Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 32s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Comparison Of Effectiveness of Pilates with Therapeutic Ultrasound Versus Therapeutic Ultrasound on Releiving Pain and To Increase Range of Motion in Supraspinatus Tendinitis – Randomized Controlled Trial

Dr. G. Mohanraj[*1], Ms. K. Hemadarani[2], Ms. K. Ishwareya[3], Dr. K. Manjuladevi[*4], N. Dharani[5]

[1]MPT(Orthopedic) Phd , Professor, HOD Department Of Physiotherapy, School Of Physiotherapy, Vinayaka Mission Research Foundation, Aarupadai Veedu Medical College And Hospital Campus Kirumampakkam , Puducherry.

[2]Master Of Physiotherapy Student , School Of Physiotherapy, Vinayaka Mission Research Foundation, Aarupadai Veedu Medical College And Hospital Campus, Kirumampakkam, Puducherry

[3]Master Of Physiotherapy Student , School Of Physiotherapy, Vinayaka Mission Research Foundation, Aarupadai Veedu Medical College And Hospital Campus, Kirumampakkam , Puducherry

[4]Neuro Assistant Professor, School Of Physiotherapy, Vinayaka Mission Research Foundation, Aarupadai Veedu Medical College And Hospital Campus, Kirumampakkam, Puducherry

[5]Post Graduate In Master Of Physiotherapy (Neurology) , Sri Venkateshwara College Of Physiotherapy Pondicherry

[*]**Corresponding author:**

[1]Dr. G. Mohanraj

[4]Dr. K. Manjuladevi

Cite this paper as: Dr. G. Mohanraj, Ms. K. Hemadarani, Ms. K. Ishwareya, Dr. K. Manjuladevi, N. Dharani, (2025) Pathogenesis and Therapeutic Advances in Cholelithiasis: From Gut Microbiota Regulation to the Frontiers of Precision Medicine. *Journal of Neonatal Surgery*, 14 (32s), 3195-3204.

ABSTRACT

Background: Supraspinatus tendinitis is the inflammation of the supraspinatus tendon resulting from micro-tears in the musculotendinous unit when it is acutely overloaded with a sudden or a heavy tensile force. It is a degeneration of the tendon's collagen due to ch ronic overuse and repeated strain. This results in tendinitis. This condition is common in athletes involved in repetitive overhead activities. Diagnosis can be done first by painful arc sign. This is when a person experiences pain upon abduction of the arm between 60 and 120. The next step would be to perform the empty can test. This is performed with the arm abducted to 90, 30° of anterior circumduction, and internal rotation with thumb downward. The patient attempts to further abduct their arm while the examiner applies downward pressure. Weakness or pain is considered a positive sign. Originally called "Contrology", Pilates is an exercise system designed by Joseph Pilates to condition the body based on Eastern theories of body-mind spirit interaction. Ultrasound induced heating is the result of the absorption of ultrasonic energy biological tissues.

Methods: The study design was a randomized control trial, 30 patients were selected from Aarupadai Veedu Medical College and Hospital, Pondicherry. They were Allocated randomly into two groups, Group A(N=15) Pilates with ultrasound therapy. Group B(N=15) Ultra sound therapy alone. The outcome measure VAS and SPADI were measured in Pre and Post test for 6-week period.

Result: Data Analysis was done according to paired 't' test between the groups A & B calculating with 5% of significance. The statistical interpretation of mean and standard deviation shows the improvement in the Pilates with therapeutic ultrasound in patient with supraspinatus tendinitis.

Conclusion: This Study concludes that The Pilates with Ultrasound Therapy for Group A shows more significant improvement in patients with supraspinatus tendinitis than Group B.

