CASE REPORT

# Effect of low level laser therapy on partial tear of supraspinatus tendon

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## Abstract

Low level laser therapy (LLLT) is one of the emerging treatment options for supraspinatus tendinopathy. Focus is on the effectiveness of LLLT in patients with partial tear of supraspinatus tendon. Two patients had three assessments; at baseline, six weeks and three months after the treatment. Tendon thickness, tendon tear, range of motion, manual muscle strength, quality of life, disability of shoulder, arm and hand were measured using errmusculoskeletal ultrasound, goniometer, Oxford classification of muscle testing, QOL-EQ-5D-3L. Patients received LLLT on a treatment dose of 840nm wavelength, 200mW probe and 30 seconds on each point. Therapy was started with energy dose as recommended by world association of laser therapy. Energy dose was reduced by 30% when inflammation came under control. Along with laser, general exercise instructions, Range of motion exercise plan, sham ultrasound for three minutes and cold packs for 15 minutes were applied to the patients three days weekly for three months. Both patients had improved pain, tear thickness, range of motion and functional ability of shoulder joint. Case report suggests high quality randomized controlled trial to find effectiveness of laser either as separate or an adjunct treatment for partial tears of supraspinatus tendon.

**Keywords:** Low level laser therapy, Range of motion exercise, Supraspinatus tendinopathy.

## Introduction

Restricted and painful movements at shoulder joint are relatively a common disorder in adults.[1] Shoulder joint also known as glenohumeral joint is surrounded by a group of muscles called rotator cuff which are affected in chronic shoulder conditions.[2] Major pathological conditions affecting the rotator cuff are tendinopathy, subacromial impingement syndrome, partial or complete tears of the tendon, and acute or chronic bursitis.[3] The patho-mechanics of rotator cuff in tendinopathies are the weakness of the kinetic chain leading to scapular dyskinesia and postural mal-alignment i. e. upper cross syndrome, reduced subacromia.[4] In a study on supraspinatus tendon among old age group, microscopic analysis revealed the change in its structure which mostly comprises of a protein i.e. collagen.[5] Normally, the type I collagen makes 95% of it, with the remaining part made of collagen type II and III. In older people and subjects suffering from tendinitis, collagen type I is replaced by collagen type III, thereby reducing the elasticity.[6]

Many options from conservative to invasive are available in the treatment of supraspinatus tear. All conservative approaches should be tried before surgery. Low level laser therapy (LLLT), used for sports injuries is one of the conservative treatments developed in 1960. Extensive research started from 1980, for different tendons of the body especially superficial rather than deep.[7] Physiological effects seen by LLLT include increased formation of blood vessels, increased adenosine triphosphate production, increased collagen synthesis and removal of inflammatory mediators from the site of injury.[8]

No study has been conducted so far, at least to the best of our knowledge, to see the physical change of the partial tear of supraspinatus tendon in terms of tendon thickness and tear width using musculoskeletal ultrasound after application of LLLT. There is need to conservatively treat the partial tear of supraspinatus tendon conservatively before referring the patients for surgery or injection therapy. This is also important for creating awareness among physical therapists to use laser as a treatment strategy for partial tears of supraspinatus tendon.

## Case Report

A 73 years old male and 45 years old female with right dominant hand presented to the University Physical therapy and rehabilitation clinic Lahore, during February 2016. They were unable to actively lift their shoulder overhead above 130°(male) and 145°(female) while in flexion and abduction modes of movement. Empty and full can test was positive.[9] There was no history of trauma. Tendon thickness and tear were measured on a grey scale Toshiba Xerio (8-14 MHz), range of motion (ROM) was recorded on Goniometry, manual muscle strength on Oxford Scale for Manual Muscle Testing, quality of life by

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**Table:** Values of variables at baseline, 6th week and 12th week after the treatment.

