

Efficacy of Scapular Dyskinesia Exercises on Functional Improvement for the Patients with Periarthritis Shoulder

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Abstract: *Background of the study: Periarthritis shoulder is a common painful condition of the shoulder joint which gradually limits the range of motion and functional ability of the individual affected with this condition. Various physiotherapy approaches are available to treat the patients with periarthritis shoulder. The objective of this study was an attempt to prove the efficacy of scapular dyskinesia exercise in improving the functional activities for the patients with periarthritis shoulder. Methodology: 30 subjects with Periarthritis shoulder were selected based on the inclusion and exclusion criteria. They were randomly allocated into 2 groups (experimental group & control group) consists of 15 subject each. Experimental group received scapular dyskinesia exercise, standardized shoulder exercise and ultrasound therapy. Control group received standardized shoulder exercise and ultrasound therapy. The subjects were assessed using an outcome measure of SPADI and Lateral scapular slide test. Result: The results were statistically analyzed by using the paired and unpaired 't' test. There were significant difference between the experimental group for SPADI 62.33 and control group 43. There were significant difference between the experimental group for LSST in Hands on hip and maximum abduction and internal rotation (1.1866 & 0.5266) in control group for LSST in Hands on hip and maximum abduction and internal rotation (1.2066 & 1.4133). Conclusion: This study proves that scapular dyskinesia exercise, standardized shoulder exercises with ultrasound therapy was found to be effective in improving the functional activities and altering the scapular abnormalities in patients with periarthritis shoulder.*

Keywords: Periarthritis shoulder, Scapular dyskinesia, SPADI, LSST, standardized shoulder exercise

1. Introduction

The shoulder is a very complex joint that play a major role in many activities of daily living. Shoulder pain is one of the most common complaints among the general population. Most of the people were affected by idiopathic loss of shoulder range of motion. A global decrease in shoulder ROM is called Periarthritis Shoulder (Kotteeswaran K & Balaji M, 2013). It is characterized by spontaneous onset of pain and progressive stiffness of the glenohumeral joint, accompanied by significant disability (Ki Deok Park, et. al., 2013). In 1934, Codman was the first to introduced the terminology "Frozen Shoulder". Long before Codman, in 1872 the same condition had already been labeled "Periarthritis" by Duplay. In 1945, Naviesar coined the term "Adhesive Capsulitis" (Richard Dias, et. al., 2005).

The prevalence of periarthritis shoulder is estimated to be 2 to 10 % in non - diabetic patients (general population) and upto 11 – 30% in diabetic patients and mainly affects the individuals between 40 - 60 years of age with female predominance (Mohannakrishnan. J & Bhanumathymohanakrishnan, 2016).

Periarthritis shoulder has three phases:

Stage 1 – (freeze phase) Patient complains of persistent and more intense pain even at rest followed by limitation of motion in all direction. This may occur at around 3 to 9 months.

Stage 2 – (frozen phase) This stage is characterized by pain only with movement, significant adhesion, limited

glenohumeral mobility, with substitute motions in the scapula. This stage lies between 9 to 15 months.

Stage 3 – (thawing stage) spontaneous improvement in the functional range of motion occur during this stage. This stage lasts for 15 to 24 months. In some case the patient never regain normal range of motion (Carolyn kisner, 2012).

Various heat modalities like short wave diathermy, ultrasound therapy, wax therapy, & moist heat along with mobilization, and capsular stretching were used to manage the periarthritis condition by reducing pain, inflammation, stiffness and as a result there is increase ROM of the shoulder joint.

Ultrasound therapy with frequency of 1 MHZ, intensity of 1.0 W / cm² in a continuous mode, is therapeutically used to treat for the periarthritis shoulder (Kotteeswaran K & Balaji M, 2013). It elevates the tissue temperature to the depth of 5 cm or more, thereby the physiological effect will increase the collagen tissue extensibility, pain threshold and enzymatic activity. These effects improve the nerve conduction velocity and contractile activity of the skeletal muscle to optimum level. The dosage of ultrasound depends upon the area, depth and nature of lesion and the treatment duration was given for 8 minutes.