Keywords: *Pilates exercise, Ultrasound therapy, Supraspinatus Tendinitis, Visual Analogue Scale, Shoulder Pain Disability Index.*

1. INTRODUCTION

Supraspinatus Tendinitis is the inflammation of the supraspinatus tendon resulting from micro-tears in the musculotendinous unit when it is acutely overloaded with a sudden or a heavy tensile force. It is a degeneration of the tendon's collagen due to chronic overuse and repeated strain. This result in tendinitis. This condition is common in athletes involved in repetitive overhead activities [2] . Supraspinatus tendinitis can be caused by extrinsic and intrinsic factors. Extrinsic factors are divided into primary and secondary impingement. Increased subacromial loading, overhead activities, or trauma can cause primary impingement. Rotator cuff overload and muscle imbalance can cause secondary impingement. Supraspinatus tendonitis can also occur because of the decrease in the supraspinatus outlet space due to underlying instability of the glenohumeral joint [4] . Stages of Tendinitis:Stage 1: Which has acute inflammation, edema, andhemorrhage within the supraspinatus tendon characteristic of early tendinitis. This stage is reversible with non-operative treatment.Stage 2: Usually represents a progression of acute edema and hemorrhage to fibrosis and inflammation within the tendon. In this there is thinning and irregularity of the tendon.Stage 3: Is typified by mechanical disruption of tendons and changes in the coracoacromial arch with osteophytosis along the anterior acromion. And there is the discontinuity of tendon. Their also may be effusion of the shoulder joint, with a complete supraspinatus tendon tear and atrophy may occur as the tear become chronic [3]. Diagnosis can be done first by painful arc sign. This is when a person experiences pain upon abduction of the arm between 60 and 120. The next step would be to perform the empty can test. This is performed with the arm abducted to 90, 30° of anterior circumduction, and internal rotation with thumb downward. The patient attempts to further abduct their arm while the examiner applies downward pressure. Weakness or pain is considered a positive sign. The validity of the empty can test has been studied and shown to have sensitivity of 62%, 41% and 88% for supraspinatus tendinitis, full thickness tear, and large to massive tears [5].

Pilates exercises bring focus on muscle strength and flexibility and the exercises are based on the body centering, concentration, control, precision, flow and breathing [8]. **Ultrasound** induced heating is result of the absorption of ultrasonic energy biological tissues. This modality now typically has a base unit for generating an electrical signal and a handheld transducer. The handheld transducer is applied with coupling gel and moved in a circular motion over and injured or painful area of the anatomy to treat conditions such as bursitis of the shoulder and tendinitis [10].

2. MATERIALS AND METHODOLOGY

The study design was an Randomized Controlled Trial with Simple Random Sampling Technique, 30 patients were randomly selected from Aarupadai Veedu Medical college and Hospital (Kirumampakkam Pomdicherry). They were allocated into two group, Group A(N=15) Pilates exercise with Ultrasound Therapy, Group B(N=15) Ultrasound therapy alone. The Treatment duration is about 5days/week for 6 weeks, the outcome measure VAS and SPADI were measured in pre and post test for 6-week period.

Study design : Randomized controlled trial

Study location : Aarupadai Veedu Medical college and Hospital

Study duration : 6 weeks

Sampling size : 30 participants

Sample size calculation : Experimental group[n=15]: Pilates exercise with ultrasound Therapy & Control group[n=15]: Ultrasound Therapy

Subjects & Selection Method: The study design design was an Randomized Controlled Trial with Simple Random Sampling Technique, 30 patients were randomly selected from Aarupadai Veedu Medical college and Hospital (Kirumampakkam Pomdicherry). They were allocated into two group, Group A(N=15) Pilates exercise with Ultrasound Therapy, Group B(N=15) Ultrasound therapy alone. The Treatment duration is about 5days/week for 6 weeks, the outcome measure VAS and SPADI were measured in pre and post test for 6 week period.