| | | Base-line | | 6th week | | 12th week | | Difference | |
|---|---|---|---|---|---|---|---|---|---|
| | | M | F | M | F | M | F | M | F |
| Physical Change | Tendon Thick (mm) | 5.8 | 9.9 | 5.7 | 7 | 5.6 | 7.4 | 0.2 | 2.5 |
| | Tear width (mm) | 4.3 | 6.8 | 2.8 | 0 | 2.7 | 0 | 1.6 | 6.8 |
| Pain | VAS | 90 | 100 | 60 | 20 | 10 | 0 | 80 | 100 |
| ROM | | | | | | | | | |
| (Deg.) | Flexion | 120 | 145 | 130 | 170 | 150 | 171 | 30 | 26 |
| | Extension | 35 | 20 | 40 | 40 | 40 | 38 | 05 | 18 |
| | Abduction | 90 | 140 | 115 | 155 | 145 | 155 | 55 | 15 |
| | Ext rotation | 50 | 85 | 56 | 85 | 60 | 86 | 10 | 1 |
| | Int. rotation | 48 | 45 | 68 | 75 | 70 | 76 | 22 | 31 |
| Strength (MM*) | Supraspin. | 3 | 4 | 4 | 5 | 4 | 5 | | |
| | Deltoid | 3 | 4 | 4 | 5 | 4 | 5 | | |
| | DASH | 57.2 | 42.5 | 31.1 | 13.3 | 14.5 | 10.2 | 42.7 | 32.3 |
| QOL** | Mobility | 1 | 2 | 1 | 1 | 1 | 1 | | |
| | Selfcare | 2 | 2 | 1 | 1 | 1 | 1 | | |
| | Activity | 2 | 2 | 1 | 2 | 1 | 1 | | |
| | Pain | 3 | 3 | 2 | 2 | 1 | 1 | | |
| | Anxiety | 2 | 2 | 1 | 1 | 1 | 1 | | |

M; male, F; female, ROM; shoulder range of motion measured by goniometer, *Oxford Scale of Manual Muscle Testing (MMT) measuring strength representing 5= Normal 4= Moderate 3=Against gravity 2=Gravity eliminated 1=Trace 0=No contraction, DASH value 0 represents no disability to 100 greatest disability, **QOL, Quality of life 1= no problem, 2= some problem, 3= extreme problem.

QOL-EQ-5D-3L and functional disability by disability of arm, shoulder and hand (DASH)[10] (Table). Musculoskeletal ultrasound was conducted by a qualified musculoskeletal ultrasound specialist.

Male subject with height 174 cm and weight 76 kg had severe left shoulder pain 90/100 on visual analogue scale (VAS). On musculoskeletal ultrasound, supraspinatus tendon thickness was 5.80 mm, partial tear thickness was 4.30 mm at the articular surface. Supraspinatus and deltoid muscle strengths were measured against the level of gravity. There was history of heart surgery 25 years back but the signs bear no clinical correlation. Female subject had height 150 cm and weight 73 kg. She was suffering from hypertension and had right sided shoulder joint pain 100/100 on VAS. She had a family history of shoulder pain with her father suffering from it. Tendon and partial tear thickness was 9.9 mm and 6.8 mm respectively at the articular surface. Strength of supraspinatus and deltoid muscles were at moderate resistance.

Patients received laser therapy (OMEGA XP model) on a treatment dose of 840nm wavelength, 200mW probe, power density 320 mW/cm2, 19.2 J/cm2, 30 seconds for each point.[1] Laser treatment along with ROM exercise plan recommended by chartered society of physiotherapy[11] - sham ultrasound for three minutes and cold packs for 15 minutes were given to the patient three days weekly for three months. Data was analysed through SPSS V21.

Both patients showed reduction in the pain and tear width, improvement in the range of motion and functional ability by moving the shoulder. Table shows values of all variables at baseline, three weeks and 12 weeks after the treatment.

Informed consent was taken from the patients before conducting the study and publication.

## Discussion

Low level laser therapy (LLLT) along with exercise is found to be an effective treatment in old age male and middle age female with supraspinatus partial tendon tear. In a study conducted by J. Kukkonen et al in year 2014,[12] it was suggested that at one-year follow-up, operative treatment is no better than conservative treatment with regard to non-traumatic supraspinatus tears, and conservative treatment should be considered as primary method of treatment for this condition.[12] In a systematic review and meta analysis done by J S Roy et al in year 2015, diagnostic ultrasound was considered as best option in detecting rotator cuff tear instead of Magnetic Resonance Imaging (MRI) and Magnetic Resonance Arthrography (MRA).[13] Study also focused on the use of musculoskeletal ultrasound in diagnosing physical change and healing effects in the supraspinatus tendon after low level laser therapy and recommended exercise.

In a study, Ay S et al used low level laser of neodymium-doped yttrium aluminium garnet for treating non-radiating low back pain. They found moderate pain

reduction and functional improvement for 30 days but the effect was not long lasting and decreased with passage of time.[14] Their results were consistent with the present study which emphasizes effectiveness of LLLT on partial supraspinatus tear but have long duration effects for three months.

