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## Research Article

### EFFECTIVENESS OF ULTRASOUND THERAPY IN COMBINATION WITH MANUAL THERAPY & SHOULDER EXERCISES FOR SUB-ACROMIAL IMPINGEMENT SYNDROME

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#### ABSTRACT

##### Aim

To Study The Comparison Between Effects of Ultrasound Therapy In Combination With Manual Therapy & Shoulder Exercises Alone For Sub Acromial Impingement Syndrome.

##### Objectives

1. To Assess The Effectiveness of Ultrasound Therapy When Added To Manual Therapy & Shoulder Exercises In The Rehabilitation of Patients With Sub Acromial Impingement Syndrome.
2. To Assess the Effectiveness of Manual Therapy & Shoulder Exercises In Treating Sub Acromial Impingement Syndrome
3. To Assess The Effectiveness of The Ultrasound With Manual Therapy And Shoulder Exercises.

##### Conclusion

The result of this study show that control and intervention are effective in improving. Rom in Abduction, External Rotation, Internal Rotation Additionally, Ultrasound Technique Is Proved To be more Effective In Improving The Rom, Pain, Spdi As Compared To Control Group Among Shoulder impingement syndrome patients. Although ultrasound technique also showed to be more effective in improving the pain as compared to control technique. Therefore, Ultrasound Technique Can Be Used In Day To Day Practice of Physiotherapy as A Treatment Protocol For A Positive Effect Among Shoulder Impingement Syndrome

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#### INTRODUCTION

Sub acromial impingement syndrome (SIS) is a painful impingement of the supraspinatus tendon and sub acromial bursa between the head of the humerus and coracoacromial arch, which is a frequent cause of shoulder pain<sup>1</sup>. It is characterized by severe pain in the anteroposterior and lateral shoulder extending to the deltoid and biceps area. It is caused by overuse or repetitive micro trauma sustained in the overhead position<sup>2</sup>. It is currently believed that stiffness and thickening of the coracoacromial ligament, lesions to the long head of the biceps, sub acromial bursitis and partial or full thickness tears of the rotator cuff and abnormal scapular kinematics are the different aetiologies for SIS<sup>3</sup>.

Physiotherapy is often the first choice of treatment for SIS. Between 10 to 30% of all shoulder patients seen in primary care are referred to physiotherapy after initial presentation,

Physiotherapy is widely used in the management of SIS which includes various treatment methods such as shoulder exercises, manual therapy, and electrotherapy. Physiotherapy has been found to be effective in reducing pain and disability in patients with shoulder impingement<sup>4</sup>.

Ultrasound is a commonly used electrotherapeutic modality for impingement as well as other forms of tendinitis and muscle injury. Therapeutic ultrasound is a modality commonly used by physiotherapist<sup>5</sup>. Ultrasound therapy works by driving alternating compression and rarefaction of sound waves with a frequency of more than 20,000 cycles per seconds. Therapeutic ultrasound may have two types of benefits, namely thermal effects and non-thermal effects. Thermal effects aid in pain relief whereas non-thermal effects enhance cell-repair effects of the inflammatory response. Reduction in pain and induce tissue repair helps in regaining the reduce range of motion due to SIS<sup>6</sup>.

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When recovering from a shoulder injury physiotherapy exercises are an integral part in regaining the range of motion, muscle elasticity, and strength<sup>7</sup>. Therapeutic exercises can be defined as the use of active or assisted exercises aimed at improving the range of motion, strength or dynamic neuromuscular control of joint motion, whereas manual therapy can be defined as the use of manually and/or mechanically applied movement techniques to improve joint motion. Both therapeutic exercises and manual therapy are commonly used as part of physiotherapy programs aimed at improving shoulder kinematics<sup>8</sup>. Therapeutic exercise focusing on strengthening the rotator cuff and scapula stabilizing musculature has been shown to be effective in treating shoulder impingement symptoms<sup>9</sup>.