Inclusion Criteria:

1. Age:25-85 years
2. Clinically diagnosed supraspinatus tendinitis with empty can test positive
3. Both (male and female)
4. Point of tenderness at the greater tuberosity

Exclusion Criteria:

1. Hypersensitivity to aquasonic gel used for ultrasound therapy
2. Open wounds around the shoulder

3. Recent clavicle fracture
4. Recent fracture around the shoulder joint
5. Shoulder dislocation
6. Inflammatory arthritis
7. Metal implants

Procedure:

The subject who fulfilled the inclusion criteria were participated in the study. Such eligible subjects were selected in this study after obtaining informed consent. The subject will be assessed before the treatment and at the end of 6-week by using Visual Analogue Scale and Shoulder Pain Disability Index. The tool of 30 subject will be divided equally into 2 group. GROUP A(n=15) and GROUP B(n=15). GROUP A will receive Pilates exercise with Ultrasound Therapy and GROUP B will receive Ultrasound Therapy.

Group A	**Group B**
Number of participants: 15	**Number of participants:** 15
Intervention: Pilates exercise training for 4 weeks and therapeutic ultrasound for 2 weeks.	**Intervention:** Therapeutic ultrasound for 2 weeks
Duration: 5 days per week.	**Duration:** 5 days per week.

Group A

Ultrasound:

Ultrasound is given for 2 weeks, 5 days per week Mode:1MHZ for deeper penetration

Frequency: 1:4

Intensity :0.8

Duration :8 minutes

Pilates

Instructions: The exercise should be performed with the principles of Pilates (centering, concentration, control, precision, flow, Breathing in coordination with exercise). While performing the exercise the patient must follow these principles. The exercise is done under the supervision of an examiner. In this four-week session the exercise program is divided into three stages and first two weeks exercise program have to done after the ultrasound. In stage two and three wand and resistive bands are used to perform exercises.

Stage1(week 1 and week 2): In stage 1 the patient must perform static exercise along with ultrasound because the first two weeks are the healing stage, active movements can aggravate pain, so the static exercise are performed.

Exercises

- **Shoulder retraction in standing** – the patient has stand by facing the wall and the patient hand is placed in the wall in 90° flexion with elbow and wrist joint in extended position. In this position the patient must retract the shoulder. This has to be done for 10 repetitions.
- **Static abduction in standing** – the patient must stand by the lateral side of the affected hand is in contact with the wall and the elbow is 90° flexed. In this position the patient must do static abduction of shoulder by giving pressure against the wall and holding it for 10 seconds and repetition of 10.

Static external rotation in standing – The patient position is same as in the static abduction. Then the patient must perform

static shoulder external rotation of shoulder by applying pressure against the wall and hold it for 10 seconds and 10 repetition.

- **Static flexion in standing** – The patient must stand by facing the wall with elbow 90°flexed and hand in fisted position is placed in contact with the wall. The patient must perform static shoulder flexion by applying pressure against the wall in fisted hand and hold it for 10 seconds and repetition of 10.
- **Static extension in standing** – The patient must stand by posterior aspect of the body is in contact with wall. The patient's elbow is flexed 90° flexed. The patient must perform static shoulder extension by applying pressure against the wall and hold for 10 seconds and repetition of 10.

Stage 2 (week 3): In stage 2 exercises are done with wand and resistive band. Low grade bands are used in this stage. The exercise should be done at a low level (within 90° of shoulder movement) because movement above the range of shoulder joints is painful. The patient has to follow the principles of Pilates is important.

Exercises

Wand exercises

- **Shoulder flexion in supine lying** – The patient is in supine lying with holding Wand in both hands. In supine lying the shoulder is stabilized by the couch. Then the patient must do shoulder flexion within the painless range along with the assistance of wand repetition of 20.
- **Abduction in supine lying** – The patient position is same as in the previous exercise. Then the patient must do the abduction along with the wand repetition of 20.

