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Comparison between the effects of TheraBand strengthening with conventional exercise on pain and function among patients with shoulder impairment

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Abstract
The shoulder is a very complex joint that is crucial for most of the daily living activities. The glenohumeral joint is a rather unstable joint compared to the other ball and socket joints in the body. Several acute and chronic disorders are known to cause painful limitation of movement in the shoulder joint. However, in most cases, the actual cause of the pain and limitation is unknown and can only conjecturally be linked to abnormalities in the rotator cuff or other structures. This health problem should, therefore, be studied in terms of impairment rather than specific disorders, at least in large epidemiological studies, where intensive diagnostic tests cannot be performed. Shoulder strengthening can be done by using various resistance devises like dumbbells, springs, TheraBand, barbells, weight cuffs. TheraBands are being used from almost a century to do elastic resistance exercises. Elastic resistance bands have been reported as a useful tool for improving muscle strength in young and elderly populations, both genders individuals with and without musculoskeletal pain.30 subjects diagnosed with shoulder impairment by physician/orthopedician and referred to department of physiotherapy were taken for the study by purposive sampling method. The subjects were examined for exclusion and inclusion criteria. The subjects fulfilling the inclusion criteria were taken for this study. They were explained about the study and an informed consent was obtained from them. The subjects willing to participate were included into the study. Then, 15 subjects each were assigned to two groups i.e., group A (TheraBand exercises) and group B (conventional exercises) by simple random sampling (lottery method) procedure. The baseline data of study outcome measure i.e., pain and disability in visual analogue scale and SPADI were measured and noted.

Keywords: Shoulder impairment, theraband exercise, conventional exercise

Introduction
The shoulder is a very complex joint that is crucial for most of the daily living activities [1]. The shoulder joint is a ball and socket joint, consisting of the scapular glenoid cavity and the humeral head surrounded by a group of tendons that support the joint and function as ligaments. These tendons are the biceps brachii tendon cranially, the supraspinatus and infraspinatus laterally, the teres minor and deltoideus caudally and the subscapularis medially [2].

The glenohumeral joint is a rather unstable joint compared to the other ball and socket joints in the body, but the aforementioned factors provide relative stability in multiple planes of motion. In disease, the majority of patients complain of loss of function and pain, with the rotator cuff, shoulder capsule and impingement being the most common culprits[3]. Several acute and chronic disorders are known to cause painful limitation of movement in the shoulder joint. However, in most cases, the actual cause of the pain and limitation is unknown and can only conjecturally be linked to abnormalities in the rotator cuff or other structures. This health problem should, therefore, be studied in terms of impairment rather than specific disorders, at least in large epidemiological studies, where intensive diagnostic tests cannot be performed [4]. Shoulder impairment is a potentially serious musculoskeletal complication and is likely to contribute to poor physical function [5]. Musculoskeletal impairments are among the most common and disabling of medical disorders. Among those with musculoskeletal impairments, some persons are disabled by their condition while others are not. Hence, prevention of disability can be approached either by preventing the impairment itself,

