



## RESEARCH ARTICLE

### EFFICACY OF ULTRASOUND WITH LASER TO IMPROVE PAIN AND DISABILITY IN ROTATOR CUFF INJURY

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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 improve disability in the shoulder joint.

**Purpose of Study:** To know the efficacy of Ultrasound Therapy and LASER therapy in the pain and disability 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 VAS and SPADI scores 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.

#### INTRODUCTION

The shoulder is a joint evolved for mobility, and to some extent stability has been sacrificed to decrease pain and disability. 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. Rotator cuff is one of the cause for shoulder joint pain, which mainly happens in the person during the physical activity of upper limb. Traumatic rupture (Milgrom *et al.*, 1995) of the rotator cuff injury was 1<sup>st</sup> time described by the smith 1834. C.S. Neer describe 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, there is mechanical inflammation and the bursa becomes thickened and fibrotic, this occurs in throwing is found in above 40 years of age (Massich Moayedi and Karen D Davis, 2013). It causes pain, weakness of shoulder muscles (Kelton Burbank, 2008) shoulder pain and responsible approximately 16% of all musculoskeletal pain with a yearly incidence of 15 new episode per 1000 patients seen in the primary health care (Murphy and Carr, 2010). Shoulder pain is a common problem with an estimated prevalence of 4% to 26%. About 1% of adults aged over 45 years consult their GP (General practionar) with a new presentation of shoulder pain

every year in the United kingdom (Randall Patten, 1994). Disability and pain affects daily activity of life eating, dressing, personal hygiene (Randall Patten, 1994). 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 tear (Murphy, 2010). There is loss of blood supply to the tear muscles and tendon (Roach *et al.*, 1991). This study hypothesized that the pain and disability improvement in the rotator cuff injury is more beneficial by the application of the Laser therapy than the Ultrasound therapy.

#### MATERIALS AND METHODS

##### 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, diagnosed case of Rotator cuff tear of grade 1 and 2 by orthopedic surgeon . Before participation the prospective individuals were explained about the objective of the study along with the duration and nature of the study. 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.

##### Inclusion Criteria for the study included

Subjects diagnosed with unilateral rotator cuff injury (stage 1 and 2); resisted isometric contraction of the muscle painful

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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 Weeks 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.

### 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.

### 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. 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 VAS for pain and SPADI. All variables were recorded by same blinded tester at baseline (0 day), after 30 days, and after 90 days. Treatment interventions were done by same physiotherapist for the 5 days in week for 4 weeks (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.

**Variables:** Dependent Variables of the study were perceived level of pain intensity, SPADI pain score, SPADI disability scores. The independent variables of the study included ultrasound treatment and LASER treatment.

**SPADI:** Participants were also requested to complete the shoulder pain and disability index (SPADI) Questionnaire. Shoulder Pain and Disability Index (SPADI) is a tool to measure the self-reported current level of shoulder pain and disability in an outpatient setting for the patients suffering from shoulder problems. The SPADI contains 13 items that assess two domains; a 5-item subscale that measures pain and an 8-item subscale that measures disability (Staples *et al.*, 2010). In both domains of SPADI the each item is scored on a visual analogue scale (VAS).

The scale is a valid tool to document the pain and disability for the shoulder pathologies including rotator cuff disease (Breckenridge and McAuley, 2011) and adhesive capsulitis (Roy *et al.*, 2009). With a reliability coefficients of ICC (intra-class correlation coefficient)  $\geq 0.89$  the SPADI has good internal consistency is high with Cronbach  $\alpha$  typically exceeding 0.90 (Treiber *et al.*, 1998), and a good construct validity, correlating well with other region-specific shoulder

questionnaires. SPADI effectively reflects the change in responses over time and effectively is able to discriminate adequately between patients with improving and deteriorating conditions (Chun-Ming Chang *et al.*, 2012). For the current study the SPADI pain and the SPADI disability scored were interpreted separately.

### 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/cm<sup>2</sup>; scanning method; treatment duration 10 minutes per session.

