



A COMPARATIVE STUDY BETWEEN ECCENTRIC TRAINING AND CONCENTRIC TRAINING IN ROTATOR CUFF TENDINOPATHY: A RANDOMIZED CONTROL STUDY.

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ABSTRACT **Background:** About 50% of population suffer from periods of shoulder pain. Of which 30% population suffers from rotator cuff tendinopathy. Shoulder joint is a very important for the functioning of the upper limb. Therefore, seeing the prevalence of rotator cuff tendinopathy, it is important to find effective conservative methods of treatment. Eccentric training has been proposed to be an effective conservative treatment in patellar and Achilles tendinopathies **Objectives:** To compare the efficacy of eccentric training and concentric training in rotator cuff tendinopathy **Methods:** 40 patients of both sexes in the age group of 40-60 years were included and randomly allocated in two groups (eccentric and concentric group). Participants underwent clinical evaluation on scales viz. Visual Analogue Scale (VAS), DASH and Constant Shoulder Score on 1st day, 4th week and 8th week. Exercises were performed twice a week under the supervision of therapist and rest of the week as advised at home. Exercise session lasted for 46-60 minutes. **Result:** Pain decreased and functional status improved in both groups, however, eccentric training appeared to show greater improvement on pain and functional status. **Conclusions:** Eccentric training should be emphasized in daily exercise regime in rotator cuff tendinopathy to decrease pain and improve functional status.

KEYWORDS : rotator cuff, eccentric training, concentric training

INTRODUCTION:

Rotator cuff is a primary dynamic stabilizer of the glenohumeral joint, has the main function to stabilize the shoulder by pressing the humeral head in glenoid cavity. Because of this unstable arrangement, it is possible for the ball to slip out of the glenoid cavity. Also repetitive strain to ligaments, capsule or rotator cuff muscles associated with overhead activities or sports or repetitive overhead movements, also hampers the functioning of shoulder complex which in turn affects the functioning of upper limb³⁰ which may lead to rotator cuff tendinopathy.

Rotator cuff tendinopathy is the most common type of pain experience and it is seen in about 30% of population³².

Rotator cuff tendinopathy is characterized as pain in the area of rotator cuff tendons and pain in the shoulder joint, especially when reaching overhead, reaching behind the back, lifting and sleeping on the affected side.

Eccentric training has been proposed to be an effective conservative treatment in patellar and Achilles tendinopathies^{7,8}. Eccentric exercise involves dynamic loading of a muscle beyond its force – producing capacity, causing physical lengthening of the muscle as it attempts to control the load, when lowering a weight. It focuses on slowing down the elongation of the muscle process. It leads to stronger muscles, faster muscle repair and increasing metabolic rate³⁰.

Need For The Study

It is well known that people suffer from shoulder pain most commonly; about 50% suffer from periods of shoulder pain. Of which 30% population suffers from rotator cuff tendinopathy³². It is important to find effective methods of treatment for shoulder pain for conservative management.

Eccentric training has been proposed to be an effective conservative treatment in patellar and Achilles tendinopathies^{7,8}, but less evidence exists about its effectiveness in rotator cuff tendinopathy. On the basis of this, the present study is conducted to compare the efficacy of eccentric training and concentric training in rotator cuff tendinopathy.

AIM:

To compare the efficacy of eccentric training and concentric training in rotator cuff tendinopathy.

To correlate the pre and post intervention scores on improvement in pain and functional activity

Methodology

Study Design:

Prospective, comparative, randomized control trial study conducted for a period of 8 weeks (twice in a week). Sample size, 40 both male and female in the age group of 40-60 years were included in this study.

Group A (eccentric group) included 20 subjects and Group B (concentric group) included 20 subjects.

Inclusion Criteria:

1. Age group: 40-60 yrs
2. Patient diagnosed with rotator cuff tendinopathy secondary to partial rotator cuff tear, impingement to rotator cuff tendons or inflammation [8] or having pain during shoulder activity for more than 1 month (5-8 on VAS scale)

Exclusion Criteria:

Patients with

1. chronic inflammatory disease like frozen shoulder, osteoarthritis
2. history of previous surgical treatment to shoulder.
3. radiating pain in the affected arm like cervical spondylosis
4. history of fractures to the same shoulder
5. psychiatric or psychological conditions affecting cognitive or perceptual functions

Study Procedure:

Patients were first screened for inclusion and exclusion criteria. Informed consent was taken from the patients willing to participate in the study. They were numbered serially in equal size, and were randomly allocated in one of the two groups.