or by preventing the impairment from becoming a disability [6]. The shoulder complex relies on muscles to provide dynamic stability during its large range of mobility. Proper balance of the muscles surrounding the shoulder complex is also necessary for strength and flexibility; a deficit in strength or flexibility in an agonistic muscle must be compensated for by the antagonist muscle, leading to dysfunction. These muscular imbalances lead to changes in arthrokinematics and movement impairments, which may ultimately lead to structural damage [7]. An array of different patterns of movement impairment and poor motor control are seen in patients with shoulder dysfunction and require careful assessment. This variation in movement impairment may be due to the different structures sensitized around the shoulder. For example, shoulder internal rotation is an important functional movement that is often compromised in patients with poor shoulder girdle motor control. This movement is often restricted, particularly in abduction, due to tightness of the posterior band of the inferior glenohumeral ligament complex and capsule. Thus, patients with tightness or sensitivity of these connective tissues may have specific restriction of reaching across the chest and reaching their hand up behind their back, causing substantial functional disability. Hence, restoration of functional internal rotation movement should be considered as an important aspect of a comprehensive management plan [8]. Shoulder strengthening can be done by using various resistance devises like dumbbells, springs, TheraBand, barbells, weight cuffs. TheraBands are being used from almost a century to do elastic resistance exercises. The properties of elastic resistance are they provide resistance, they allow free range of motion, they allow different speed of movement and they allow progressive resistance. All these four properties are critical for the offered by effective resistance training program. One of the most important benefits of elastic resistance is that, unlike free weights, it does not rely on gravity to provide resistance, this increases its potential for use in more functional movement patterns that similar in daily activities and sports [9]. TheraBand exercise is a revolutionary replacement to traditional static stretching devices. Resistance exercise using the TheraBand is simple and economical and has safety advantages. It is generally used for rehabilitation purposes because training can be selected case by case through free control of the loading intensity. Several studies have reported that strengthening exercise using the TheraBand for the upper and lower extremities improves strength and balance abilities. TheraBand can be used as an alternative to other strength training sessions since they can be used in all age groups due to their extensive availability and low cost as well as operating more than one region at the same time; moreover, they can be applied anywhere without any difficulties [10]. The results of different studies have suggested that resistance exercises and training using Thera-Band can have positive effects on flexibility, mobility, quality of sleep, daily activities, ability to stand and walk, reduced knee pain, metabolic parameters, and body fat [11]. As for the resistance produced by the TheraBand, it increases with stretching of the band while allowing the multiple joints to work at the same time. In addition, as the exercise range of motion increases, the resistance provided by the TheraBand increases, which increases the muscle fiber count. Increased number of muscle fibers leads to increased adaptation to the exercise-acquired muscle strength [12]. Resistance band training is now used widely as part of general fitness and strength training. Typically, the bands are color coded to show different levels of resistance and users need to select an appropriate level and are simple to use and their light weight allows people to easily carry them if traveling and continue with routine sessions for strength training [13].TheraBand can be used at the same time to train one or more joints. They could also theoretically be used as a realistic substitute for resistance training. Elastic resistance bands have been reported as a useful tool for improving muscle strength in young and elderly [12, 13].

Materials and Methods

Materials

- TheraBand
- Couch
- Informed consent form.
- Data collection sheet.
- Visual analogue scale.
- SPADI

Methodology

30 subjects diagnosed with shoulder impairment by physician/orthopedician and referred to department of physiotherapy will be taken for the study by purposive sampling method. The subjects will be examined for exclusion and inclusion criteria. The subjects fulfilling the inclusion criteria will be taken for this study. They will be explained about the study and an informed consent will be obtained from them. The subjects willing to participate will be included into the study. Then, 15 subjects each will be assigned to two groups i.e., group A (TheraBand exercises) and group B (conventional exercises) by simple random sampling (lottery method) procedure. The baseline data of study outcome measure i.e., pain and disability in visual analogue scale and SPADI will be measured and noted.

Study outcome measure

1. visual analogue scale (VAS)
2. Shoulder pain and disability index (SPADI)

Procedure

Phase 1: Ethical clearance The Synopsis was submitted to the institutional research committee (IRC) and permission was obtained.

Phase 2: Enrolement of Participants. On getting permission from IRC to carry out the study, participants were enrolled based on the inclusion and exclusion criteria. An informed consent was taken from the participants before beginning the study.

Phase 3: Data Collection 15 subjects each in the group A and group B were received the below stated interventions and were tested for pain and disability by using VAS and SPADI

Group A: Experimental groupThera Band exercises 15subjects in this Group were given TheraBand exercises. Shoulder flexion, extension, abduction, internal and external rotation was performed using TheraBand. Above exercises were started with 2-3 sets of 10-15 repetitions. The exercises were started with the yellow color and progressed to red. Progression to next color was considered when individual

was able to easily complete 3 sets of 10-15 repetitions. The intervention was given 5 times a week for four weeks.