### ULTRASOUND treatment group

Group A patients administrated with ultrasound dose with Frequency 1 MHz  $\pm 5\%$ ; duty cycle 10%,20%,50% continuous; ultrasound head size 5cm; peak power 20 Watts at 1MHz; intensity amplitude used 0 to 2.5W/cm<sup>2</sup> in continuous mode and 0.3 W/cm<sup>2</sup> in pulse mode; treatment time 8 Minutes per session for 5 days week for 4 weeks (total 20 sessions). In both the groups exercises were given which include 15 repetitions of towel compression exercise is done daily. 10 repetition of Theraband exercise is followed to increase the strength of the rotator cuff muscle (Sayed *et al.*, 2016). 10 repetition of shoulder wheel exercise in clock and anti-clock wise direction (Umit Dundar *et al.*, 2010). 10 repetition of each Shoulder ladder exercise is performed (Shivaumar *et al.*, 2014). 10 repetition of Dumble exercise with 2.5 pound is performed in supine position.

### 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 VAS (pain), SPADI pain and disability index 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 un-paired t-test. These comparisons were performed to evaluate the differences in the performance of the variables for between group as well as with-in group comparisons.

## RESULTS

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 ( $p=0.2481$ ). 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.

**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 2. Baseline comparison of the variables VAS (pain), SPADI disability index of participants at day 0**

Variables	Ultrasound therapy group (n=10)	LASER therapy group (n=10)	Level of significance (P value)
Pain severity (VAS)	7.6 ± 0.51	7.6 ± 0.96	0.5000
SPADI pain score	39.5 ± 0.52	40.80 ± 1.94	0.2212
SPADI disability score	61.20 ± 0.91	60.40 ± 3.30	0.2352

**Table 3. ANOVA Comparison among the variable score with time shows that the performance of Ultrasound Therapy group and LASER Therapy group shows that all the group improve significantly with Time**

		0 day	30 day	90 day	Level of difference P value
Pain severity (VAS)	Ultrasound group	7.6 ± 0.51	4.5 ± 0.52	2.5 ± 0.52	0.000*
	LASER group	7.6 ± 0.96	3.5 ± 0.70	1.2 ± 0.91	0.001*
SPADI pain score	Ultrasound group	39.5 ± 0.52	21.9 ± 2.02	12.3 ± 2.00	0.000*
	LASER group	40.8 ± 1.94	16.2 ± 1.13	7.80 ± 1.03	0.001*
SPADI disability score	Ultrasound group	61.2 ± 0.91	33.1 ± 2.88	16.5 ± 2.06	0.001*
	LASER group	60.4 ± 3.30	24.5 ± 2.91	12.5 ± 1.79	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 VAS score on 90 day in ultrasound therapy group are found with mean and standard deviation  $2.5 \pm 0.52$  and in Laser therapy  $1.2 \pm 0.91$  whereas SPADI pain and disability score in ultrasound therapy found to be  $12.3 \pm 2.00$  and  $16.5 \pm 2.06$  respectively. While in LASER therapy SPADI score was  $7.8 \pm 1.03$  and  $12.5 \pm 1.79$  for pain and disability index.

## DISCUSSION

The aim of the study was to know the 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 variable such as VAS and SPADI pain and disability score. Similar research has used ultrasound in cervical myofascial for 3 consecutive week at Trapezius muscles trigger point has found significant improvement in pain and stiffness of neck muscles (UmitDundar *et al.*, 2010). 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 pain and improvement in the disability of the shoulder joint (Shivaumar *et al.*, 2014). Khalid Othman Al Amoudi (Khalid Othman Al Amoudi *et al.*, 2016) 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 exercise (Sayed Tantawy *et al.*, 2016). 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.

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 before (Liz Saunders *et al.*, 1995). 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 an As Ga 904 nm laser with mean power of 60 mW and beam area of  $0.5 \text{ cm}^2$ . Nine points were irradiated on the knee, with energy of  $3.0 \text{ J/point}$ . 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 produces anti-inflammatory effects By this action low level laser used to 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 osteoarthritis (Vanessa Ovanessian Fukuda, 2011). The laser causes higher improvement may be because of the deep penetration of the laser wave than the ultrasound wave. Similar another study by (Evelyn Mikaela Kogawa 2005) has used low level laser TENS in Tempomandibular disorder both the treatment responded well but low level laser therapy shows more improvement in jaw opening and decrease the pain and tenderness and decrease the VAS in both the group but laser group shows  $p < 0.05$ . Another review of research article by (Roberta T Chow 2009) says that LLLT immediately reduces pain on the Acute pain Neck pain and chronic pain up to 22 weeks. Similar another strong recommendation of low level laser Therapy study by (Yoshiro Musha and Takao Kaneko 2009) in peri-arthritis case that low level laser not only reduces pain and tenderness but also improve range of motion (ROM) of the shoulder joint improve significantly and also reduced the serum prostaglandin

hormone E2 (PGE2) secretion after laser treatment. The further study may be consider with more no of subjects as well as the increase the duration in days wise.

