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A Comparative Study to Analyse the Efficacy of Rotator Cuff Strengthening Exercises Versus Scapular Stabilization Exercises to Reduce Pain and Regain Function in Patients with Shoulder Impingement Syndrome

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ABSTRACT

BACKGROUND AND PURPOSE: Shoulder impingement syndrome (SIS) is a painful condition with gradual restriction of all the movement of shoulder joint. Pain causes rotator cuff muscle dysfunction, leading to proximal humeral head migration, and subsequent subacromial bursitis.
The objective of this study was to evaluate and compare the effectiveness of rotator cuff strengthening exercises with ultrasound therapy and scapular stabilization exercises with ultrasound therapy to reduce pain and improve functions in patients with shoulder impingement syndrome.
METHODS: Forty patients with the history of shoulder impingement syndrome participated in this study. They were randomly assigned into two groups. Group A (n= 20) received Rotator cuff strengthening exercises and ultrasound therapy and Group B (n=20) received scapular stabilization exercises and ultrasound therapy. All participants of group A and group B performed the active exercises 3 sets of 10 repetitions. The training was carried out 3 times a week for a period of 8 weeks. The pain level, functional evaluation and ROM were assessed by VAS, SPADI and goniometer respectively at baseline and at the end of the 8th week of interventions.
RESULTS: The result showed significant improvement in all outcome measures in both the groups but rotator cuff strengthening exercises (group A) shows better improvement than scapular stabilization exercises (group B) with P value of 0.000.
CONCLUSION: The study concluded that rotator cuff strengthening exercises showed significantly better improvement compared to scapular stabilizing exercises in reducing pain and regaining functions in patients with shoulder impingement syndrome.

Keywords: Shoulder impingement syndrome, rotator cuff strengthening exercises, scapular stabilization exercises, shoulder pain and disability index, visual analogue scale

INTRODUCTION

Shoulder impingement syndrome (SIS) is defined as compression and mechanical abrasion of the rotator cuff structures as they pass beneath the coracoacromial arch during elevation of the arm[8]. It is broadly described as encroachment of the subacromial tissues due to narrowing of the subacromial space. SIS is commonly

referred to as painful arc syndrome, subacromial impingement syndrome, supraspinatus syndrome, swimmer's shoulder, or thrower's shoulder[14]. The prevalence of shoulder pain among those older than aged 70 is 13.2–26% whereas those adults younger than 70 years of age is 7–27% of which 70% suffers from subacromial impingement syndrome. The most common intrinsic cause of shoulder pain and disability is shoulder impingement syndrome[24]. It is characterized by pain and functional restrictions, mainly during overhead activities[8]. SIS can be classified into external and internal impingement where external impingement or subacromial impingement is the mechanical encroachment of soft tissue in the subacromial space and internal impingement is the encroachment between the humeral head and glenoid rim. It can also be classified into primary or secondary impingement such that structural narrowing of the subacromial space is seen in the primary impingement syndrome, whereas functional disorders are the basis of the secondary impingement syndrome[14]. Repetitive trauma, articular capsule abnormalities, overhead activity for prolonged periods, rotator cuff muscle weakness, abnormal scapular musculature and abnormal structure of the acromion are the most common risk factors of SIS[11].

The glenohumeral joint contributes 2° of elevation with 1° of scapulothoracic articulation where scapular muscle facilitates upper-extremity movement via the scapular motions of protraction, retraction, upward (lateral) rotation, and downward (medial) rotation[26]. Scapular positioning is important to center the humeral head and thus creates a stable base of support for shoulder movements during daily activities and sports participation[19]. Stability at the scapulothoracic joint depends on the surrounding musculatures. The scapular muscles must dynamically position the glenoid so that efficient glenohumeral movement can occur[18]. When weakness or dysfunction is present in the scapular musculature, normal scapular positioning and mechanics may become altered with decrease in scapular external rotation, upward rotation, and posterior scapular tilt leading to inefficiency in shoulder function, which can not only result in decrease in neuromuscular performance but may also increase the probability of shoulder injury[18,19].