Group B: Experimental Group-Conventional exercise.
15 subjects of this group were given conventional exercises. Shoulder girdle exercises Scapular protraction, retraction, elevation, and depression were given. Patient was sitting, with the arm supported. Assist elevation, depression, protraction, or retraction with pressure directly on the scapula in the direction opposite the motion. Treatment protocol Duration of each session: 15min Duration between each repetition: 3sec Sessions: 1 session/day Repetitions: 10 reps Hold time: 5 seconds. Frequency: 3 times a day Duration: 4 weeks in alternative days.
Active exercises Codman's Pendulum: Progress to 3-5 minutes. Repeat 5 times each day. Stick Exercises: Repeat 5 times per day, 10 repetitions. Wall Climb: At the peak, hold for 15-30 seconds. 10-15 repetitions, repeat 5 times per day. Capsular stretches: Hold for 15-30 seconds, 5 repetitions, 5 times per day. Posterior, anterior, and inferior capsule stretches was given

Fig 1: Photographs of a participant of Group A performing TheraBand Exercise

Fig 2: Photographs of a participant of Group B performing Conventional Exercise

Does the study require any investigations to be conducted on patients or other human/animal? Describe briefly
Yes, pain and disability in visual analogue scale and SPADI will be measured and noted.
Has ethical clearance been obtained from your institution in case of?
Yes

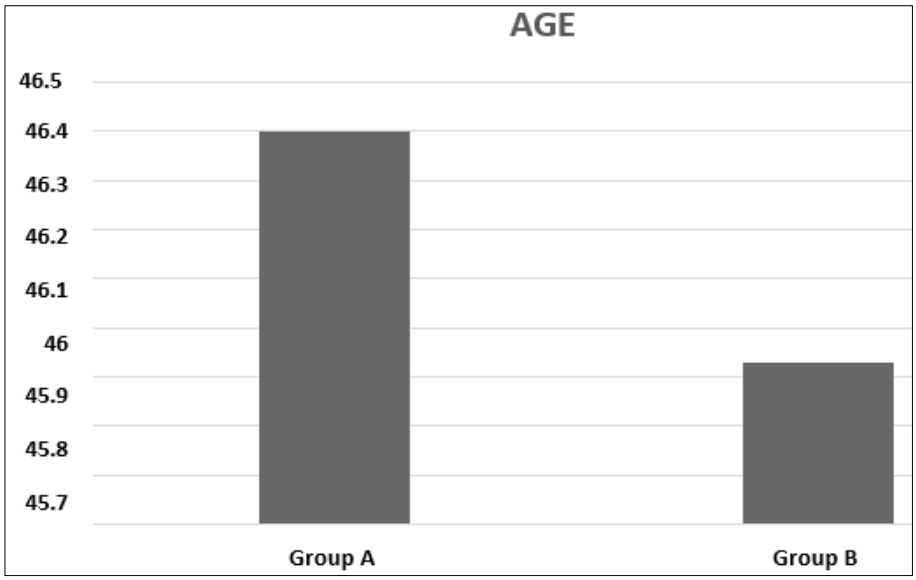
Results: In the present study 30 subjects were recruited, with 15 in each group. Participants of Group A were examined for effectiveness of TheraBand strengthening exercise and Group B were examined for effectiveness of conventional exercise among patients with shoulder impairment. Before the intervention recruited participants were subjected to the pain and disability evaluation with intended Standardized outcome measures, VAS and SPADI. The data collected before and after intervention was subjected to various statistical tests with respect to analysis of age and study parameters. Data was also subjected to test of hypothesis of the study.