### Conclusion

The current study concludes that LASER Therapy was found to be effective treatment for management of pain and disability in patients with rotator cuff injury. Although both ultrasound therapy as well as laser therapy is helpful modalities for improving the pain score (VAS) and SPADI score thus, can be used for the management of the rotator cuff injuries, yet LASER is much better and effective.

**Ethical clearance:** The methodology of the study was approved by the research committee of the Monad University, Hapur, Uttar Pradesh, India.

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### REFERENCES

Breckenridge, J.D. and McAuley, J.H. 2011. Shoulder pain and disability index (SPADI). *Journal of physiotherapy*, 57(3): 197

Chun-Ming Chang et al, 2012. An interactive Game-based shoulder wheel system for rehabilitation, *Dove Press Journal*.

Ekeberg, O.M., E.B. Holter, E.K. Tveitå, A. Keller, N.G. Juel and J.I. Brox, 2008. BMC Musculoskeletal disorder, 9:68.

Kelton M. Burbank, 2008. Chronic Shoulder pain; part 1 Evaluation and diagnosis American Family Physician; Volume 77, Number 4 . February 15, 453-460.

Khalid Othman Al Amoudi et al. 2016. Comparative study of Rotator cuff Tendinitis Management ultrasound with exercise and exercise alone : *Journal of Nursing and Health Science*, Volume 5, Issue 3 Ver. III, PP 124-128.

Liz Saunders et al, 1995. The Efficacy of Low-Level Laser therapy in Supraspinatus Tendinitis, *Clinical rehabilitation*, 9;126-134.

Massich Moayedi and Karen D. Davis: 2013. Theories of pain :From specificity to gait control. *J.Neurophysiol*, 1091:5-12.

Milgrom, C.S., M. Schaffler, S. Gilbert, M. Van Holsbeeck, 1995. Rotator –cuff changes in asymptotic Adult: *J.Bone joint surg [br]*, 77-B;296-8

Murphy, R.J., Carr, A.J. 2010. Shoulder pain. *ClinEvid* (Online).

Neer, C.S. 1983. impingement lesion: *Clinical Orthopedics and Related Research*. November 173, 70-77

Randall M. Patten, 1994. Tear of Anterior portion of Rotator cuff (The subscapularis tear);MRImaginefinding: *American Roentgen ray society*, 162, 351-354.

Roach, K.E., Budiman-Mak, E., Songsiridej, N., Lertratanakul, Y. 1991. Development of a shoulder pain and disability index. *Arthritis Care Res.*, 4 (4): 143-149.

Roy, J.S., MacDermid, J. C. and Woodhouse, L. J. 2009. Measuring shoulder function: A systematic review of four questionnaires. *Arthritis & Rheumatism*, 61: 623–632.

Shivaumar, H.B., Channapa, Pradeep kumar Reddy et al. 2014. A Comparative study between the efficacies of ultrasound therapy with cryokinetics versus ultrasound with soft tissue massage (Deep friction massage) in acute supraspinatus tendinitis. *J of Evolution of Med and Dent Sci.*, Vol. 3, Issue 15.

Staples, M.P., Forbes, A., Green, S., Buchbinder, R. 2010. Shoulder-specific disability measures showed acceptable construct validity and responsiveness. *J Clinical Epidemiolog*, 63:163–70.

Treiber, F.A., Lott, J., Duncan, J., Slavens, G., Davis, H. 1998. Effects of Theraband and lightweight dumbbetraining on shoulder rotation torque and serve performance in college tennis player. *Amj.Sports Med.*, 26(4):510-5.

Umit Dundar, Ozlamsolak, Fatmasalma et al, 2010. Effectiveness of Ultrasound Therapy in Cervical Myofascial Pain Syndrome: A Double Blind, Placebo-Controlled Study: *Turk J Rheumatol.*, 25: 110-5.

Vanessa Ovanessian Fukuda, Thiagoyukio Fukuda, MarcioGuimaraes et al. 2011. Short –term Efficacy of low level laser in patients with osteoarthritis : A Randomized placebo-controlled,Double-Blind clinical Trial: *Rev Bras Ortop.*, 46(5):526-33.

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