The primary etiology of shoulder impingement, include anatomic abnormalities of the coracoacromial arch or humeral head, tension overload, ischemia, or degeneration of the rotator cuff tendons and abnormal kinematics of shoulder. Inflammation in the suprahumeral space, inhibition of the rotator cuff muscles, damage to the rotator cuff tendons, and altered kinematics are believed to exacerbate the condition[8].

The pathology relates to chronic repetitive mechanical process in which the conjoint tendon of the rotator cuff undergoes repetitive compression and micro trauma as it passes under the coracoacromial arch when the arm is abducted or rotated, the subacromial space width changes thereby increasingly compressing the cuff. The supraspinatus tendon is the most commonly implicated rotator cuff muscle in shoulder impingement as it is in close contact to the anterior inferior border of the acromion in 90 degrees of abduction with 45 degrees of internal rotation. There is avascular or 'Critical' zone near the supraspinatus tendon insertion at the greater tuberosity which increases in area with advancing age. Neer outlined 3 stages of shoulder impingement:

Stage 1 - a process of acute inflammation, oedema, and haemorrhage of the rotator cuff conjoint tendon. This stage affects younger patients normally aged below 25 years of age.

Stage 2- affects patients between 25-40 years of age and represents a continuation of the process, outlined in stage 1, to a more irreversible form. The tendon becomes swollen and there is increased friction. In

this stage, the rotator cuff tendon undergoes fibrosis and tendonitis.

Stage 3- affects older patients usually over the age of 40 years. The key factor in stage is that there is an actual mechanical disruption of the rotator cuff tendon in the form of either partial or complete cuff tears and changes also occur in the coracoacromial arch such as osteophyte formation[13].

Treatment of shoulder impingement syndrome is divided into conservative and surgical treatment[11].Conservative treatment consists of a wide range of procedures such as infiltration of corticosteroid, or local anesthetic, prolotherapy, kinesiotaping[20], cryotherapy, various types of manual therapy, manipulation techniques and joint mobilization procedure[17]. physical therapy modalities such as Transcutaneous electrical nerve stimulation[20], Laser therapy[12] and Ultrasound, which is a common treatment for a number of clinical conditions such as sprained ligaments, inflamed tendons and tendon sheaths, lacerations, soft tissue damage, scar tissue sensitivity and strained and torn muscles, inflamed and damaged joint capsules, fasciitis, and delayed-onset muscle soreness[29]. Ultrasound consists of high frequency mechanical vibration created when a generator produces electrical energy that is converted to acoustic energy through mechanical deformation of a piezoelectric cystal located within the transducer. UST has a frequency range of 1-3 MHz. Low frequency ultrasound waves have greater depth of penetration and a frequency of 1 MHz is absorbed primarily by tissues at a depth of 3-5cm, hence recommended for deeper injuries. A frequency of 3 MHz is recommended for superficial lesions at a depth of 1-2 cm. The amount of energy that reaches a specific site depends upon characteristics of ultrasound (frequency, intensity, amplitude) and tissues. The amount of energy in an ultrasound beam is expressed in watts[31]. The effects of ultrasound is to improve blood flow, increased capillary permeability and tissue metabolism, enhancement of tissue extensibility, elevation of pain threshold, and alteration of neuromuscular activity leading to muscle relaxation[12].

Exercise interventions targeting rotator cuff and scapular muscles demonstrate significant reduction in pain and functional improvement[6]. Scapular stabilization exercises on a scapular plane can be employed to correct abnormal scapular location and movement function disorders related to abnormal dynamic adjustment and to stabilize the entire shoulder girdle in patients with shoulder joint damage or immediately after surgery as it does not place excessive force on the shoulder joint[11]. It provides an additional benefit of a stable base and improved mechanics for unimpeded shoulder mobility[5].

