</sup>

Camargo et al<sup>(14)</sup> recently showed reduced pain and improved shoulder function after six weeks of isokinetic eccentric training of the rotator cuff. However, my study had observed the effects after 12 weeks.

A study shown that a traditional training of rotator cuff done for 12 weeks at home along with 9 physical therapy sessions was effective in enhancing isometric strength and reducing pain intensity and shoulder dysfunction in patients with SIS. Eccentric loading of these subjects increase isometric strength at 90degrees of scapular abduction. This study showed that when

physical therapy session is combined with a exercise program at home, this produced better results.<sup>(7)</sup>

An eccentric strengthening program for rotator cuff done for 12 weeks that includes scapular control can be helpful in pain management and function improvement in subacromial impingement patients. A randomized controlled trial should be done to provide strong evidences.<sup>(10)</sup>

In another study, an exercise strategy involving heavy load eccentric training for the RC and concentric/eccentric exercises for the scapula stabilizers, can be good in reducing pain and improving shoulder function in patients with SIS. This exercise regime reduces the need for arthroscopic sub acromial decompression within the 3 months duration used in the study.<sup>(16)</sup>

This study proved the effectiveness of both the strategies applied to the patients as they improved functional status, both the exercise programs including eccentric exercises and routine physical therapy are effective in reducing pain and enhancing functional outcome, as shown by p-values. (0.001 VAS, 0.000 DASH).

### Conclusion

Eccentric loading training for the cure of shoulder pain due to rotator cuff tendinopathy has confirmed to be more helpful in aiding pain, and fixing functional impairment in patients having rotator cuff tendinopathy than routine physiotherapy treatment methods. The results of this clinical analysis aids in explaining the employment of eccentric loading in patients with rotator cuff problems.

### Author's Contribution

**Arooj Fatima:** Data collection, Manuscript writing, Literature review, Statistical analysis

**Ashfaq Ahmad:** Critical revision of article

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