Baseline evaluation which included demographics, range of motion pain assessment by VAS, functional activity by DASH and Constant Shoulder Score was done. Subjects were re-evaluated on 4th, and 8th week

Occupational Therapy Intervention

Both the groups were educated about the condition. Icing for 5 minutes before and at the end of each session was given. Also, neck exercises and back exercises were given at the start of each session. The week wise protocol is as follows:

- **Exercises of Scapula and Back:**
- Static ex: Static contraction for 10 seconds in Scapular protraction, retraction, elevation, depression, back extension
- Active Ex: Active scapular protraction, retraction, elevation, depression
- Neck exercises: flexion, extension, lateral flexion and rotation
- Pulley exercises: empty can position⁹

For Group A

Week 1: neck and scapular exercises, pendular exercises, eccentric exercises using pulley for Supraspinatus and deltoid upto 45 degrees and 90 degrees respectively

Week 2-3: pendular exercises, eccentric exercises using pulley full range, activities like placing down light objects from multiple angles,

and inclined sandling in downwards direction slowly.

Week 4-5: eccentric exercises using pulley and light weights along with the activities mentioned above.

Week 6-7: eccentric exercises using pulley and weights along with activities like placing down moderate weights objects and eccentric motion of lateral rotation using theraband

Week 7-8: eccentric exercises using pulley with and weights along with activities like placing down moderate weights objects and eccentric motion of lateral rotation using theraband.

For Group B

Week 1: neck and back exercises, pendular exercises, abduction upto 45 degrees and 90 degrees sitting position with wand, emphasis on flexion and abduction and concentric exercises using pulley for suprapinatus and deltoid upto 45 degrees and 90 degrees.

Week 2-3: pendular exercises, concentric exercises using pulley, activities like placing up light objects from multiple angles, inclined sandling in upward direction slowly.

Week 4-5: concentric exercises using pulley and light weights along with the activities mentioned above depending on their improvement.

Week 6-7: concentric exercises using pulley and weights along with activities like placing up moderate weights objects and concentric motion of lateral rotation using theraband

Week 7-8: concentric exercises using pulley with and weights along with activities like placing up moderate weights objects and concentric motion of lateral rotation using theraband

RESULTS AND DATA ANALYSIS

Table 1: Descriptive Description Of VAS, DASH and CSS Values At Baseline, Week4 And Week 8 In Eccentric And Concentric Group

Descriptive Statistics									
Group	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles			
						25 th	50 th (Median)	75 th	
Eccentric	BVAS	20	7.3500	.48936	7.00	8.00	7.0000	7.0000	8.0000
	W4VAS	20	3.6000	.75394	3.00	5.00	3.0000	3.0000	4.0000
	W8VAS	20	2.8000	.69585	2.00	4.00	2.0000	3.0000	3.0000
Concentric	BVAS	20	7.4000	.50262	7.00	8.00	7.0000	7.0000	8.0000
	W4VAS	20	5.4500	.51042	5.00	6.00	5.0000	5.0000	6.0000
	W8VAS	20	5.0500	.75915	4.00	6.00	4.2500	5.0000	6.0000
Eccentric	BDASH	20	27.8500	2.45539	25.00	33.00	26.2500	27.0000	28.0000
	W4DASH	20	17.2500	2.14905	14.00	20.00	15.0000	18.0000	19.5000
	W8DASH	20	10.4000	2.56289	8.00	15.00	8.0000	9.0000	12.7500
Concentric	BDASH	20	28.9000	2.44734	23.00	33.00	27.2500	28.5000	31.0000
	W4DASH	20	24.5500	2.41650	21.00	30.00	23.0000	24.0000	25.7500
	W8DASH	20	19.2000	3.67924	12.00	25.00	15.7500	19.5000	22.0000
Eccentric	BCSS	20	54.2000	5.37636	48.00	63.00	48.0000	55.0000	58.0000
	W4CSS	20	68.7500	2.48945	65.00	71.00	66.0000	69.5000	71.0000
	W8CSS	20	83.2000	3.60701	77.00	87.00	79.0000	85.0000	85.0000

Concentric	BCSS	20	52.8500	4.23364	44.00	57.00	49.2500	55.0000	55.0000
	W4CSS	20	58.5500	5.66127	51.00	66.00	52.5000	57.0000	65.2500
	W8CSS	20	63.7500	6.87386	51.00	79.00	59.0000	64.0000	71.0000