Manual or manipulative therapy encompasses the treatment of health ailments of various etiologies through “hands-on”, physical intervention<sup>10</sup>. Various manual therapy techniques have proved to be effective for SIS<sup>11</sup>. Stretching reduces capsular tightness and a few studies have evaluated the effectiveness of incorporating glenohumeral joint mobilizations for SIS<sup>12</sup>.

### **Aim and Objectives**

#### **Aim**

To study the comparison between effect of ultrasound therapy in combination with manual therapy & shoulder exercises alone for subacromial impingement syndrome.

#### **Objectives**

- To assess the effectiveness of ultrasound therapy when added to manual therapy & shoulder exercises in the rehabilitation of patients with subacromial impingement syndrome.
- To assess the effectiveness of manual therapy & shoulder exercises in treating subacromial impingement syndrome
- To assess the effectiveness of the ultrasound with manual therapy and shoulder exercises.

#### **Study Design**

Comparative Experimental Study design (two-group pretest-posttest experimental study design)

#### **Source of Data**

Dr. Ulhas Patil Hospital & Medical College.

#### **Sampling Method**

Random sampling.

**Sample Size:** Sample size was 30 based on the selection criteria.

#### **Criteria for sampling**

#### **Inclusion criteria**

1. Age between (25-55yrs)
2. Main complaints in glen humeral joint region or proximal arm.
3. Documented X-Ray or evidence of sub acromial impingement through physical examination.

4. Presence of 2 of following signs indicating SIS.
5. Neer impingement test,
6. Hawkins-Kennedy impingement test,
7. Painful arc with active abduction / flexion.
  - a. Pain in 2 of following resistance tests: external rotation, internal rotation, abduction/flexion.
  - b. Pain at rest or with free movement against resistance with score on the visual analogue scale (1-8)/10.

#### **Exclusion Criteria**

1. Primary scapulothoracic dysfunction due to paresis.
2. Diagnosed instability or previous history of dislocation
3. More than 1/3 restriction of elevation compared to the unaffected side.
4. Sustain shoulder weakness or loss of active shoulder function.
5. Shoulder surgery in the last 12 month on the involved side.
6. Involvement with sensory & muscular deficits.
7. Radiological findings of tumors lesions, avascular necrosis, glenoid development defects, acromial bone, severe degenerative signs affecting interarticular space & fractures.

#### **Outcome Measures**

- Visual Analogue Scale
- Shoulder Disability Index
- Range of motion.

#### **Material Used For Study**

- Pen
- Paper
- Universal goniometer
- Ultrasound therapy apparatus
- Weight cuffs
- Therabands

#### **Procedure**

The study was conducted after obtaining the approval from the institutional ethical committee (IEC).

A total of 34 patients who are affected by SIS were screened for the study considering the inclusion and exclusion criteria. Out of these, 30 participants and their guardian or parents agreed for the participation in the study. All the participants and their guardian or parents were briefed about the study and informed consent was obtained from them to participate in the study. Later on subjects were randomly assigned to one of two groups, Control group & intervention group.

These participants were divided into 2 groups by convenient sampling. The participant who was referred first and eligible for the study was assigned to the control group. And the second patient was referred to the intervention group. Thus participants were assigned to groups alternatively. A group of 15 participants were assigned to the control group and 15 participants to the intervention group.

Among the selected participants only 30 participants completed the study and were included in the analysis. One participant was excluded due to falling on the affected shoulder during the

study period. One participant was unable to complete the study due to family problems. Other 2 participants quit due to unknown reasons.