The closed-chain axial loading exercises are the primary means of early shoulder rehabilitation[30]. According to DeLorme, a progressive resistance training, improves muscle strength. It is the gradual increase of load to improve strength with increase in local resistance, number of repetitions, volume of training, speed of repetitions followed by appropriate rest period[24]. It progresses based on the patient's ability to perform a higher number of repetitions at a given load without increasing symptoms[1]. Functional mobility retraining, muscular strengthening and stretching of the soft tissues of shoulder reduces pain, functional loss and also restores shoulder kinematics or muscle activity patterns[22]. Physical therapy intervention aims to improve shoulder range of motion, glenohumeral joint mobility, and muscular strength of the trapezius, serratus anterior and rotator cuff [5].

OBJECTIVES OF THE STUDY:

To analyse the effectiveness of ultrasound therapy and rotator cuff strengthening exercises versus ultrasound therapy and scapular stabilization exercises to reduce pain and improve functions in patients with shoulder impingement syndrome.

MATERIALS & METHODS

MATERIALS:

Couch and pillow, chair, therapeutic ultrasound machine, dumbbells, ultrasonic gel and cotton, goniometer, a towel roll.

SOURCE OF DATA:

Navodaya College of Physiotherapy (NCP) and Navodaya Medical College Hospital and Research Center, Raichur (NMCH).

RESEARCH DESIGN: A comparative study.

SETTING OF STUDY:

Navodaya medical college hospital and research center, Raichur. Orthopaedic Physiotherapy Department.

VARIABLES:

Independent variables:

- Rotator cuff strengthening exercises using dumbbell.
- Scapular stabilization exercises.
- Ultrasound Therapy.

Dependent variables:

- Shoulder pain and disability index (SPADI).
- Visual analogue scale (VAS).
- Goniometer.

SAMPLE AND SAMPLING TECHINQUES:

- Simple random sampling technique was used to allocate the patients.
- Total sample consisted of 40 patients with shoulder impingement syndrome.
- Each group consisted of 20 patients.

Group A: Rotator cuff strengthening exercises and ultrasound therapy.

Group B: Scapular stabilization exercises and ultrasound therapy.

INCLUSION CRITERIA:

1. Aged between 18 and 65 years.
2. Experiences pain before 150° of active shoulder elevation in any plane.
3. Positive Neer or Hawkins–Kennedy test indicating impingement.
4. Pain on resisted lateral abduction or Jobe test.
5. History of proximal anterior or lateral shoulder pain persisting for more than 1 week in the last six months.
6. Tenderness on palpation of rotator cuff tendon.
7. Pain and weakness on resistance to internal rotation, external rotation, or scapular plane elevation.

EXCLUSION CRITERIA:

1. Intra-articular steroid injection.
2. Fractures of the scapula, clavicle or humerus.
3. Glenohumeral dislocation/subluxation.
4. Concomitant cervical symptoms consistent with radiculopathy.
5. History of a shoulder surgery within the previous 12 weeks.
6. Osteoarthritis greater than grade 2 on the Kellgren-Lawrence scale.
7. Full-thickness rotator cuff tear.
8. Adhesive capsulitis.
9. Peripheral nerve lesions.

OUTCOME SCALES:

- By using Shoulder pain and disability index (SPADI).
- Visual analogue scale (VAS).

Goniometer.

STUDY DURATION: One year duration.

METHODOLOGY

Procedure:

Forty subjects, within age group 18-65 years, fulfilling the inclusion and exclusion criteria diagnosed with shoulder impingement syndrome participated in this study.

A brief explanation of the process was given to prepare the subjects after obtaining the informed consent.

Pre-assessment were taken prior to the commencement of treatment with self-report outcome measures of VAS, which is a 10 cm line (0= no pain, 10=the worst pain imaginable), shoulder ROM was measured using Universal goniometer and shoulder disability assessed with SPADI, it consisting

of 13 items, divided into two subscale: pain-5 items and disability-8 items.