Table 1: Independent test

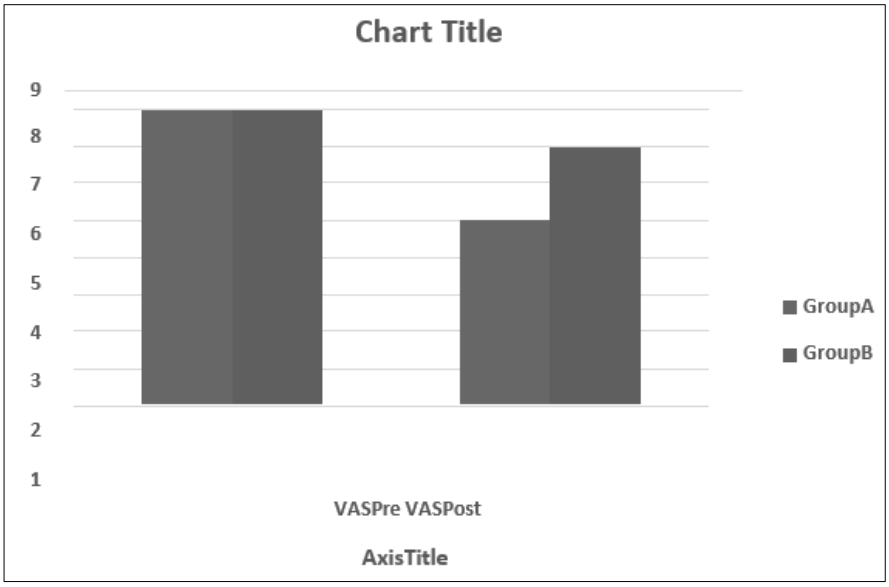
	Group A (n=15)	Group B (n=15)	t	P Value
	Mean± sd	Mean± sd		
AGE	46.4±6.25	45.93±6.46	0.201	0.842
VAS Pre	8±0.85	7.87±1.13	0.367	0.716
VAS Post	5.13±0.83	6.87±1.25	-4.478	<0.001
VAS Difference	2.87±0.52	1±0.54	9.727	<0.001
SPADI Pre	80.66±5.21	81.44±4.98	-0.419	0.678
SPADI Post	33.93±3.24	51.74±4.27	-12.88	<0.001
SPADI Difference	46.73±4.85	29.7±6.35	8.252	<0.001

Analysis of age and study outcome measures

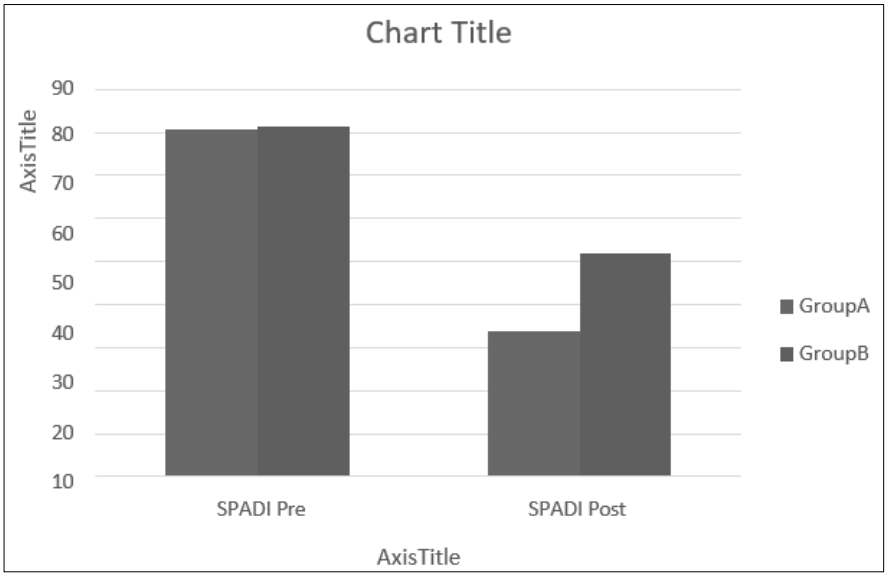
Interpretation
Comparison of the AGE between the two groups how that AGE is higher in Group A group with at value of 0.201 and is statistically non-significant with a p value of 0.8.
Comparison of the VAS Pre between the two groups shows that VAS Pre is higher in Group A group with at value of 0.367and is statistically non-significant with a p value of 0.716.
Comparison of the VAS Post between the two groups shows that VAS Post is higher in Group B group with a t value of-4.478 and is statistically significant with a p value of<0.001
Comparison of the VAS Difference between the two groups shows that VAS Difference is higher in Group A group with a t value of 9.727 and is statistically significant with a p value of <0.001.
Comparison of the SPADI Pre between the two groups shows that SPADI Pre is higher in Group B group with at valueof-0.419and is statistically nonsignificant with a p value of 0.678
Comparison of the SPADI Post between the two groups shows that SPADI Post is higher in Group B group with a t value of-12.88 and is statistically significant with a p value of <0.001.
Comparison of the SPADI Difference between the two groups shows that SPADI Difference is higher in Group A group with at value of 8.252 and is statistically significant with a p value of <0.001.