Exercise using resistance band

- **Shoulder horizontal abduction –** The resistive band is tied at a low level, then the patient stands beside the tied part, then the patient holds the other end of the band. Then the patient must perform the horizontal abduction against the resistance of the band within the painless range. Repetition of 20.
- **Shoulder external rotation –** The patient must stand beside the tied band by holding another end of the band. Elbow have to flexed 90°, then the patient have to do the external rotation movement against the resistance of band within the painless range. Repetition of 20.
- **Shoulder extension –** The patient must stand by facing the tied band and the patient holding another end of band. The patient must do the shoulder extension against the resistance of the band within the painless range. Repetition of 20.
- Shoulder retraction exercise is continued as said in stage one and two.

Stage 3 (week 4): In stage 3 grade of the band is improved. The exercise must do at the range of shoulder joint. The principles of Pilates must be followed.

Exercise

- The same exercise protocol as stage 2 is followed with wand and resistive band. The wand exercise is done in standing in this stage. The shoulder retraction is followed.

Statistical analysis & results:

A study **to find out "Comparison of effectiveness of Pilates with therapeutic ultrasound versus therapeutic ultrasound on relieving pain and to increase range of motion in supraspinatus tendinitis"** – The pre-test and post-test interventional differences between the two groups were analyzed using paired-t test for the outcome measure. Statistical analysis was set at 5% of significance.

TABLE 1 Age Distribution Analysis of Group A and Group B

AGE	GROUP A		GROUP B	
	NUMBERS	PERCENTAGE	NUMBER	PERCENTAGE
25-38	2	13.3	2	13.3
40-50	5	33.3	6	33.3
51-60	5	33.3	4	33.3

61-70	2	13.3	2	13.3
71-80	1	6.6	1	6.6

Graph 1: The graph shows the graphical representation of age distribution analysis of Group A and Group B.

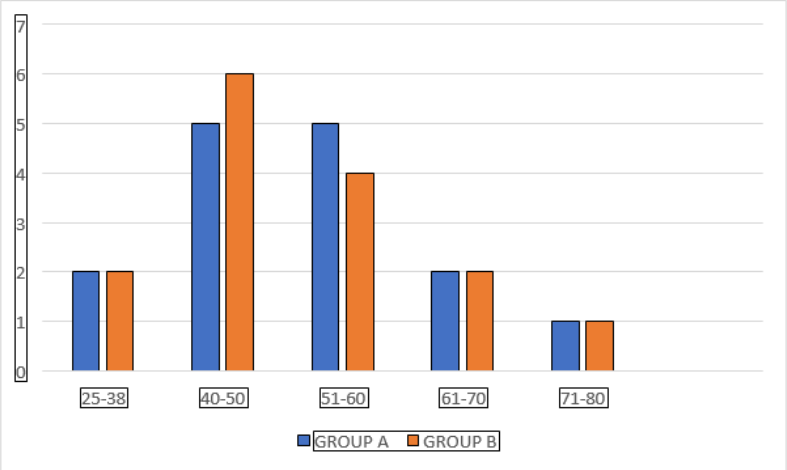
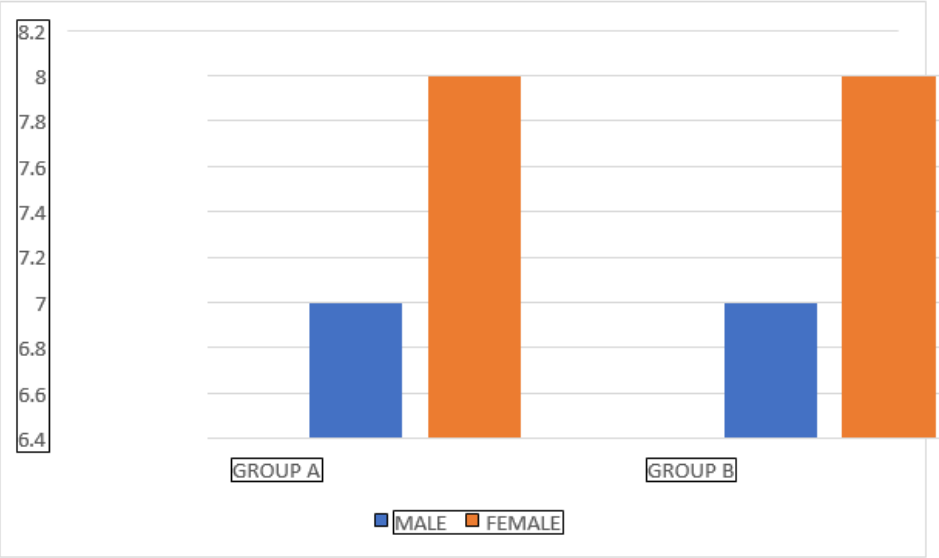


