

Role of Ultrasound With Laser To Improve Function in Rotator Cuff Injury For Age Group 40 -55 Years

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Abstract: Background: Rotator cuff injury is a major problem for rural as well as urban population and the rehabilitation plays an important role in decreasing pain and improving function in the shoulder joint. Purpose of Study: To know the role of Ultrasound Therapy and LASER therapy in the management of rotator cuff muscles injury of the shoulder joint. Methodology: 20 male patients (10 in each group) were randomly recruited for the study. Group A is Ultrasound therapy whereas group B is LASER therapy for 5 days in a week for four weeks. The data were taken on baseline, 30 days and 90 days. Result: The result shows that the ROM flexion, abduction, internal and external rotation of shoulder are improved significantly higher in LASER group compared to as ultrasound therapy group. Conclusion: Thus the study concludes that ultrasound therapy as well as LASER therapy is helpful modalities for management of rotator cuff injuries but LASER causes higher improvement. Therefore LASER is much better than the Ultrasound therapy for the management of grade 1 and 2 rotator cuff injury.

Index Terms: Ultrasound, rotator cuff injury, ROM, LASER

I. INTRODUCTION

The shoulder is a joint evolved for mobility, and to some extent stability has been sacrificed to achieve a wide range of motion. Rotator cuff injury is injury to the four group of muscle and tendon of shoulder joint. Shoulder stability is a result of a complex interaction between static and dynamic shoulder restraints. Disruption to these restraints manifests itself in a spectrum of clinical pathologies¹. Supraspinatus, infraspinatus, subscapularis, teres minor. All these four group of muscles joint to form Cuff called rotator cuff .injury or tear of any muscles leads to pain, edema, loss of motor function, decrease in ROM that is abduction, flexion, internal rotation, and external rotation. Meyer reported Attrition theory of its etiology². C.S. Neer describes the types of tear, edema and hemorrhage as grade 1 may be due to overuse and overhead activity in sports. This is observed in younger age group of below 25 years. Grade 2 Stages found in age above 25 years to 40 years due to overhead activity, due to repeated over head activity and there is mechanical inflammation the bursa becomes thickened and fibrotic, this occurs in throwing is found in above 40 years of age³. It causes pain, weakness of shoulder muscles⁴. There is complete loss of motor function of shoulder abduction, flexion, internal rotation and external rotation.

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Rotator cuff tear is due to intrinsic factor and extrinsic factor. Intrinsic factor are due to osteoarthritic change occurs in shoulder bone which is due to age related degenerative changes occurs which giving rise to partial and later complete rupture of the tendon body. Impingement of rotator cuff, over use or overhead activity in sports activity. Extrinsic factors are those which are due to external factor e.g. RTA, sports activity, swimming sports, fall from height.

Prevalence of rotator cuff is about 14.7% prevalence per 1000 patients per year with life time 70 % of shoulder pain is complained by patients. In the community as many as 20% of the adult population experience shoulder symptoms at any one time and this seems to be increasing in incidence⁵. About 1% of population reaches to clinician for consultation for shoulder injury it is third most common site of injury in body which causes pain ,stiffness unable to perform abduction, flexion internal and external rotation, disability and affects daily activity of life eating, dressing, personal hygiene⁶. Most common causes of shoulder pain in primary care are reported to be rotator cuff disorders, acromioclavicular joint (AC) disorder and glenohumeral joint (GH) disorders. There is weakness in muscles and tendon due to tear⁵. There is loss of blood supply to the tear muscles and tendon⁷.

This study hypothesized that the functional improvement in the rotator cuff injury is more beneficial by the application of the Laser therapy than the Ultrasound therapy

II. METHODOLOGY

A. Study design

20 male patients with 10 subjects in each group A and group B, with diagnosis of shoulder rotator cuff injury were recruited for the study from the out-patient (OPD) department of the Goodwill hospital & Research Centre Noida U.P. India. Diagnosed case of Rotator cuff tear of grade 1 and 2 by orthopedic surgeon .This study was approved by MONAD UNIVERSITY, Hapur for PhD curriculum course. Before participation the prospective individuals were explained about the objective of the study along with the duration and nature of the study. They were also explained that upon participation in the study they can be allotted to any of the treatment group as per their random allocation. Volunteers, who will to comply with protocol of the study, were evaluated according to the inclusion and exclusion criteria of the study for checking their suitability for this study.