15 participants from the control group completed the study that received manual therapy and performed shoulder exercises (8 women and 7 men; mean age = 37.62 years, SD =14.57, range=18-56). And 15 participants from the intervention group also completed the study that received US therapy in addition to manual therapy and shoulder exercises (6 women and 9 men; mean age =39.92 years, SD =16.6, range=18-60)

### Measurements

#### Universal Goniometer

- Goniometric measurement of shoulder All shoulder ROMs were measured using the universal goniometer. Shoulder flexion, abduction, and external rotation were measured in the supine position whereas shoulder extension and external rotation were measured in the prone position.
- The axis of goniometer was placed at 2.5cm inferior to the lateral aspect of the acromion process for shoulder flexion and extension, at 1.3cm inferior and lateral to the coracoid process for abduction and at the olecranon process of the ulna for shoulder internal and external rotation.

#### Visual Analog Scale (VAS) for shoulder pain

Shoulder pain intensity was measured in various activities involving the shoulder. The participants were asked to mark the pain intensity for each activity on separate visual analogue scales. The right end of the VAS was defined as "worst pain imaginable", the left end as "no pain ". Each level was recorded in a table (Table). A score was then calculated out of 10 with higher scores reflecting higher pain levels.

#### Shoulder Disability Index

Shoulder disability level was measured in various activities involving shoulder. The right end of the VAS was defined as "so difficult required help", the left end as "no difficulty". The level of difficulty in doing each activity is marked in the table. A score was then calculated out of 100 with higher scores reflecting higher disability levels.

#### Duration of Intervention

The total treatment sessions consisted of the application of manual physical therapy and shoulder exercises for a total of 15 treatment sessions of 40 minutes, over a period of 3 consecutive weeks (5 days per week)

#### Intervention

At the beginning of the treatment all participants were given a brief explanation on anatomy and biomechanics of the shoulder complex and a short description of the etiology and pathology of SIS.

The treatments in the first week aimed at reducing the pain intensity and to prevent further damage and consisted of manual therapy techniques such as joint mobilization techniques and shoulder pendulum exercises.

The second and third week aimed at restoring the functional level by increasing ROM, muscle strength and flexibility and consisted of ROM exercises with rope and pulley, L bar exercises, self-capsular stretching exercises, joint mobilization techniques and strengthening exercises with weights, therapeutic bands, springs and push-ups. The standard exercise protocol and manual therapy were given in order to restore muscular deficits in strength, mobility, and coordination of the rotator cuff and the shoulder girdle muscles to unload the sub acromial space during active movements. And the participants were expected to return to their functional level without recurrence at the end of the treatment.

Participants in the intervention group received pulsed ultrasound for 5 minutes with a device that was operated at a frequency of 1 MHz, and an intensity of 1 W/cm<sup>2</sup>, The treating physical therapist, using the technique of slow circular movements, applied the transducer head over the superior and anterior periarticular regions of the participant's glenohumeral joint and on the shoulder trigger points. The treatment was continued from the first treatment day over the 15 day treatment period.

#### For Control Group

##### 1st week-to reduce pain

Joint mobilization technique;

##### 2nd& 3rd week

To increase ROM&muscle strength

- Weight cuff exercises;
- L-bar exercises;
- Pulley exercises;
- Capsular stretching exercises;
- Thera band exercises;
- Wall pushups;
- Joint mobilization technique

#### For Interventional Group

1<sup>st</sup> week protocol+2<sup>nd</sup> & 3<sup>rd</sup> week protocol +Ultrasound therapy. Ultrasound therapy- Used for the reduction in pain and induce tissue repair helps in regaining the reduce range of motion due to SIS.

.Duration=15days(5days/wk)

.Time =5minutes

.Mode =pulsed mode

.Frequency=1MHz

.Intensity =1W/cm<sup>2</sup>

#### Treatment protocol

#### Goals

- Relieve pain.
- Maintain/increase flexibility (ROM).
- Improve and maintain muscle power

#### Range of motion exercises

##### Pendulum exercise

- Flexion- Extension exercises 15 times
- Abduction- Adduction exercises 15 times

- Circumduction (clock wise & anti clock wise) each 15 times

Active/active assisted/passive ROM

- Abduction with rope and pulley... 15 repetitions
- L- Bar active assisted exercises.
- Abduction- Adduction with L- bar exercises 15 repetitions
- Flexion – Extension with L- bar exercises 15 repetitions
- Internal rotation- External rotations L- bar exercises 15 repetitions

Self-capsular stretching

- Anterior self- capsular stretching 3 repetitions.
- Posterior self – capsular stretching 3 repetitions.