TABLE 2 GENDER Distribution Analysis of Group A and Group B.

GENDER	GROUP A		GROUP B	
	NUMBERS	PERCENTAGE	NUMBERS	PERCENTAGE
MALE	7	46.7	7	46.7
FEMALE	8	53.3	8	53.3
TOTAL	15	100	15	100



Graph 2: The graph shows the graphical representation of gender distribution analysis of Group A and Group B.

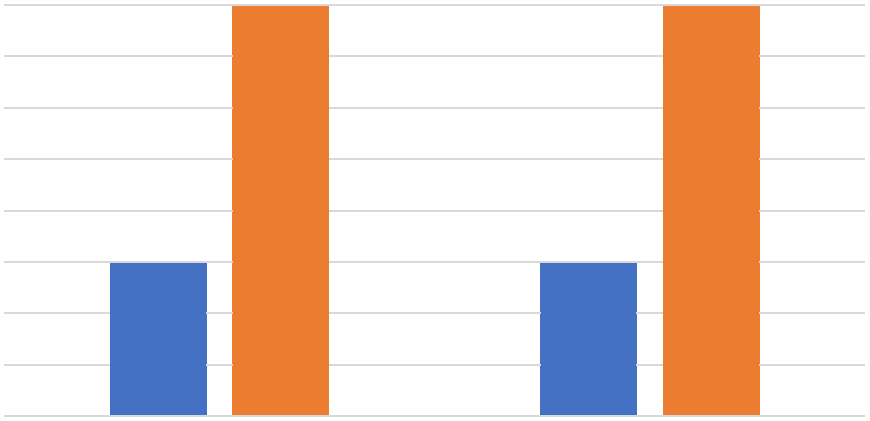


TABLE 3 The table shows mean value, mean difference, standard deviation and paired 't 'value between pre and post test scores of Visual Analog

Scale Group A.

Measurement	Mean	Mean Difference	Standard deviation	Paired 't' value
Pre test	4.47	1.93	1.41	6.4388
Post test	2.53		1.64	

Graph 3: The graph shows the graphical representation of pre and post-test, mean value of VAS Group A.

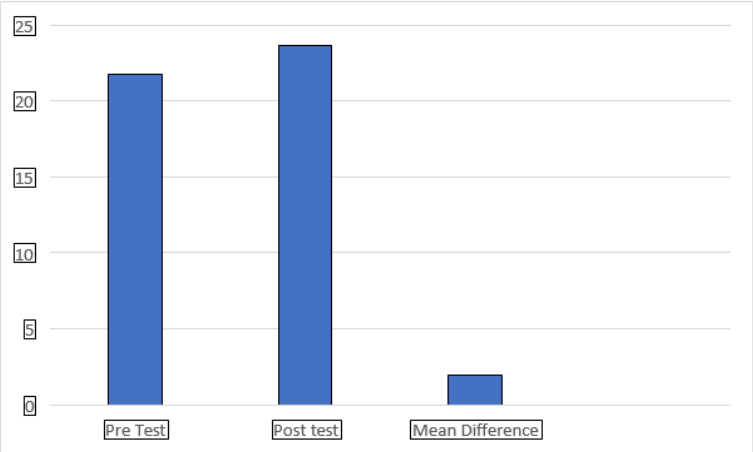


TABLE 4 The table shows mean value, mean difference, standard deviation and paired 't 'value between pre and post test scores of Visual Analog Scale Group B.