In Periarthritis shoulder condition there is an alteration of the function of scapula tilting anteriorly and laterally. And the weakened scapula thoracic muscles potentially lead to abnormal positioning of the scapula, disturbance in the scapula humeral rhythm which results in the scapula dyskinesia (Kotteeswaran K & Balaji M, 2013).

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Scapular Dyskinesia:

Scapular dyskinesia is defined as observable alteration in the position of the scapula and the pattern of scapula motion in relation to the thoracic cage. Several factors may create these abnormal pattern and position. Alteration in the scapular position and motion occur in 68 - 100% of patients with shoulder injuries (Ben Kibler. W, MD, & John MC Mullen, ATC 2003). Due to capsular stiffness developed in periartthritis shoulder there will be tightness of pectoralis major, latissimusdorsi, teres major and minor muscles thereby resulting in weakness of middle and lower trapezius, rhomboidus major and minor muscle, serratus anterior. This muscular weakness provides additional stress to the capsule, rotator cuff muscles, subacromial bursa which lead to protracted shoulder girdle and increase scapulothoracic motion which alter the glenohumeral mechanics (Veena[at]kirthika. S, P. B. Bhavani&Rajalaxmi 2015). Abnormal scapula orientation can alter the center of rotation of the humerus on the glenoid and lead to abnormal shoulder joint kinematics (Reuther, Katherine E, 2014).

Kibler, in 1991, has developed the less time – consuming lateral scapular slide test to evaluate scapular stability (Kotteeswaran K & Balaji M, 2013). This semi - dynamic test evaluates three positions of the scapula on injured and non - injured sides in relation to a fixed point on the spine as varying amounts of load are put on the supporting musculature (Ben Kibler. W, MD, & John MC Mullen, ATC 2003).

The scapular dyskinesia exercise are scapular clock exercise, PNF D2 pattern, towel sliding, serratus anterior punches, these set of exercise were used to strengthen the shoulder girdle muscles to restore the normal scapular motion and help to correct scapular dyskinesia (Kotteeswaran K & Balaji M, 2013). In this study, the recovery phase (stage 2) for treating of Periartthritis shoulder has been consider in the exercise protocol of scapular dyskinesia rehabilitation. This protocol consists of axially loaded AROM exercises, open kinetic chain tubing exercise & Black burn exercise. These exercises aim to facilitate energy transfer through the kinetic chain from trunk to the arm as an essential part of rehabilitating the periartthritis shoulder.

This current study examines the effect of scapular dyskinesia exercises in altering the abnormal scapular motion and reducing the pain with conventional treatment of therapeutic ultrasound, thereby improving the functional activity in patients with periartthritis shoulder.

2. Need of the Study

On reviewing the literature, many studies had conducted on scapular dyskinesia to decrease pain, to strengthen the muscles of scapula with increase in range of motion for periartthritis shoulder. But none other studies was there, to find out the effects of scapular dyskinesia exercise in improving the functional activities as an outcome measure for the periartthritis shoulder with scapular dyskinesia problem. So the need of the study is to find out the effects of scapular dyskinesia exercise to improve the functional activities in patients with periartthritis shoulder.

Aim and objectives of the study

- To find out the effects of scapular dyskinesia exercise in improving functional activities for periartthritis shoulder.
- To find out the effects of scapular dyskinesia exercise in correcting the scapular alteration for the periartthritis shoulder by lateral scapular slide test as an outcome measure.
- To find out the effects of scapular dyskinesia exercise in improving the functional activities in patients with Periartthritis with SPADI as an outcome measure.

3. Methodology

Total 30 subjects with periartthritis shoulder between the age group of 45 to 60 years were selected. This study was conducted at srivenkateshwaraa medical college, hospital and research centre, Puducherry, They were equally randomized into two groups: Experimental group (15) and Control group (15). Treatment duration was 3 weeks.