Joint mobilization

1. Initially start with grade 1. Gradually progress into 2.
2. Joint distraction and Inferior, anteroposterior and posteroanterior glides. 15 gliding for each sets ant 3 times therapist have to perform

Strengthening exercise

Modalities (For intervention group only)

Ultrasound treatment (Pulsed 1MHz ultrasound at 1 W/cm2 for 5 minutes,) patient should be in relaxed sitting position.

Statistical Analysis

Demographics

A total of thirty four patients were screened for the study considering the inclusion & the exclusion criteria. 30 participants and their relatives agreed for the participation in the study

**Table No 1** Distribution of participants according to age in years

Age Group	No of Participants	Percentage(%)
25-34	04	13%
35-44	11	37%
45-54	13	43%
>55	02	7%

**Table No. 2** Distribution of participants

Gender	Number of Participants	Percentage(%)
Male	16	53%
Female	14	47%

**Table No 3** Comparison of mean pre interventional and post interventional value of ROM for abduction between Control and Interventional group

ABD	Pre Interventional (MEAN±SD)	Post Interventional (MEAN±SD)	'p' value	't' value	Result
Cont	124.33±9.170	167.47±6.675	<0.0001	20.150	Significant
Inter	110.86±9.862	178.60±8.576	<0.0001	47.91	significant

**Range of motion (for abduction):-** The pre interventional mean score for Control Group was 124.33±9.170 and for Interventional Group was 110.86±9.862. The post interventional mean score for Control Group was 167.47±6.675

and for Interventional Group was 178.60±8.576 There was statistically significant difference in the mean score of ROM in abduction in pre and post interventional in both the groups [Table 3 and graph 3].

**Table no 4** Comparison of mean pre interventional and post interventional value of ROM for external rotation between Control and Intervention group.

External rotation	Pre Intervention (MEAN±SD)	Post Intervention (MEAN±SD)	'p' value	't' value	Result
Control	46.20±6.109	69.33±5.912	<0.0001	24.598	Extremely significant
Intervention	58.40±6.97	84.46±5.125	<0.0001	21.39	Extremely significant

**Range of motion (for external rotation):-** The pre interventional mean score for Control Group was 46.20±6.10 and for Interventional Group was 58.40±6.97. The post interventional mean score for Control Group was 69.33±5.912 and for Intervention Group was 84.46±5.125 There was statistically significant difference in the mean score of ROM for external rotation in pre and post interventional in both the groups [Table 4 and graph 4]

**Range of motion (for internal rotation):-** The pre interventional mean score for Control Group was 47.60±9.912 and for Intervention Group was 55.66±8.731

**Table No 5** Comparison of mean pre interventional and post interventional value of ROM for internal rotation between Control and Intervention group.

PAIN(VAS)	Pre Intervention (MEAN±SD)	Post Intervention (MEAN±SD)	'p' value	't' value	Result
Control	7.8±0.94	1.73±0.73	<0.0001	17.606	Significant
Intervention	8.066±1.163	0.953±0.79	<0.0001	43.866	Significant

**Table No 6** Comparison of mean pre interventional and post interventional value of pain between Control and Interventional group.