After evaluation, the 40 subjects were equally divided into two groups:

Group A: Patients (n=20) received rotator cuff strengthening exercises and ultrasound therapy.

Group B: Patients (n=20) in this group received scapular stabilization exercises with ultrasound therapy.

TREATMENT PROTOCOL

GROUP A:

ROTATOR CUFF STRENGTHENING EXERCISES PROGRAM:

- Muscle strength assessment using a repetition maximum (RM) exercise according to DeLorme.
- Patients were performed 6 repetitions with the maximum bearable weight, thereby determining the 6-repetition maximum (6 RM).
- Once the 6 RM load was determined, training divided into the following regimen:

2 sets of 8 repetitions,

- the first set with 50% of the 6 RM and
- the second set with 70% of the 6 RM, depending on patient's pain threshold.

- Between the first and second set, there was 2 minutes of rest period and the speed of movement was 2 seconds for both the eccentric and concentric phases.

The exercises included:

- Full can,
- Internal rotation,
- External rotation,
- Abduction and
- Prone extension exercises of the shoulder.

- All the exercises were performed using dumbbell. Training was carried out 3 times a week for a period of 8 weeks.
- Full can exercise performed in sitting position and instructed to grasp the dumbbell then elevation of shoulder in scapular plane.
- Internal rotation and external rotation in side lying position with a towel roll under the elbow joint. Patient instructed to lie on the unaffected side, then patient rotate the affected shoulder to full range of motion using dumbbell.
- Shoulder abduction was performed in side lying position and prone shoulder extension in neutral position.
- Each individual was performed warm-up for 5 minutes with one set of 8 repetitions at 30% of resistance, prior to the exercise.

GROUP B:

SCAPULAR STABILIZATION EXERCISES:

Scapular stabilization exercise included:

- Wall push up exercise,
- Wall slide exercise,
- Scapular protraction and retraction,
- Scapular clock exercise and
- Prone shoulder abduction.

- During wall push up patient was in standing position with partial weight bearing against a wall.
- While performing wall slides, instructed to increased resistance by pushing the ulnar border of the forearm against the wall as the hands slide upward.
- Scapular protraction and retraction was performed in side lying position. Passive manual resistance to protraction and retraction applied without stressing on the glenohumeral joint using a pillow such that the glenohumeral joint is in slight abduction and forward flexion during scapular motion.
- Prone shoulder abduction performed in the plane of scapula above 120^{o}.
- Scapular clock exercise was performed with hand placed on the wall at 12 o'clock/ 6 o'clock position (elevation/ depression) and 3 o'clock/ 9 o'clock position (retraction/protraction).
- All the mentioned exercises were conducted for 3 sets of 10 repetitions 3 times per week for a period of 8 weeks.

ULTRASOUND THERAPY for both group A and group B:

Patients received ultrasound therapy for a period of 3 times a week for 8 weeks.

Treatment parameters used:

- Mode: pulsed mode.
- Frequency: 1 MHZ.
- Intensity: 1 W/cm^2.
- Treatment time: 8 minutes.
- Coupling Media: Ultrasonic gel.

Patient position:

Patients were sitting on a stool with affected arm supported over the pillow. The painful area of the affected shoulder treated by using slow circular movements, with the transducer head over the superior and anterior periarticular regions of glenohumeral joint and in the surrounding area.

Statistical Analysis

Analysis was done by independent sample 't' test and paired 't' test.

RESULT

A comparative study consisting of 40 subjects were randomized into 2 equal groups with 20 subjects in group A received ultrasound therapy and rotator cuff strengthening exercises and group B received ultrasound therapy and scapular stabilization exercises to study the significance difference between two groups. All participants in both groups completed the treatment period.