Inclusion Criteria:

- Capsular pattern positive.
- Freezing stage of periartthritis shoulder patients with normal finding on radiograph (within one year period).
- Both genders are included.
- Age 40 – 65 years.
- Scapular muscle weakness.
- Patient who have above 1.5cm difference in LSST.

Exclusion Criteria:

- Shoulder dislocation.
- Shoulder surgery within past year.
- History of Rotator Cuff tear
- Types of fracture in relation to shoulder (or) shoulder girdle within 1 year.
- History of direct contact injury to the neck (or) upper extremity within past 30yrs.
- Shoulder girdle motor control deficit associated with neurological disorder (E. g.) stroke, parkinsonism
- Postural abnormality.
- Proprioceptive dysfunction.

Outcome Measure

- Lateral scapular slide test (LSST)
- Shoulder Pain and Disability Index (SPADI)

4. Procedure

Patient who fulfilled the inclusion criteria were included for the study. The benefit of the study and treatment intervention will be explained to the patient and a written informed consent was taken. The subject will be assessed using inch tape for LSST & SPADI for pain and functional activities. Here ultrasound therapy is used as a conventional therapy for both groups. The patients were allocated randomly into 2 groups consisted of 15 patients each.

Experimental Group: Scapular dyskinesia Exercise with ultrasound therapy must be given for 3 sets – 10 repetitions for the 5 days for 3 weeks.

Control Group: Standardized shoulder exercise with ultrasound therapy must be given for 3 sets – 10 repetition for the 5days for 3 weeks.

Assessment of Lateral Scapular Slide Test:

Measurement of Inferior angle of the scapula to the corresponding spinous process.

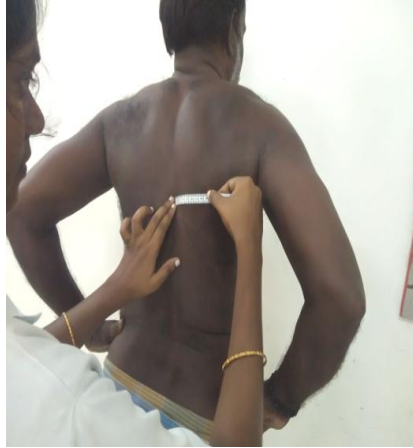


Figure 1: Hands on hip



Figure 2: LSST in maximum abduction and internal rotation

Experimental Group (Scapular Dyskinesis Exercises):

Wall slide:

- Therapist position: stand beside the patient.
- Patient position: Face the wall 1foot distance.
- Procedure: Both the elbow and shoulder 90 degree flexed and ask the patient to slide the forearm against the wall.



Figure 3: Wall slide exercise

Scaption slide:

- Therapist position: Stand beside the patient.
- Patient position: Walk standing position.
- Procedure: Ask the patient to place the shoulder in 45 degree of abduction on the table. The patient raises the arm away from the side in the plane of the scapula, halfway between abduction and flexion.



Figure 4: Scaption slide exercise

Serratus anterior punches:

- Therapist position: Stand beside the patient.
- Patient position: Supine lying with flexed 90degree and slightly abducted and elbow fully extended position.
- Procedure: Place a light weight in the hand, if resistance is tolerated then ask the patient “push” the weight upward without rotating the body.



Figure 5: Serratus anterior punches

Black burn exercises:

Position 1:

- Therapist position: Stand beside the patient.
- Patient position: Prone lying with shoulder, elbow, & wrist in extended position.
- Procedure: The therapist has to apply resistance over the wrist and ask to perform the shoulder extension with the scapula in the retracted position.

Position 2:

- Therapist position: Stand besides the patient
- Patient position: Prone with shoulder abducted 90 degree, elbow flexed and forearm perpendicular to the floor.
- Procedure: Instruct the patient to perform horizontal abduction with the scapula in the retracted position against the resistance applied by then therapist.

Position 3

- Therapist position: Stand beside the patient
- Patient position: Prone with shoulder abducted 90 and externally rotated 90 (90/90 position). The elbow should be flexed 90 degree (or) extended.
- Procedure: Instruct the patient to lift the arm a few degrees off the table.