B. Inclusion Criteria for the study included

Subjects diagnosed with unilateral rotator cuff injury (stage 1 and 2); resisted isometric contraction of the muscle painful suggestive of its inflammation/tendinitis; age group of between 20 -55 years (this excludes mostly age related degenerated tears; and adolescence related bone/muscles disorders; pain associated with shoulder movements for at least 3 Week to 1 months; limitations in the shoulder range of motion in direction of abduction, flexion, internal rotation and external rotation. All subjects must have diagnosis of rotator cuff injury established using clinical and radiological examination by experts.

C. Exclusion Criteria for the study were

Patients with type-I diabetes mellitus; past history of surgery on the affected extremity or neck; history of neck/head injury; neurological symptoms such as paresthesia or loss of sensation; radiological evidence of tendon calcification in the rotator cuff muscle(s); evidence of complete muscle tear; rotator cuff injury secondary to hyperthyroidism; history of cardio-vascular accident, brachial plexus injury, neurological illness, parkinsonism.

D. Procedure

The design of the study is randomized – controlled trial with three months prospective follow up. The subjects were randomly allocated equally in to any one of the two intervention groups by lottery method. For this, 20 folded papers chits of same shape, color and size were marked either with symbol “A” for the Ultrasound group or symbol “B” for LASER Group were kept in a box and mixed thoroughly before and after withdrawing a paper chit from the box. Each participant of the study was asked to withdraw any one slip of own choice from the box. After the slip was withdrawn, the symbol marked on this slip indicated which treatment group he/she has to be allotted.

After receiving the written consent form from the participants, the demographic variables including age, weight, gender, sex, height and Body mass index (BMI) of the two groups were recorded at baseline. Baseline scores of the dependent variables of the study were recorded including shoulder ROM (range of motion) for flexion, abduction, internal and external rotation.

All variables were recorded by same blinded tester at baseline (0 day), after 30 days, and after 90 days of interventions. All interventions were done by same physiotherapist supervising the test and intervention procedures. Test and retest of the two groups was conducted in the same place and environment and at same time of the day.

After group allocations, respective subjects for either group were given interventions as per the protocol of their concerned group. Treatment interventions were done by same physiotherapist for the 5 days in week for 4weeks (hence total 20 sessions). The duration of each individual treatment session was about 45 to 50 minutes per session. Subjects we required not to take any other treatment or change their exercise schedule. They were requested to report any discomfort or issues if experienced by them during the study tenure.

E. Variables

Dependent Variables of the study were: range of motion (flexion, abduction, internal rotation and external rotation) scores. The independent variables of the study included ultrasound treatment and LASER treatment. *Shoulder ROM*: - range of motion for the shoulder joint was measured using full circle goniometer adopting the standard methodology as described in many previous published literatures.

F. LASER treatment group

Following are the parameters of the LASER therapy used in the LASER intervention group: Infra-red diode LASER; wavelength 905nm; maximum power 25 watt; peak power value 25 watt; pulse frequency 5000Hz; total energy density 1.5Joule/cm²; scanning method; treatment duration 10 minutes per session.

Patient was positioned in the supine lying posture on high couch; with body parts well supported in the position of maximum comfort. The affected shoulder was exposed and marks were made on skin on the anterior aspect of the greater tubercle of humerus bone shoulder at the maximum tender point. Therapist stood on the affected side of affected shoulder. The remaining part of the patient’s body was covered except the part to be treated.

For the LASER treatment both therapist as well as patient wore the protective goggles. Therapist manually scanned the treatment probe over the targeted area in rhythmic manner to cause uniform exposure of the LASER beam to the target area of shoulder.

G. ULTRASOUND treatment group

For ultrasound treatment the coupling medium was applied over the target marked area and then ultrasound transducer head was moved in uniform circular motion to cover the entire area and to make the uniform exposure over the region. The purpose of the coupling medium is to exclude air from the region between the patient and the transducer so that ultrasound can get to the area to be treated.

Group A patients administrated with ultrasound dose with Frequency 1 MHz +/-5%; duty cycle 10%,20%,50% continuous; ultrasound head size 5cm; peak power 20 Watts at 1MHz; intensity amplitude used 0 to2.5W/cm² in continuous mode and 0.3 W/cm² in continuous mode; treatment time 8 Minutes per session for 5 day week for 4 weeks total 20 session.

In both the groups exercises were given which include 15 repetitions of towel compression exercise is done daily. A rounded towel is put in between arm and axillary area, patients is asked to compress his arm, this technique of arm compression will bring contraction and relaxation phase in muscles will increase blood supply in muscles, this exercise will built the muscles bulk which was lost after injury to rotator cuff muscles. This exercise will strengthen the muscles and tendon of the supraspinatus, infraspinatus, subscapularis, teres minor and deltoid, triceps, pectorals muscles.