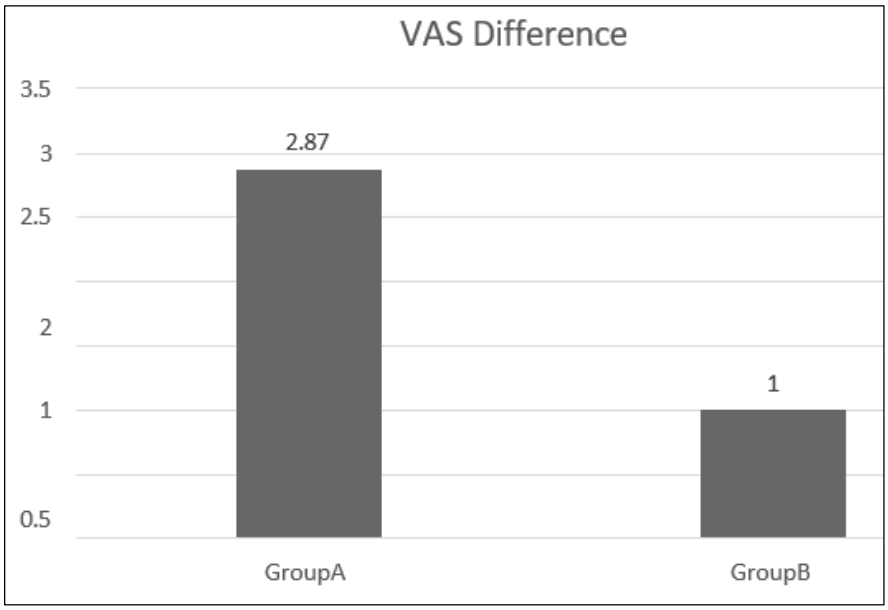
Graph 1: Representation of the number of subjects in each age groups



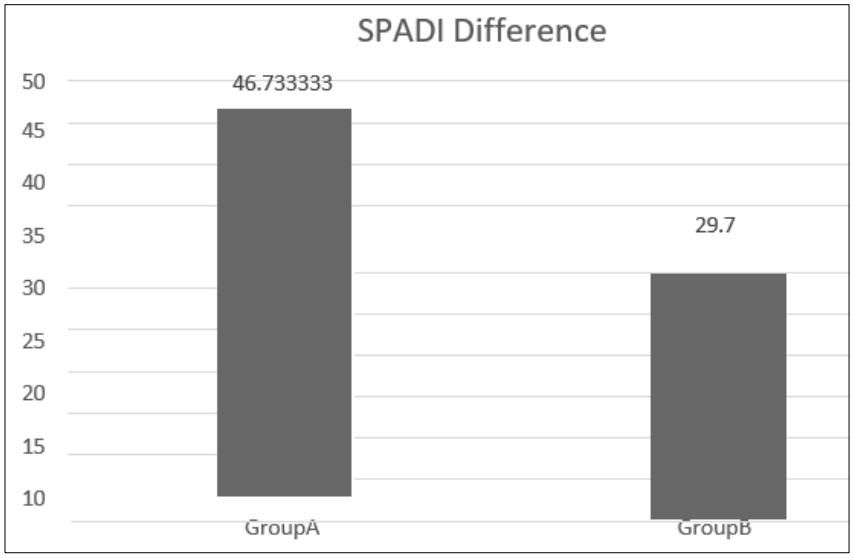
Graph 2: Representation of pre and post VAS difference in both groups