Position 3

Figure 6: Black burn exercises

PNF D₂Pattern:



Figure 7: PNF D₂Flexion

Figure 8: PNF D₂ Extension

D₂flexion procedure: Shoulder in flexion, abduction with lateral rotation.

D₂ extension procedure: Shoulder in Extension, adduction with medial rotation.

Wand exercise:

- Therapist position: Stand beside the patient.
- Patient position: Lying.
- Procedure: Hold a stick in both hands, palm down, and stretch the arms by lifting them over your head, keeping the arms straight. Hold for 5 sec and return to starting position.

Control Group (Standardised Shoulder Exercises)

Towel slide exercise:

- Therapist position: stand beside the patient.
- Patient position: standing relaxed with hands held by the side of the body.
- Procedure: The patient places the hand on a towel with the elbow slightly flexed. The patient is ask to wash his/her back in too & fro motion going from a retracted scapula & extend arm to protract scapula repeat the following procedure for 5 times.



Position 1



Position 2

Pendular exercise:

- Therapist position: Stand beside the patient.
- Patient position: Standing, with the trunk flexed at the hip about 90°. The arm hangs loosely downward in a position between 60° & 90° elevation.
- Procedure: Ask the patient to perform forward, backward, side to side, in circles clockwise & anti clockwise direction

Finger ladder Exercise:

- Therapist position: Stand beside the patient.
- Patient position: Face the wall 1 foot distance.
- Procedure: Touch the wall at your waist level with finger of affected arm & walk the finger up the wall like a spider crawl to the point you can perform comfortably.

Mariner’s wheel Exercise:

- Therapist position: Stand beside the patient
- Patient position: Hands are placed on the Mariner’s wheel.
- Procedure: Ask the patient to perform clockwise and anticlockwise to move the wheel in the circular motion.

Ultrasound Therapy:

Ultrasound therapy with intensity of 1.0 watt/ cm sq and 1MHZ frequency was applied for 8 minutes during each session. The treatment was carried out in 5 sessions in a week, for a period of 3 weeks.

Statistical Analysis

In this study, the outcome values obtained were manually calculated to find out efficacy of scapular dyskinesis exercise in improving the functional activities for patients with periarthritis shoulder was statistically analyzed between experimental and control group. The pre - test and post - test interventional differences within the two group were analyzed using paired ‘t’ test for outcome measures. Statistical significance was set at $p < 0.05$ to consider as a significance difference.

Paired ‘t’ Test Value (Within Group Analysis)

Table 1: Within group analysis of SPADI Outcome measure in Experimental group

| Experimental Group | Mean | SD | t - Value | p - Value |
|--------------------|-------|-------|-----------|-----------|
| Pre Test | 83 | 6.491 | 28.51 | <0.05 |
| Post Test | 20.66 | 7.037 | | |

The p value of SPADI for Experimental group is <0.05, considered significant.

The t value of SPADI for Experimental group is 28.51 with 14 degree of freedom.

Table 2: Within group analysis of SPADI Outcome measure in Control group

| Control Group | Mean | SD | t - Value | p - Value |
|---------------|-------|-------|-----------|-----------|
| Pre Test | 68.33 | 9.940 | 19.79 | <0.05 |
| Post Test | 25.33 | 9.154 | | |

The p value of SPADI for Control group is <0.05, considered significant.

The t value for Control group is 19.79 with 14 degree of freedom.

Table 3: Within group analysis of LSST (Hands on hip) in Experimental group

| Experimental Group | Mean | SD | t - Value | p - Value |
|--------------------|--------|--------|-----------|-----------|
| Pre Test | 2.4133 | 0.3758 | 10.7753 | <0.05 |
| Post Test | 1.1866 | 0.2325 | | |

The p value of LSST for Experimental group is <0.05, considered significant.

The t value of LSST for Experimental group is 10.77 with 14 degree of freedom.