Measurement	Mean	Mean Difference	Standard deviation	Paired 't' value
Pre test	4.80	2	1.90	9.1652
Post test	2.80		1.61	

Graph 4: The graph shows the graphical representation of pre and post-test, mean value of VAS Group B.

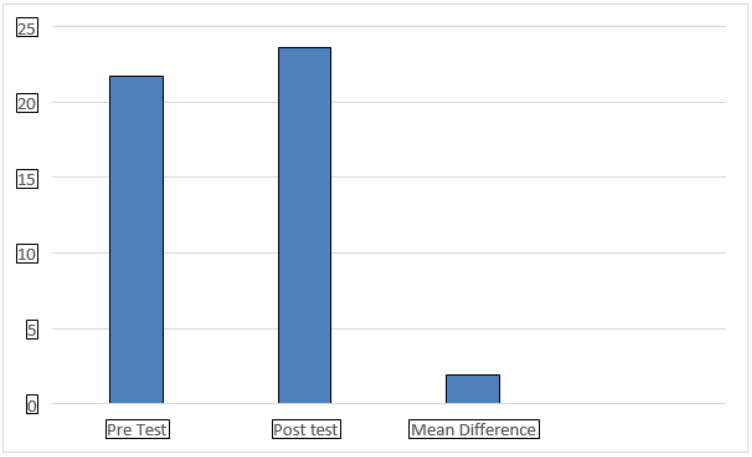


TABLE 5 The table shows mean value, mean difference, standard deviation and paired 't 'value between pre and post test scores of Shoulders Pain and Disability Index (SPADI) of Group A.

Measurement	Mean	Mean Difference	Standard deviation	Paired 't' value
Pre test	62.33	38.93	5.08	56.1583
Post test	23.40		4.88	

Graph 5: The graph shows the graphical representation of pre and post-test, mean value of SPADI Group A.

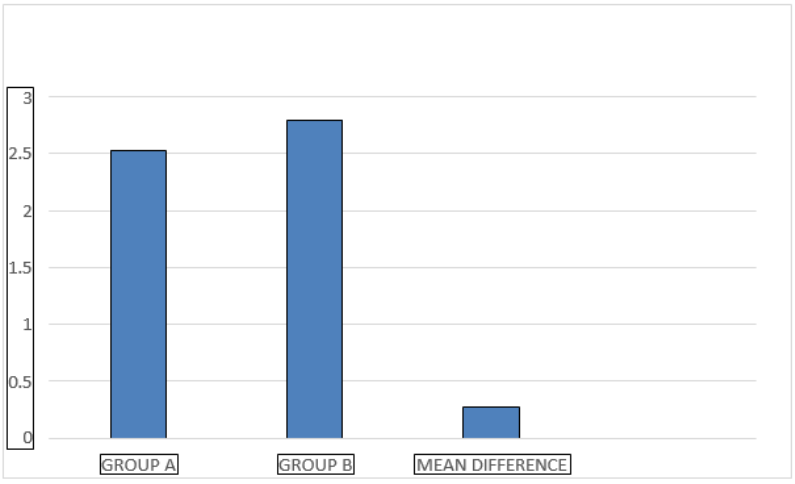


TABLE 6 The table shows mean value, mean difference, standard deviation and paired 't 'value between pre and post test scores of Shoulder Pain And Disability Index (SPADI) of Group B.

Measurement	Mean	Mean Difference	Standard deviation	Paired 't' value
Pre-test	55.67	35.07	6.48	33.8826
Post-test	20.60		4.32	

Graph 6: The graph shows the graphical representation of pre and post-test, mean value of SPADI Group B.