Internal rotation	Pre Intervention (MEAN±SD)	Post Intervention (MEAN±SD)	'p' value	't' value	Result
Control	47.60±9.912	74.80±4.178	<0.0001	15.04	Significant
Intervention	55.66±8.731	83.20±5.254	<0.0001	19.337	Significant

**Interpretation:** The pain is reduced in interventional group as compared to control group as shown in graph 6

**Shoulder Pain Disability Index (SPDI):-** The pre interventional mean score for Control Group was 115.57±9.33 and for Interventional Group was 116.81±10.16. The post interventional mean score for Control Group was 53.92±17.89 and for Interventional Group was 40.125±6.29 There was statistically significant difference in the mean score of SPDI in pre and post interventional in both the groups [Table 7 & graph 7)

**Table No 7** Comparison of mean pre interventional and post interventional value of pain between Control and Interventional group.

SPDI	Pre Intervention (MEAN±SD)	Post Intervention (MEAN±SD)	'p' Value,t, Value	Result
Control	115.57±9.33	53.92±17.89	<0.0001	11.50 Significant
Intervention	116.81±10.16	40.125±6.29	<0.0001	26.96 Significant

**Comparison of Mean Difference values of ROM (Abduction)**

The mean difference score for CON group was  $43.133 \pm 9.170$  and for INT group was  $57.733 \pm 9.862$  there was significant difference in the mean difference score of Mean difference values of Rom (Abduction) Control Group And Interventional Group [Table 8 and Graph 8].

**Table No 8** Comparison of Mean Difference values of Rom (Abduction) Between Control Group And Interventional Group.

Abduction	control	intervention	'p'Value	't'Value	Result
Mean difference	$43.133 \pm 9.170$	$57.733 \pm 9.862$	<0.0001	14.728	Extremely significant

**Comparison of Mean Difference values of Rom External Rotation)**

The mean difference score for CON group was  $23.13 \pm 6.109$  and for INT group was  $58.467 \pm 6.77$  There was significant difference in the mean difference score of Mean difference values of ROM between control group and interventional group [Table 8 and graph 8]

**Table no. 9** Comparison of Mean Difference values of Rom (External Rotation) between Control group and Interventional Group

External rotation	contro	intervention	'P' value	't' Value	Result
Mean difference	$23.13 \pm 6.109$	$58.467 \pm 6.77$	<0.0001	10.539	Extremely significant

**Comparison of Mean Difference values of ROM (Internal Rotation)**

The mean difference score for CON group was  $27.20 \pm 9.912$  and for INT group was  $27.07 \pm 8.73$  there was significant difference in the mean difference score of Mean difference values of ROM between control group and interventional group [Table 10 and graph 10]

**Table no. 10** Comparison of Mean Difference values of ROM (Internal Rotation) between Control group and Interventional Group

Internal Rotation	Control	intervention	'p' Value	't' Value	Result
Mean difference	$27.20 \pm 9.912$	$27.07 \pm 8.73$	<0.0001	9.793	Significant

**Comparison of Mean Difference values of PAIN (VAS)**

The mean difference score for CONTROL group was  $6.067 \pm 0.9411$  and for INT group was  $7.133 \pm 1.163$ . There was significant difference in the mean difference score of Mean difference values of PAIN between Control group and Intervention [Table 11 and graph 11].

**Table No. 11** Comparison of Mean Difference values of Pain between Control group and Interventional Group.

Pain(VAS)	Control	Intervention	'p' Value	't'Value	Result
Mean difference	$6.067 \pm 0.9411$	$7.133 \pm 1.163$	<0.0001	19.994	Significant

**Comparison of Mean Difference values of Shoulder Pain Disability Index (SPDI)**

The mean difference score for CONTROL group was  $63.40 \pm 17.89$  and for INT group was  $75.93 \pm 10.16$ . There was

significant difference in the mean difference score of Mean difference values of SPDI between CONTROL group and INTERVENTION [Table 12 and graph12].