10 repetition of thera band exercise is followed to increase the strength of the rotator cuff muscle, thera band is tied to pole and the patients is asked to hold the thera band on the affected side by fist making to hold, and patients is asked to stretch it abductor and adductor

position⁸. 10 repetition of shoulder wheel exercise in clock and anti-clock wise direction is performed to gain better circumductory movement and better translation of rotator cuff muscles at Gleno-humeral joint muscles⁹.10 repetition of each Shoulder ladder exercise is performed to increase elevation of the shoulder range of motion in vertical plain as well as in horizontal plane i.e. flexion and abduction direction of shoulder joint against gravitational force in standing position¹⁰.10 repetition of dumbbell exercise with 2.5 pound is performed in supine position in open and close chain exercise is done to increase muscles tone and strength of rotator cuff muscles and tendon.

H. Ethical clearance

The methodology of the study was approved by the research committee of the Monad University, Hapur, Uttar Pradesh, India. The purpose and details of the study were explained to the study subjects and assurance was given regarding confidentiality of the participant’s identity related data.

I. Data analysis

A *priori* alpha level of significance was chosen as 0.05 was used for all analyses. Data obtained was summarized using descriptive statistics of mean and standard deviation. All statistical analysis were performed using SPSS 16.0.

Scores of the dependent variables ROM of shoulder joint for flexion, abduction, internal rotation and external rotation were compared for the three instances in each group at baseline, after 30 days and after 90 days using repeated measures ANOVA and the comparisons were evaluated using Tukey’s post-hoc analysis. These comparisons were performed to evaluate the differences in the performance of the variables for between-group as well as with-in group comparisons.

III. RESULTS

Table 1. Baseline comparison of the demographic variables of participants.

Demographic variables	Ultrasound therapy group (n=10)	LASER therapy group (n=10)	Level of significance (P value)
Age (years)	45.30 ± 3.19	47.60 ± 4.94	0.1164
Weight (kg)	67.90 ± 1.52	67.10 ± 1.63	0.1384
Height (cm)	165.50 ± 3.56	165.80 ± 2.97	0.4202
Duration of symptoms (weeks)	3.30 ± 0.48	3.60 ± 0.16	0.9819
BMI	24.82 ± 1.20	24.41 ± 1.43	0.2481

Table 1 depicting the Independent t-test for between group comparison of the baseline data shows that there was no significant difference between the baseline scores of the Age (p = 0.1164); weight (p = 0.1384); height (p

=0.4202), symptoms duration (p=0.9819) and BMI (p=0.2481).

Table 2. Baseline comparison of the variables ROM (flexion, abduction, internal rotation and external rotation) of participants at day 0.

ROM (variable)	Ultrasound therapy group (n=10)	LASER therapy group (n=10)	Level of significance (P value)
Flexion (day 0)	45.80 ± 6.51	47.00 ± 3.85	0.3110
Abduction (day 0)	44.20 ± 5.11	46.80 ± 3.58	0.1023
Internal Rotation (day 0)	28.60 ± 1.42	29.90 ± 2.24	0.1308
External rotation (day 0)	29.30 ± 2.62	33.80 ± 3.58	0.0024

Base line data in table 1 and table 2 shows that both the groups were homogenous at baseline and there was very little possibility that the any improvement/deterioration in the scores with time could be due to group characteristics.

Table 3: ANOVA comparison among the variable scores with time show that, the performance of the ultrasound therapy group and LASER therapy group shows that for all variables the scores improved significantly with time.

		0 day	30 day	90 day	Level of difference P value
ROM shoulder flexion	Ultrasound group	45.8 ± 6.51	82.3 ± 4.4	122.9 ± 3.75	0.000*
	LASER group	47.0 ± 3.85	96.8 ± 4.02	133.1 ± 2.33	0.001*
ROM shoulder abduction	Ultrasound group	44.2 ± 5.11	81.0 ± 2.53	120.4 ± 2.63	0.001*
	LASER group	46.8 ± 3.58	98.2 ± 3.48	133.6 ± 1.17	0.001*
ROM shoulder internal rotation	Ultrasound group	28.6 ± 1.42	49.6 ± 2.63	59.9 ± 1.28	0.001*
	LASER group	29.9 ± 3.24	53.5 ± 2.54	63.9 ± 1.64	0.001*