Tumilty et al. conducted a study on 25 subjects using low level laser irradiation for the treatment of tendinopathy. Twelve subjects gave positive results when pain and inflammation were the variables but 13 subjects had no improvement in pain.[7] They gave conflicting results which may be due to different types of tendinopathy, regional variations, small sample size, age or using different laser parameters and thus leading to discrepancy between the results.

Another systematic review and meta-analysis gave consistent results indicating the effectiveness of low level laser therapy for shoulder tendinopathy. They stated that low level laser therapy has better effect on tendinopathy even used alone but moderate to high effects in case of combined approach used in conventional physiotherapy treatment.[15] All studies included in this meta-analysis did not use the musculoskeletal ultrasound to find any physical change within the tendon.

## Conclusion

Low level laser therapy (LLLT) remained effective in patients with partial tear of supraspinatus tendon. The most important aspect of this study is to highlight the role of LLLT in physical change of tendon along with reduction in pain and improvement in shoulder joint's range of motions, muscle strength, and quality of life. Limitation of the study includes low quality evidence, as cases were not compared with any placebo.

**Disclaimer:** This case report has neither been presented nor submitted for publication elsewhere.

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## References

1. Mohseni-Bandpei MA, Keshavarz R, Minoonejhad H, Mohsenifar H, Shakeri H. Shoulder pain in Iranian elite athletes: the prevalence and risk factors. J Manipulative Physiol Ther 2012; 35: 541-8.
2. Robb G, Arroll B, Reid D, Goodyear-Smith F. Summary of an evidence-based guideline on soft tissue shoulder injuries and related disorders--Part 2: Management. J Prim Health Care 2009; 1: 42-9.
3. Wilson JJ, Best TM. Common overuse tendon problems: A review and recommendations for treatment. Am Fam Physician 2005; 72: 811-8.
4. Izraelski J. Assessment and Treatment of Muscle Imbalance: The Janda Approach. J Can Chiropr Assoc 2012; 56: 158.
5. Marturano JE, Xylas JF, Sridharan GV, Georgakoudi I, Kuo CK. Lysyl oxidase-mediated collagen crosslinks may be assessed as markers of functional properties of tendon tissue formation. Acta Biomater 2014; 10: 1370-9.
6. Lui PP, Chan LS, Lee YW, Fu SC, Chan KM. Sustained expression of proteoglycans and collagen type III/type I ratio in a calcified tendinopathy model. Rheumatology (Oxford) 2010; 49: 231-9.
7. Tumilty S, Munn J, McDonough S, Hurley DA, Basford JR, Baxter GD. Low level laser treatment of tendinopathy: a systematic review with meta-analysis. Photomed Laser Surg 2010; 28: 3-16.
8. AlGhamdi KM, Kumar A, Moussa NA. Low-level laser therapy: a useful technique for enhancing the proliferation of various cultured cells. Lasers Med Sci 2012; 27: 237-49.
9. Hanchard NC, Howe TE, Gilbert MM. Diagnosis of shoulder pain by history and selective tissue tension: agreement between assessors. J Orthop Sports Phys Ther 2005; 35: 147-53.
10. Kirkley A, Griffin S, Dainty K. Scoring systems for the functional assessment of the shoulder. Arthroscopy: J Arthroscop Relat Surg 2003; 19: 1109-20.
11. Hanchard NC, Goodchild L, Thompson J, O'Brien T, Davison D, Richardson C. Evidence-based clinical guidelines for the diagnosis, assessment and physiotherapy management of contracted (frozen) shoulder: quick reference summary. Physiother 2012; 98: 117-20.
12. Kukkonen J, Joukainen A, Lehtinen J, Mattila K, Tuominen E, Kauko T, et al. Treatment of non-traumatic rotator cuff tears. Bone Joint J 2014; 96: 75-81.
13. Roy JS, Braën C, Leblond J, Desmeules F, Dionne CE, MacDermid JC, et al. Diagnostic accuracy of ultrasonography, MRI and MR arthrography in the characterisation of rotator cuff disorders: a systematic review and meta-analysis. Br J Sports Med 2015; 49: 1316-28.
14. Ay S, Do?an SK, Evcik D. Is low-level laser therapy effective in acute or chronic low back pain? Clin Rheumatol 2010; 29: 905-10.
15. Haslerud S, Magnussen LH, Joensen J, Lopes-Martins RA, Bjordal JM. The Efficacy of Low-Level Laser Therapy for Shoulder Tendinopathy: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Physiother Res Int 2015; 20: 108-25.