**Table No 12** Comparison of Mean Difference values of SPDI between Control group and Interventional Group.

SPDI	control	intervention	'p'VALU E	't' VALUE	Result
Mean difference	$63.40 \pm 17.89$	$75.93 \pm 10.16$	<0.0001	12.242	Significant

**RESULT**

Statistical analysis was done by trial version of Grap PadInStat (v 3.06) software. The data was entered into an excel spread sheet, tabulated and subjected to statistical analysis. Various statistical measures such as mean, standard deviation (SD) and test of significance such as paired 't' test and unpaired 't' test were utilized to analyze the data. Within group, comparison of Mean pre interventional and post interventional values of ROM, SPDI and PAIN was done by using paired 't' test. This test was carried out in both the groups (Control group and Interventionation group) separately. Inter-group comparison of Mean Difference values of ROM, SPDI and Pain between Control (CON) group and INTERVENTION (INT) group was done by using unpaired 't' test. The result were concluded statistically significant with  $p < 0.0001$ . The results of the study were found to be increase in Range of motion, Shoulder Disability and Pain in both Control group and Intervention group in shoulder impingement syndrome patients. The comparison was made between the values taken before the treatment and after the 3 weeks of treatment in both the groups. Both the CON and INT group were found to be significant effective in improving ROM, Pain and shoulder disability. In INT group after 3 WEEKS of treatment as compared to CON grou., pAIN was found to be significantly improved in INT group after 3WEEKs of treatment as compared to CON group.

**DISCUSSION**

The aim of this study was to identify whether ultrasound therapy has an additional effect when combined with manual therapy and shoulder exercises in the treatment of patients with SIS.

The measurements in VAS, disability index and shoulder ROM shows significant improvement in both control and intervention groups at the end of three weeks treatment period. In the control group VAS for pain measurement has reduced from  $7.8 \pm 0.94$  to  $1.73 \pm 0.733$ , the disability index has reduced from  $115.57 \pm 9.332$  to  $53.92 \pm 17.89$ . and the ROM for abduction external rotation and internal rotation were increased from abduction  $124.33 \pm 9.170$  to  $167.47 \pm$ , external rotation  $46.20 \pm 6.109$  to  $69.33 \pm 5.912$ , and internal rotation  $47.6 \pm 9.912$  to  $74.80 \pm 4.178$

In the intervention group VAS for pain measurement has reduced from  $8.066 \pm 1.163$  to  $0.093 \pm 0.79$ , the disability index has reduced from  $116.81 \pm 10.16$  to  $40.125 \pm 6.29$ . And the ROM for abduction external rotation and internal rotation were increased from abduction  $110.86 \pm 9.862$  to  $168.60 \pm 8.576$ , external rotation  $58.40 \pm 6.97$  to  $84.46 \pm 5.125$ , and internal rotation  $55.66 \pm 8.731$  to  $83.20 \pm 5.254$ .

Between group comparisons for the improvement in patient condition regarding pain, disability and shoulder ROM for abduction, internal rotation and external rotation after the three weeks treatment or at the end of first or second week have shown statistically significant difference between the groups.

The participants' age ranged from 25-55. The distribution of age among the control and intervention groups has significant difference. And the comparison between difference for baseline measurements and overall improvement for pain, shoulder disability and shoulder ROM has shown significant difference according to the different age groups involved in this study either in the control or intervention groups.

Most of the participants had been affected by their dominant shoulder. But some of them had been affected by their non-dominant shoulder. But according to the results comparison between baseline measurements and overall improvement has significant difference in either group.

In this study both male and female participants were included. But comparison between female and male participants for baseline measurements and overall improvement has significant difference in control or intervention group.

## CONCLUSION

The result of this study show that Control And intervention are effective in improving. Rom in abduction, external rotation, internal rotation additionally, ultrasound technique is proved to be more effective in improving the ROM, Pain, SPDI as compared to CONTROL GROUP among shoulder impingement syndrome patients. Although ULTRASOUND technique also showed to be more effective in improving the Pain as compared to control technique. Therefore, ultrasound technique can be used in day to day practice of physiotherapy as a treatment protocol for a positive effect among shoulder impingement syndrome

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