ROM shoulder external rotation	Ultrasound group	29.3 ± 2.62	55.3 ± 2.00	63.4 ± 1.34	0.001*
	LASER group	33.8 ± 3.58	60.7 ± 2.98	71.2 ± 2.48	0.001*

Table 3 shows that the variable scores of the LASER group improved significantly higher while compared to the Ultrasound therapy group. While making the comparison it was found that in “0 versus 30 days” as well as “30 versus 90 days” comparison all the variable significantly improved in the ultrasound therapy group as well as in the LASER therapy group. However the improvement in the LASER therapy group was much higher than that in the ultrasound therapy group as flexion on 90 day in ultrasound therapy group are found with mean and standard deviation 122.9 ± 3.75 and in Laser therapy 133.1 ± 2.33 whereas abduction in ultrasound therapy found to be 120.4 ± 2.63 while in LASER therapy 133.6 ± 1.17 . Similarly, the internal rotation in group A was 59.9 ± 1.28 and in group B was 63.9 ± 1.64 and external rotation 63.4 ± 1.34 in group A and 71.2 ± 2.48 in group B.

IV. DISCUSSION

The aim of the study was to know the functional improvement of subjects when ultrasound and laser therapy is used in rotator cuff injury of the shoulder joint, in this study the laser group improve more than the ultrasound group when comparing with functional variable such as flexion abduction, internal rotation, and external rotation.

Similar research has used ultrasound in cervical myofascial for 3 consecutive wk at Trapezius muscles Trigger point has found functional improvement in rom of neck muscle and significant improvement in pain and stiffness reduction of neck muscles¹¹. Similar another study in supraspinatus tendinitis it has found that ultrasound therapy with deep friction massage in Acute Supraspinatus Tendinitis, has found very effective in decreasing in pain and improvement in the functional movements of the shoulder joint¹².

Similarly another study by Gerold R Embenbichler et.al in calcified tendinitis of the shoulder joint has found improvement in the blood circulation and decrease in calcification of the tendon and there is clinical improvement in the functional movement of the shoulder joint when compared to the base line day the p value found to $p < 0.05$ when compared to the sham group. Ultrasound treatment alleviates the symptom for short term¹³. Khalid Othman Al Amoudi¹³ has found that ultrasound and exercise has more positive improvement in pain and functional ROM of the shoulder joint when compared to the subjects who receive only exercise¹⁴.

In this study the improvement for LASER group was more efficient than the ultrasound group which is also similar to the previous study by Liz Saunder in supraspinatus tendinitis used low level laser. A low power laser using an 820 nm, 40 mW probe operating at 5000 Hz to produce a dose of 30 J/cm² was used to treat one group (L); the other group was treated with a similar,

but dummy, laser (DL). It was found that the laser group has got improvement in the pain tenderness when compared to the dummy grouped but this is biased but functional improvement is seen the laser group the p value of the laser group is less The data revealed that the L group had less pain ($p < 0.05$), less secondary weakness ($p < 0.01$) and tenderness ($p < 0.05$) after the treatment than before¹⁵. Another study used low level laser Therapy (LLLT) on osteo- arthritis of the knee joint, LLLT was performed three times a week, totaling nine sessions, using a As-Ga 904 nm laser with mean power of 60 mW and beam area of 0.5 cm². Nine points were irradiated on the knee, with energy of 3.0 J/point. found good result by using low-level laser in osteo- arthritis of grade 2,3,4, suggested mechanisms include: increased mitochondrial ATP and tissue oxygenation, increased levels of neurotransmitters implicated in pain modulation (such as serotonin) and anti-inflammatory effects by this action low level laser used to produce anti-inflammatory decrease the inflammation in the knee joint and improve knee function, ADL and strength of quadriceps muscles when compared to laser irradiated group1 with placebo group 2. There is significant improvement in pain and inflammation and improvement in functional ADL, Low level laser is good tool for treatment of osteoarthritis¹⁶.

The laser causes higher improvement may be because of the deep penetration of the laser wave than the ultrasound wave .The further study may be consider with more no of subjects as well as the increase the duration in days wise.

V. CONCLUSION

The current study concludes that LASER Therapy was found to be effective treatment for management of decrease function and range in patients with rotator cuff injury. Although both ultrasound therapy as well as laser therapy is helpful modalities for improving the ranges of shoulder flexion, abduction and rotation and can be used for the management of the rotator cuff injuries, yet LASER is much better and effective.

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