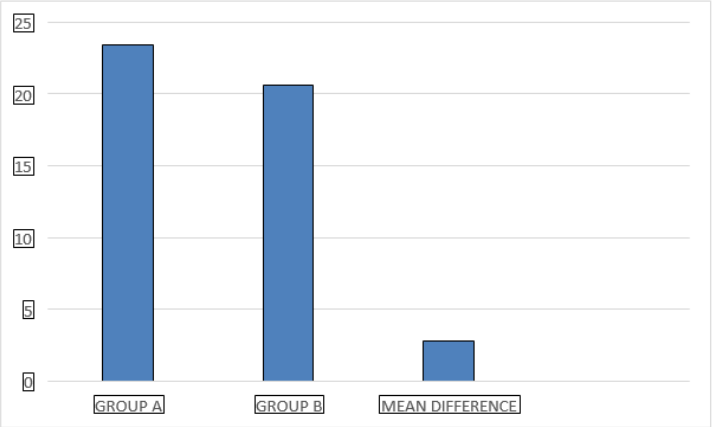


TABLE 7 The table shows mean value, mean difference, standard deviation and paired 't 'value between Post test scores of Group A and Group B of Visual Analog Scale.

Measurement	Mean	Mean Difference	Standard deviation	Paired 't' value
Group A	2.53	0.27	1.64	0.4488
Group B	2.80		1.61	

Graph 7: The graph shows the graphical representation of pre and post test, mean value of VAS Group A and Group B.

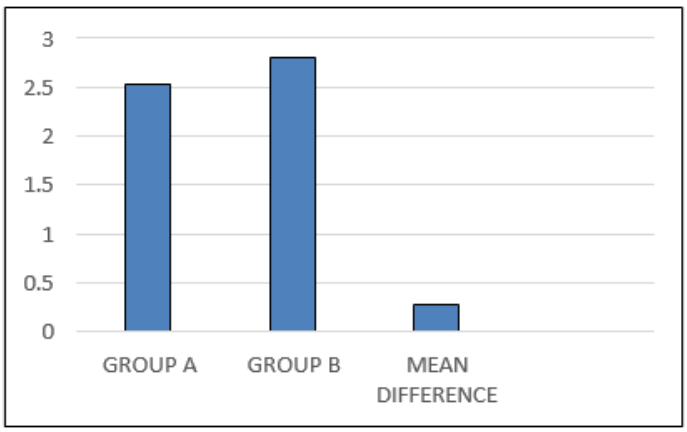
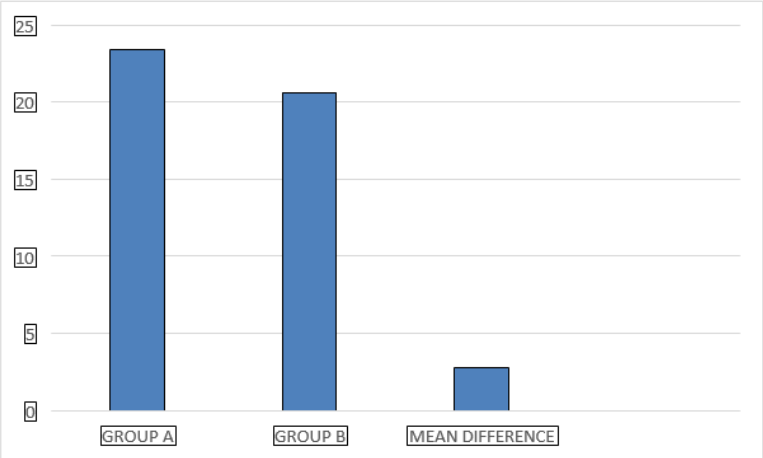


TABLE 8 The table shows mean value, mean difference, standard deviation and paired 't 'value between Post test scores of Group A and Group B of SPADI.

Measurement	Mean	Mean Difference	Standard deviation	Paired 't' value
Group A	23.40	2.80	4.88	1.6632
Group B	20.60		4.32	

Graph 8: The Graph shows the graphical representation of pre and post-test, mean value of SPADI Group A and Group B.