Table 1: Comparison of age

	Group	N	Mean	Std. Deviation	Std. Error Mean
Age	Group - A	20	48.2000	8.58150	1.91888
	Group - B	20	44.1500	8.08035	1.80682

Table 2: Comparison of sex

Sex	Group - A		Group - B		P Value
	No.	%	No.	%	
Male	13	65	12	60	0.744
Female	7	35	8	40	
Total	20	100	20	100	

Group A has 13 male subjects and 7 female subjects, and Group B has 12 male and 8 female subjects.

GROUP A

Table 3: Intra group comparison of mean between pre and post-test of Group A

Group - A		Mean	N	Std. Deviation	" t " Value	P Value
VAS	Pre Test	7.1	20	0.852	17.394	0.000
	Post Test	3.65	20	0.813		
SPADI Pain	Pre Test	35.25	20	5.476	22.243	0.000
	Post Test	21.8	20	5.126		
SPADI Disability	Pre Test	52.75	20	8.453	17.015	0.000
	Post Test	23.55	20	4.729		
Flexion	Pre Test	116.6	20	11.454	21.624	0.000
	Post Test	165.8	20	9.384		
Abduction	Pre Test	104.9	20	10.597	25.896	0.000
	Post Test	150.8	20	11.335		
Internal Rotation	Pre Test	40.1	20	6.121	15.986	0.000
	Post Test	63	20	7.469		
External Rotation	Pre Test	46.6	20	7.639	18.624	0.000
	Post Test	64.65	20	6.450		

The data in table 3 shows intra group comparison of mean pre and post-test of GROUP-A:

Group A intra comparison of VAS, SPADI and ROM of pre and post mean values were statistically analyzed by paired t test.

The mean value of VAS on pre and post test were 7.1±0.852 and 3.65±0.813 respectively. The pre and post test mean of pain in SPADI were 35.25 ± 5.476 and 21.8 ±5.126 and the mean of disability were 52.75± 8.453 and 23.55 ± 4.729 respectively.

The pre and post test of mean value for flexion were 116.6±11.454 and 165.8±9.384, for abduction mean value were 104.9± 10.597 and 150.8±11.335,for internal rotation mean were 40.1±6.121 and 63±7.469, for external rotation pre and post mean value were 46.6±7.639 and 64.65±6.450 respectively, Comparison of all the variables for pre and post-test in Group A were highly significant with p value 0.000.

GROUP B

Table 4: Intra group comparison of mean between pre and post-test of Group B

Group - B		Mean	N	Std. Deviation	" t " Value	P Value
VAS	Pre Test	7.4	20	0.940	21.476	0.000
	Post Test	5.05	20	0.999		
SPADI Pain	Pre Test	36.2	20	4.641	15.239	0.000
	Post Test	26.6	20	3.136		
SPADI Disability	Pre Test	53.05	20	6.549	18.146	0.000
	Post Test	31.6	20	4.358		
Flexion	Pre Test	117.2	20	9.501	16.028	0.000
	Post Test	151.8	20	8.186		
Abduction	Pre Test	102.45	20	8.642	13.777	0.000
	Post Test	128.55	20	8.709		
Internal Rotation	Pre Test	40.35	20	6.491	23.405	0.000
	Post Test	54.05	20	6.794		
External Rotation	Pre Test	46.75	20	7.601	20.142	0.000
	Post Test	51.7	20	7.463		

The data in table 4 shows intra group comparison of mean pre and post-test of GROUP-B:

Group B intra comparison of VAS, SPADI and ROM of pre and post mean values were statistically analyzed by paired t test.

The mean value of VAS on pre and post test were 7.4±0.940 and 5.05±0.999 respectively. The pre and post test mean value of pain in SPADI were 36.2±4.641 and 26.6±3.136, and the mean value of disability were 53.05± 6.549 and 31.6±4.358 respectively.