Table 4: Within group analysis of LSST (Hands on hip) in Control group

| Control Group | Mean | SD | t - Value | p - Value |
|---------------|--------|--------|-----------|-----------|
| Pre Test | 1.9733 | 0.3750 | 5.1725 | <0.05 |
| Post Test | 1.2066 | 0.3283 | | |

The p value of LSST for Control group is <0.05, considered significant.

The t value of LSST for Control group is 5.172 with 14 degree of freedom.

Table 5: Within group analysis of LSST (Maximum abduction and internal rotation) in Experimental group

| Experimental Group | Mean | SD | t - Value | p - Value |
|--------------------|--------|--------|-----------|-----------|
| Pre Test | 2.4466 | 5.3031 | 12.7266 | <0.05 |
| Post Test | 0.5266 | 0.2086 | | |

The p value of LSST for Experimental group is <0.05, considered significant.

The t value of LSST for Experimental group is 12.72 with 14 degree of freedom.

Table 6: Within group analysis of LSST (Maximum abduction and internal rotation) in Control group

| Control Group | Mean | SD | t - Value | p - Value |
|---------------|--------|--------|-----------|-----------|
| Pre Test | 2.8466 | 0.4138 | 9.063 | <0.05 |
| Post Test | 1.4133 | 0.1684 | | |

The p value of LSST for Control group is <0.05, considered significant.

The t value for Control group is 9.603 with 14 degree of freedom

Unpaired ‘t’ Test Value (Between Group Analysis)

SPADI:

Table 7: Showing the post - test values of Experimental group & Control group: (unpaired t - test values)

| Group | Mean | SD | t - value | p - value |
|--------------------|-------|-------|-----------|-----------|
| Experimental Group | 62.33 | 8.465 | 6.082 | <0.05 |
| Control Group | 43 | 8.409 | | |

The ‘p’ value of SPADI is < 0.05 considered significant.

The 't' value of SPADI is 6.082 with 28 degree of freedom.

LSST (Hands on hip)

Table 8: Showing the post test values of Experimental Group & Control group (Unpaired 't' test – values)

| Group | Mean | SD | t - value | p - value |
|--------------------|--------|--------|-----------|-----------|
| Experimental Group | 1.1866 | 0.2325 | 3.626 | <0.05 |
| Control Group | 1.2066 | 0.3283 | | |

The 'p' value of LSST in Hands on hip <0.05, is considered significant.

The 't' value of LSST in Hands on hip for is 3.626 with 28 degree of freedom.

LSST (Maximum abduction and internal rotation)

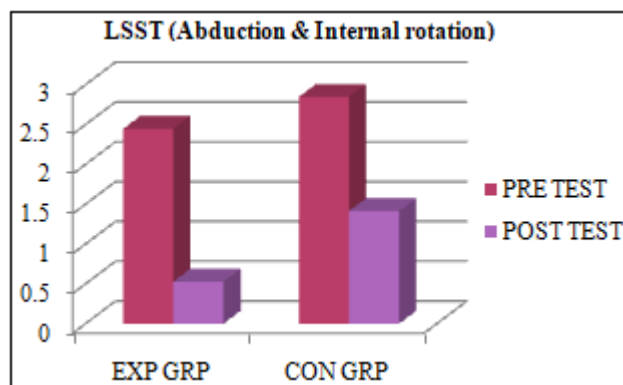
Table 9: Showing the post test values of Experimental Group & control group (unpaired 't' test – values)

| Group | Mean | SD | t - value | p - value |
|--------------------|--------|--------|-----------|-----------|
| Experimental Group | 0.5266 | 0.2086 | 2.2706 | <0.05 |
| Control Group | 1.4133 | 0.1684 | | |

The 'p' value of LSST in maximum abduction and internal rotation is <0.05, considered significant.