Table 2: Showing Statistical Significance In VAS, DASH and CSS Values

Group		W4V AS - BVA S	W8V AS - BVA S	W8V AS - W4V AS	W4D BDA SH	W8D ASH - BDA SH	W8D ASH - W4D ASH	W4C SS - BCS S	W8C SS - BCS S	W8C SS - W4C SS
Eccentric	Z	-4.018 ^b	-3.982 ^b	-3.933 ^b	-3.937 ^b	-3.843 ^b	-3.947 ^c	-3.956 ^c	-3.947 ^c	-3.358 ^b
	P-value	.000	.000	.000	.000	.000	.000	.000	.000	.001
Concentric	Z	-4.128 ^b	-3.976 ^b	-3.946 ^b	-3.925 ^b	-3.930 ^b	-3.940 ^c	-3.936 ^c	-3.843 ^c	-1.789 ^b
	P-Value	.000	.000	.000	.000	.000	.000	.000	.000	.074

	BVAS	W4V AS	W8V AS	BDA SH	W4D ASH	W8D ASH	BCSS	W4C SS	W8C SS
Mann-Whitney U	190.000	16.500	7.500	132.500	.000	12.000	164.500	22.500	4.500
Wilcoxon W	400.000	226.500	217.500	342.500	210.000	222.000	374.500	232.500	214.500
Z	-.322	-5.169	-5.323	-1.855	-5.448	-5.114	-.988	-4.875	-5.371
Asymp. Sig. (2-tailed)	.747	.000	.000	.064	.000	.000	.323	.000	.000
Exact Sig. [2*(1-tailed Sig.)]	.799 ^b	.000 ^b	.000 ^b	.068 ^b	.000 ^b	.000 ^b	.341 ^a	.000 ^a	.000 ^a

·Wilcoxon signed ranks test was performed for comparison within group (For comparison of median recorded as baseline, 4th week and 8th week)

Mann Whitney U test used for comparison of mean between two groups

Results showed statistically significant improvement in terms of decrease of pain (in VAS from median of 7 to 3 in eccentric group and 5 in concentric group) mean rank for eccentric is 10.88 and concentric is 30.12 at end of 8th week, the difference between median VAS score is statistically significant p < 0.05; and improvement in functional activities viz. DASH from median of 27 in eccentric group and 28 in concentric group to 9 and 19 in eccentric and concentric group respectively with mean rank for eccentric is 11.10 and concentric is 29.90 at end of 8th week. The difference between median DASH score is statistically significant p < 0.05. While in Constant Shoulder Score(CSS) improvement from median score of 55 to 85 and 64 in eccentric and concentric group respectively with mean rank for eccentric is 30.38 and concentric is 10.72. the difference between median VAS score is statistically significant p < 0.05 at end of 8th week.

DISCUSSION

In the study, positive effects of respective intervention were observed in both eccentric and concentric group as observed at the end of 8th week with p value less than 0.05, hence accepted within the level of significance. The results indicate that eccentric group shows more improvement from baseline to 8th week.

In consistence with all the related studies we found similar results. Our findings revealed that eccentric training was more effective than concentric training in improving functional activity as well as decreasing pain in rotator cuff tendinopathy.

It was also found that subjects in eccentric group showed better Range and strength improvement along with better Endurance than in concentric. This maybe because Eccentric training has added advantages of maintaining fibre length and promote healing, as it consumes less oxygen and recruits less motor units. Since, Eccentric exercises produce more force than concentric and it activates contractile as well as non-contractile tissues and has more mechanical advantage than concentric exercises as it activates only the contractile units. Therefore, eccentric exercises require less effort in controlling the load as compared to concentric exercises. Since eccentric exercise consumes less oxygen and energy than concentric³⁰, therefore it may improve endurance more efficiently than concentric activities because muscle fatigue occurs less quickly with eccentric exercise. In concentric group, subjects underwent 12-14 weeks of therapy to achieve maximum recovery possible as most of the initial time was utilized in decreasing the pain. This may be due to the above reasons and also because maybe the muscle is already shortened and in guarded position, concentric exercises further shorten it. 4 out of 20 subjects of concentric group developed frozen shoulder (cause not known and requires further studies)

Also it was observed that maximum pain was experienced between 60-120 degree i.e mid ranges of abduction. This may be due to abnormal muscle kinetics leading to impingement of supraspinatus under the subacromial arch.

Therefore, initially exercises were given within the range of 60 and 90 degrees along with back and scapular exercise, thereby improving the muscle strength, postural correction and functional training thus prevent the tendons from getting impinged in subacromial space and hence decreasing pain.

CONCLUSIONS

After analysing and comparing it with the existing literature, we can conclude that eccentric training yield better outcome measures in terms of decreasing pain, improving upper extremity function than concentric training.

Limitations And Future Scopes

1. Small sample size
2. Further studies need to be carried out, with better designs and a larger number of patients in order to obtain better evidence and to be able to provide some grade of recommendation about its usage, which cannot be established with the current data.
3. The study was conducted for a limited duration
4. patients developed frozen shoulder and cause was not known; further studies are required.

Conflict Of Interest: none

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