Graph 3: Representation of pre and post SPADI difference in both groups



Graph 4: Representation of VAS differences in Group A and Group B



Graph 5: Representation of SPADI differences in Group A and Group B

Analysis of gender (Group A and group B)
Gender difference using chi-square test

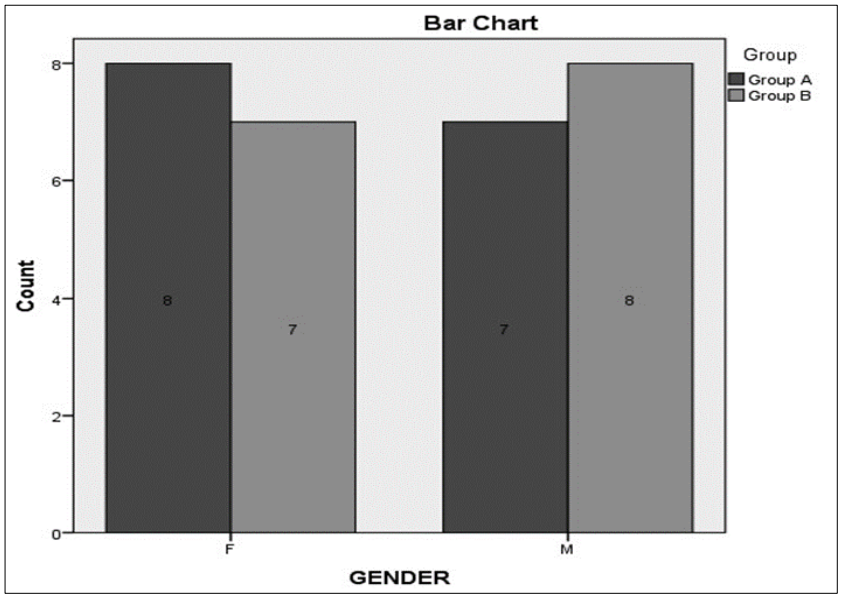
Table 2: Gender *Group Cross tabulation

			Group		Total
			Group A	Group B	
		Count	8	7	15
Gender	F	%within Group	53.3%	46.7%	50.0%
R		Count	7	8	15
	M	%within Group	46.7%	53.3%	50.0%
		Count	15	15	30
Total		%within Group	100.0%	100.0%	100.0%

Table 3: Chi- Square Tests

	Value	df	P value (<0.05is significant)
Pearson Chi-Square	.133	1	.715

Table 6.2: Analysis of gender (Group A and Group B)