The pre and post test mean for flexion were 117.2±9.501 and 151.8±8.186, for abduction mean value were 102.45±8.642 and 128.55±8.709, for internal rotation mean were 40.35 ±6.491 and 54.05 ±6.794, for external rotation pre and post mean value were 46.75±7.601 and 51.7±7.463 respectively. Comparison of all the variables for pre and post-test in Group B were highly significant with p value 0.000.

Inter group post-test comparison of mean value between Group A and Group B:

Table 5: Inter group VAS post-test comparison of mean values between Group A and Group B

	Group	N	Mean	Std. Deviation	" t " Value	P Value
VAS	Group - A	20	3.65	0.813	4.863	0.000
	Group - B	20	5.05	0.999		

The post test mean of VAS in group A was 3.65±0.813, and in group B was 5.05±0.999. The P value of post test Visual Analogue scale is 0.000 that is the comparison of post test mean between group A and group B is statistically significant.

Table 6: Inter group SPADI (pain) post-test comparison of mean values between Group A and Group B

	Group	N	Mean	Std. Deviation	" t " Value	P Value
Pain	Group - A	20	21.8	5.126	3.572	0.001
	Group - B	20	26.6	3.136		

The post test mean of pain in group A was 21.8±5.126, and in group B was 26.6±3.136. The P value of post test SPADI (pain) is 0.001 that is the comparison of post test mean between group A and group B is highly significant.

Table 7: Inter group SPADI (Disability) post-test comparison of mean values between Group A and Group B

	Group	N	Mean	Std. Deviation	" t " Value	P Value
SPADI Disability	Group - A	20	23.55	4.729	5.598	0.000
	Group - B	20	31.6	4.358		

The post test statistical analysis of group A shows mean of disability 23.55±4.729, and group B shows mean of disability 31.6±4.358. The P value of post test SPADI (Disability) is 0.000 that is the comparison of post test mean between group A and group B is statistically significant.

Table 8: Inter group Flexion (ROM) post-test comparison of mean values between Group A and Group B

	Group	N	Mean	Std. Deviation	" t " Value	P Value
Flexion	Group - A	20	165.8	9.384	5.028	0.000
	Group - B	20	151.8	8.186		

The post test mean of Flexion in group A was 165.8±9.384, and in group B was 151.8±8.186. The P value of post test Flexion (ROM) is 0.000 that is the comparison of post test mean between group A and group B is highly significant.

Table 9: Inter group Abduction (ROM) post-test comparison of mean values between Group A and Group B

	Group	N	Mean	Std. Deviation	" t " Value	P Value
Abduction	Group - A	20	150.8	11.335	6.961	0.000
	Group - B	20	128.55	8.709		

The post test statistical analysis of group A shows mean of Abduction 150.8±11.335, and group B shows mean of Abduction 128.55±8.709. The P value of post test Abduction (ROM) is 0.000 that is the comparison of post test mean between group A and group B is statistically significant.

Table 10: Inter group Internal Rotation (ROM) post-test comparison of mean values between Group A and Group B

	Group	N	Mean	Std. Deviation	" t " Value	P Value
Internal Rotation	Group - A	20	63	7.469	3.964	0.000
	Group - B	20	54.05	6.794		

The post test statistical analysis of group A shows mean of Internal Rotation 63±7.469, and group B shows mean of Internal Rotation 54.05±6.794. The P value of post test Internal Rotation (ROM) is 0.000 that is the comparison of post test mean between group A and group B is highly significant.

Table 11: Inter group External Rotation (ROM) post-test comparison of mean values between Group A and Group B

	Group	N	Mean	Std. Deviation	" t " Value	P Value
External Rotation	Group - A	20	64.65	6.450	5.871	0.000
	Group - B	20	51.7	7.463		

The post test statistical analysis of group A shows mean of External Rotation 64.65±6.450, and group B shows mean of External Rotation 51.7±7.463. The P value of post test External Rotation (ROM) is 0.000 that is the comparison of post test mean between group A and group B is highly significant.