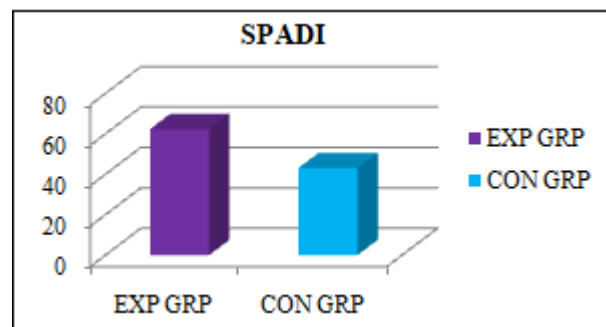
The 't' value of LSST in maximum abduction and internal rotation for is 2.2706 with 28 degree of freedom.

In within group analysis of pre and post test value of LSST shows Experimental group is more significant than Control group with the value of (p<0.05).



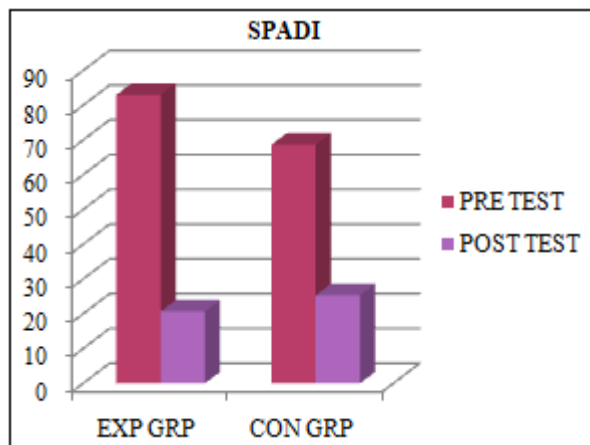
Graphical Representation - 3

In within group analysis of pre and post test value of LSST shows Experimental group is more significant than Control group with the value of (p<0.05).



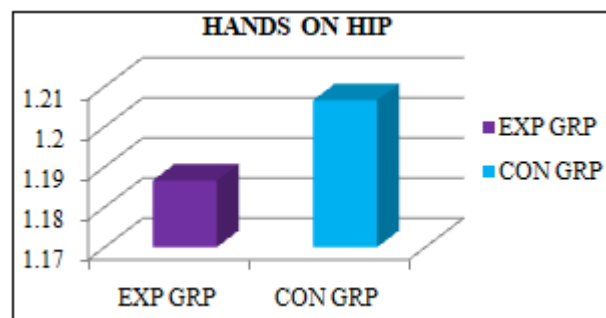
Graphical Representation 4

In between Experimental group and Control group SPADI value analysis shows that Experimental group is more significant than Control group with the p value of <0.05.



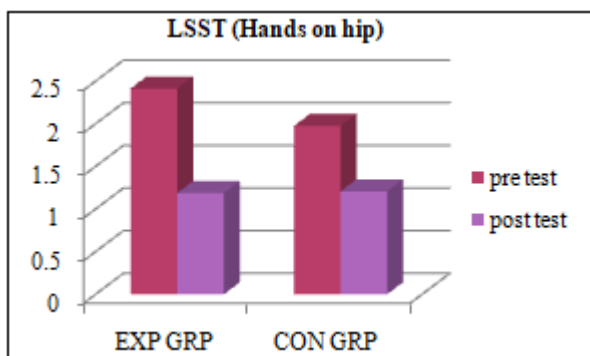
Graphical Representation 1

In within group analysis of pre and post test value of SPADI shows Experimental group is more significant than control group with the value of (p<0.05).

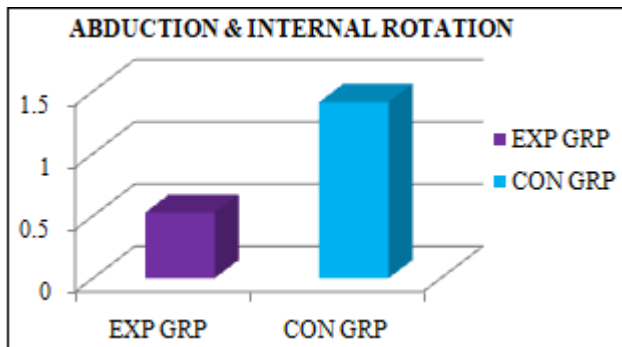


Graphical Representation 5

In between Experimental group and Control group LSST (Hands on hip) the post test value analysis shows that Experimental group is more significant than Control group with the p value of <0.05



Graphical Representation 2



Graphical Representastion 6

In between Experimental group and Control group (Abd & Int. rotation) the post test value analysis shows that Experimental group is more significant than Control group with the p value of <0.05 .