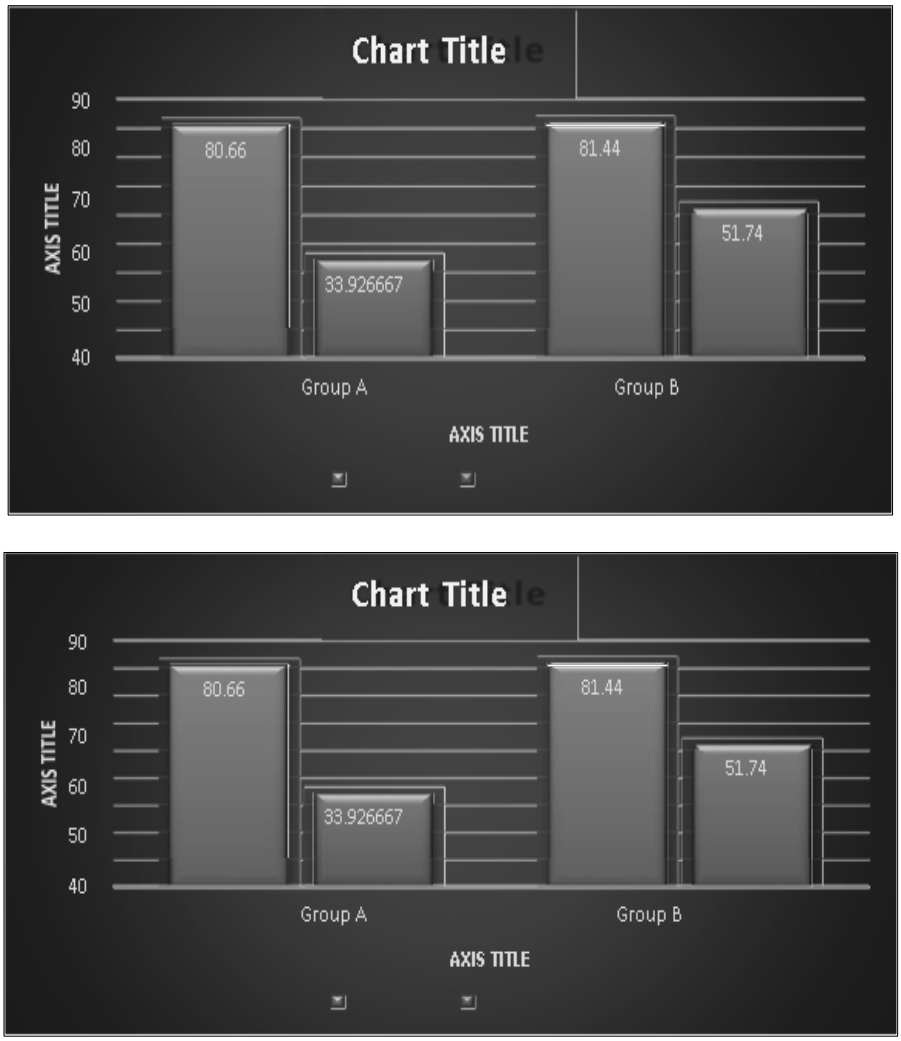


Graph 6: Representation of gender of Group A and Group B

Table 4: Analysis of the outcome measures of Group A and Group B separately

Paired test to compare before and after in each group separately

		N	Mean± SD	Mean difference ± SD	t	P Value
Pair1	VAS Pre	15	8±0.85	2.87±0.52	21.50	<0.001
	VAS Post	15	5.13±0.83			
Pair2	SPADI Pre	15	80.66±5.21	46.73±4.85	37.29	<0.001
	SPADI Post	15	33.93±3.24			
Pair1	VAS Pre	15	7.87±1.13	1±0.54	7.25	<0.001
	VAS Post	15	6.87±1.25			
Pair2	SPADI Pre	15	81.44±4.98	29.7±6.35	18.11	<0.001
	SPADI Post	15	51.74±4.27			



Graph 7: Representation of the outcome measures of Group A and Group B separately

Interpretation

Group A

- On comparison of the mean values of VAS Pre and VAS Post the mean values of VAS Pre is higher with a difference of 2.867 is statistically significant with a p value of <0.001.
- On comparison of the mean values of SPADI Pre and SPADI Post the mean values of SPADI Pre is higher with a difference of 46.7333333 is statistically significant with a p value of <0.001.

Group B

- On comparison of the mean values of VAS Pre and VAS Post the mean values of VAS Pre is higher with a difference of 1 is statistically significant with a p value of <0.001.
- On comparison of the mean values of SPADI Pre and SPADI Post the mean values of SPADI Pre is higher with a difference of 29.7 is statistically significant with a p value of <0.001.