The result showed reduction of pain and disability, and increase active range of shoulder flexion, abduction, internal rotation and external rotation and regaining functional status in both the groups after 8 weeks. But Group A is showed statistically better improvement in outcome measures as compared to Group B with P value of 0.000.

DISCUSSION

This Present study is conducted to analyse the effectiveness of rotator cuff strengthening exercises with ultrasound therapy versus scapular stabilization exercises with ultrasound therapy to reduce pain and regain function in patients with shoulder impingement syndrome. Currently, found that very limited studies have been conducted to determine the rotator cuff strengthening exercises and scapular stabilization exercises in shoulder impingement syndrome as two individual studies but there is no literature proving one is more effective than other, hence the need arise for comparing the two interventions.

In this study VAS was used for measuring shoulder pain, Goniometer for shoulder range of motion and SPADI for shoulder pain and disability as their validity and reliability are established. All outcome measures showed improvement in reducing pain and regain function in both groups but Group A (Rotator cuff strengthening and ultrasound therapy) showed more significant improvement with P value of 0.000 compared to Group B in post training.

The major findinds of this study that after 8 weeks both the group have shown significant improvement from baseline in range of motion, reduction of pain and disability. However, rotator cuff strengthening exercises with ultrasound therapy showed significantly better improvement compare to scapular stabilizing exercises with ultrasound therapy.

Progressive resistance exercise (PRE) is a system of dynamic resistance training in which a constant external load is applied to the contracting muscle by some mechanical means (usually a free weight or weight machine) and incrementally increased. It progresses based on the patient's ability to perform a higher number of repetitions at a given load without increasing symptoms. PRE programs improve the force-generating capacity of muscle that may carry over to improvement in physical performance.

Antonio Carlos Da Silva et al conducted a randomised control trial to assess pain, function, and muscle strength in with Shoulder impingement syndrome. Patients from experimental group showed an improvement in VAS regarding pain, function and Goniometric measurement of shoulder ROM were statistically significant. Thus, the study concluded that PRE program for the musculature of the shoulder patients with shoulder impingement syndrome was effective in reducing pain and improving function and quality of life.

Christina Blume et al reported both eccentric and concentric PRE program resulted in improved function, AROM and strength in patient with SIS. The use of exercise testing protocol appears to be a safe method for selecting and progressing resistance for shoulder rehabilitation exercises. The method used in the current study demonstrated appropriate exercise dosing to accomplish meaningful strength

and functional gains in an efficient amount of time for patients with subacromial impingement syndrome.

The positions of the shoulder in forward flexion, horizontal adduction, and internal rotation during elevation, acceleration and follow-through phases of the throwing motion are likely to produce impingement due to abrasion of the supraspinatus, infraspinatus, or biceps tendon. Brox et al studied a population with stage II shoulder impingement syndrome. The authors found more improvement regarding pain in the group that performed exercise training, included strengthening exercises performed twice a week for a period of 3-6 months.

The result showed reduction of pain and disability, and increase active range of shoulder flexion, abduction, internal rotation and external rotation and regaining functional status in both the groups after 8 weeks of interventions. But based on post-test comparison between two experimental groups, it can be said that Group A (Rotator cuff strengthening exercises with Ultrasound Therapy) has showed statistically better improvement in all outcome measures as compared to Group B (Scapular Stabilizing exercises with Ultrasound Therapy) with P value of 0.000.

CONCLUSION

This study revealed that the both group A (rotator cuff strengthening exercises with ultrasound therapy) and group B (scapular stabilization exercises with ultrasound therapy), showed significant improvement in reduction of pain and disability, and improving functions in patients with shoulder impingement syndrome.

But when compared to scapular stabilization exercises group, the rotator cuff strengthening exercises group showed statistically highly significant improvement in all outcome measures.

Hence, this study concludes that the rotator cuff strengthening exercises is more effective than the scapular stabilization exercises to reduce pain and regain function in patients with shoulder impingement syndrome.

Declaration by Author

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