5. Results & Discussion

This study was conducted to evaluate the efficacy of scapular dyskinesia exercise, along with ultrasound therapy and standardized shoulder exercise with ultrasound therapy in patients with periarthritis shoulder. This study is focusing on strengthening the scapular muscles, thereby correcting the scapular alteration in improving the functional activities of the periarthritis shoulder patients.

Overall 30 subjects with age group between 40 to 65 years of both genders were selected on the basis of inclusion criteria were randomly allocated into two groups. 15 subject from experimental group were treated with scapular dyskinesia exercise coupled with ultrasound therapy and 15 subject from control group were treated with standardized shoulder exercise coupled with ultrasound therapy.

Pre - treatment values of pain and disability were assessed using SPADI and scapular alteration was assessed using LSST before and after 3 weeks of treatment. From the statistical analysis, experimental group shows (paired 't' test) in the outcome measure SPADI is 28.51 and LSST (Hands on hip) is 10.7753 & (maximum abduction and internal rotation) is 12.72 whereas for control group SPADI is 19.799 and LSST (Hands on hip) is 5.1725 & (maximum abduction and internal rotation) is 9.063. In between the group analysis of the unpaired 't' test) in SPADI shows is 6.082 and in LSST (Hands on hip) is 3.626 & (Maximum abduction and internal rotation) is 2.2706.

Hence experimental group treated with scapular dyskinesia exercise with ultrasound therapy were showed significant improvement in functional activities thereby improving the ROM and correcting the scapular alteration than the control group treated with standardized shoulder exercise along with ultrasound therapy. Based on this result the data accepts the alternate hypothesis and reject the null hypothesis. This result was significance at 'p' value <0.05 .

The guidelines for integrated rehabilitation of scapular dyskinesia exercise protocol in recovery phase followed by W. Ben Kibler were used in this study to strengthen the shoulder girdle muscle to restore normal scapular motion and correct scapular dyskinesia (Ben Kibler, 2013).

In this study the patient had difficulty in doing exercise before, due to pain. Those patients who were having severe pain were given rest on that day, and instructed to do at home base exercises. Later on the exercises with minimal intensity were given on the next day and they show better improvement. And as a result this help in reducing shoulder pain and correcting of scapular alteration in periarthritis shoulder.

According to Suraj Kumar and Abhay Kumar et al (2012) in their study, "The effectiveness of Maitland technique in idiopathic shoulder adhesive capsulitis discussed about the physiological effect of standardized shoulder exercise given for 4 weeks. They concluded that standardized shoulder exercise within the pain free range used to stimulate the mechanoreceptors and decrease the inflammation and pain by the movement of synovial fluid within the shoulder joint (Suraj Kumar, 2012). Therefore this study concluded that experimental study with scapular dyskinesia exercise, standardized shoulder exercise along with ultrasound therapy was more effective than the control group receiving the standardized shoulder exercise along with ultrasound therapy.

Finally future studies can be continued for 6 weeks to show extreme significant of scapular dyskinesia exercises in periarthritis shoulder. The exact load of the exercises is not well known and it should be clearly assessed in future studies.

6. Conclusion

This study proved that scapular dyskinesia exercises coupled with ultrasound therapy was effective in improving the functional activities and altering the scapular abnormalities than the standardized shoulder exercise coupled with ultrasound therapy for the patients with periarthritis shoulder.

7. Limitations and Recommendation

7.1 Limitations

- Sample size were small
- Treatment duration is too short to interpret the results, and also considering the condition.

7.2 Recommendation

- Large sample size can be selected.
- Further studies can be done base on the other criteria's excluded in this study.

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