3. DISCUSSION

In this present study was examined the efficacy of pilates with therapeutic ultrasound on patient with supraspinatus tendinitis. A totally 30 supraspinatus tendinitis patient were included in this study, they were divided into 2 groups. Group A and Group B. Group A received pilates with therapeutic ultrasound and Group B received therapeutic ultrasound alone for 4 weeks. After the intervention obtaining the results pilates with therapeutic ultrasound is highly effective in reduce pain and improving range of motion. The application of the ultrasound leads to warm the tendon, muscle, and other tissues to improve blood flow and accelerate healing. Pilates exercise brings focus on muscle strength, flexibility, and endurance. Results of this study showed that there is significant difference in pain and range of motion under the intervention of pilates with therapeutic ultrasound.

This result was supported by H. B. shivakumar (2014), conducted a study to investigate the Efficacies of ultrasound therapy with cryokinetics versus ultrasound therapy with soft tissue massage in acute supraspinatus tendinitis. This study concluded that ultrasound therapy reduces the pain and heals effectively.

And another study Eda Akbas conducted a study on pilates based approach provide additional benefit over traditional physiotherapy in the management of rotator cuff tendinopathy. This study concludes that pilates based approach in shoulder pain and disability reduces pain and improve shoulder activities.

So this present study was conducted to find the effectiveness of pilates with therapeutic ultrasound in supraspinatus tendinitis.

4. LIMITATIONS

Muscle strength was not assessed.

Smaller samples were taken.

In this study unilateral shoulder pain is concentrated.

5. CONCLUSION

The study concluded that pilates with ultrasound therapy were effective in reducing pain and improving the range of motion in patients with supraspinatus tendinitis. While comparing group A and group B there was statistical reduction in pain and improvement in range of motion and reduced shoulder disability was effective in group A than B after 6 weeks of training.

REFERENCES

[1] Berrazueta JR, et al.., : Successful treatment of shoulder pain syndrome due to supraspinatus tendinitis with transdermal nitroglycerin. A double blind study. Pain.1996.

[2] Pankaj Sharma, et al.., :Tendon Injury And Tendinopathy: Healing And Repair. The Journal Of Bone And Joint Surgery. Am. 87:187-202, 20053.

[3] Rene Calliet..,: Shoulder Pain.3rd Edition. Jaypee Brothers: New Delhi.1992

[4] Joel A, Delisa, Bruse M. Gans et al.., : Physical Medicine & Rehabilitation: Principles & Practice Vol. 1.

Lippincott Williams & Wilkins 2005; Page no. 181-182.

[5] Gamze Senbursa, et al.., : The Effectiveness of Manual Therapy in Supraspinatus Tendinopathy. Acta Orthop Traumatol Turc. 2011; 45(3): 162-167.

[6] Holtby MB, Richard, et al.., : Validity of the Supraspinatus Test in Diagnosing Patients with Rotator Cuff Pathology. Journal of Orthop & Sports Physical Therapy. 34(2004): 194-200.

[7] Keays KS, et al.., : Effects of Pilates exercises on shoulder range of motion, pain, mood, and upper-extremity function in women living with breast cancer: a pilot study. Phys Ther. 2008; 88: 494-510.

[8] Drury, Billie et al.., : Pilates for the Tennis Player Shoulder.

[9] Kloubec, J. A. (2010).., :Pilates for improvement of muscle endurance, flexibility, balance, and posture. The Journal of Strength and Conditioning Research, 24, 661–667.

[10] Anderson BD,et al.., : Introduction to Pilates-based rehabilitation. Orthopaedic Physical Therapy Clinics of North America. 2000; 9: 395- 410.

[11] John Low,et al.., : Therapeutic ultrasound. In, Electrotherapy Explained Principles & Practice, 3rd Edition. New Delhi, Butterworth Heinemann, 2000; Page no. 172.

[12] John Low, et al.., Therapeutic ultrasound. In, Electrotherapy Explained Principles & Practice, 3rd Edition. New Delhi, Butterworth Heinemann, 2000; Page no. 172.