Discussion

This study was designed to compare the effects of TheraBand strengthening with conventional exercise on pain and function among patients with shoulder impairment. It was an experimental comparative study. The given interventions were TheraBand strengthening and conventional exercise. 30 subjects between the age group of 35-55 years diagnosed with shoulder impairment were taken for the study and subjects were divided into two groups i.e., Group-A and Group-B with 15 subjects each. Comparison of the AGE between the two groups showed that AGE is higher in Group A group with a t

value of 0.201 and is statistically non-significant with a p value of 0.842 30 subjects diagnosed with shoulder impairment by physician/orthopedician and referred to department of physiotherapy were taken for the study by purposive sampling method. The subjects were examined for exclusion and inclusion criteria. The subjects fulfilling the inclusion criteria were taken for this study. They were explained about the study and an informed consent was obtained from them. The subjects willing to participate were included into the study. Then, 15 subjects each were assigned to two groups i.e., group A (TheraBand exercises) and group B (conventional exercises) by simple random sampling (lottery method) procedure. The baseline data of study outcome measure i.e., pain and disability in visual analogue scale and SPADI were measured and noted. A similar study was conducted by Selvakumar K *et al.* to analyze the effect of TheraBand strengthening with conventional exercise on pain, function, and range of motion in patients with Adhesive Capsulitis. 30 Patients with Adhesive Capsulitis were selected based on the inclusion and exclusion criteria. Group A received TheraBand strengthening with Conventional exercise and Group B received Conventional exercise. Range of Motion (ROM) of shoulder is measured using universal goniometer. Pain and Functional ability quantified with Shoulder Pain and Disability Index as outcome measures. The result proved that TheraBand strengthening of shoulder along with conventional exercise (GROUP A) is more effective than conventional exercise (GROUP B) in increasing the ROM, reduction of Pain and Disability and improve in Functional ability.1 Moradi M *et al.* done a study on Efficacy of throwing exercise with TheraBand in male volleyball players with shoulder internal rotation deficit: a randomized controlled trial. The result of this study suggests that improvement in neuromuscular control, strength, joint position sense and functional rotator cuff external rotation-internal rotation ratio in asymptomatic volleyball players with GIRD after an 8- week exercise-based intervention. This study showed that there was improvement in neuromuscular control, strength, joint position sense and functional rotator cuff ER-IR ratio in asymptomatic volleyball players with GIRD after an 8-15 week exercise-based intervention. Gustafson O conducted a study on Shoulder Impairment Following Critical Illness: A Prospective Cohort Study. Adult patients with an ICU length of stay of greater than 72 hours with no preexisting or new neurologic or traumatic upper limb injury were included in the study. The study showed that Shoulder impairment is a highly prevalent potential source of disability in ICU survivors. This persists at 6 months after discharge with a significant impact on upper limb function.5 Makela M et al conducted a study on Shoulder joint impairment among Finns aged 30 years or over: prevalence, risk factors and co-morbidity. A representative sample (n=7217) of the Finnish population aged >30 yr. participated in a health examination survey (the Mini-Finland Health Survey). The design of the survey allowed an independent assessment of disability, reported shoulder pain, shoulder joint impairment and major chronic co-morbidity. The result showed that shoulder impairment is an important component of ill health among the elderly and cannot be reduced to reported pain alone.4 Based on above result this study proved that the Group A i.e., TheraBand exercises had shown significant improvement in VAS and SPADI values and reduced pain and improvement in function among patients with shoulder impairment compared to the Group B i.e., conventional exercises. So, this study recommends using TheraBand exercises for reducing pain and improving function among patients with shoulder impairment.

Conclusion

This study aimed to compare the effects of TheraBand strengthening with conventional exercise on pain and function among patients with shoulder impairment. All the subjects who were allotted into group A received TheraBand exercises and the group B received conventional exercises for 4 weeks. This study showed that group A has better results than group B thus concluding that TheraBand exercises is more effective than conventional exercises for reducing pain and improving function among patients with shoulder impairment.

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