

Significance of Low-level Laser Therapy in Rotator Cuff Tendinitis: A Prospective, Single-blind Study

Mohsen Karami^a, Amin Karimi^{a*}, Babak Gangei^b, Kamyar Akrami^c, Adel Ebrahimpour^a

^a Department of Orthopedic Surgery, Shahid Beheshti University of Medical Sciences, Tehran, Iran; ^b Department of Orthopedic Surgery, Tehran University of Medical Sciences, Tehran, Iran; ^c Department of Rehabilitation Sciences, Tehran University of Medical Sciences, Tehran, Iran

*Corresponding Author: Amin Karimi, Department of Orthopedic Surgery, Shahid Beheshti University of Medical Sciences, Tehran, Iran. E-mail: aminkarimi79@yahoo.com

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Abstract

Introduction: This prospective, single-blind trial aims at assessing the efficacy of low-level laser therapy in rotator cuff tendinopathy. **Materials and Methods:** Fifty-four patients with painful impingement syndrome were equally divided into two groups, of which one was treated using an inactive machine via the placebo procedure (group A) and another from a functional machine (group B). The Range of Motion and Western Ontario Rotator Cuff Index (WORC) questionnaires were implemented to conduct the comprehensive shoulder examination of the patients during a 2 months follow-up period. **Results:** After one month of treatment, the patients in group B recorded better WORC score compared to group A (38 versus 46), which was significant ($P=0.03$). However, after one more month, the score changed to 40 for group A and 36 for group B, which was not statistically significant. In each group, the WORC score changed after treatment with significant difference (P -value=0.023 in group A and 0.04 in group B), but the difference between both the groups was not significant after the final visit. **Conclusion:** The results suggest that low-level laser therapy had no significant effect and acted primarily as a placebo treatment in rotator cuff tendinitis.

Keywords: Laser, Physiotherapy, Shoulder, Tendinitis

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Introduction

Musculoskeletal disorders (MSDs) are injuries that cause problems in human body's movement. Some of the common MSDs in the modern society include osteoarthritis, tendinitis, and painful spinal disorders (1). Different treatments such as locally applied or orally administered drugs, electrotherapies, joint mobilization techniques, exercise therapy, cognitive behavioral therapies, and alternative treatments are currently used for these MSD conditions (2, 3).

Two significant biological responses have been targeted as possible mechanisms for low-level laser therapy (LLLT) owing to its beneficial clinical effects on tendinopathy and osteoarthritis (4, 5). The first possible biological response results in a modulating as well as dose-dependent effect on fibroblast metabolism and collagen deposition. It has been observed in various controlled studies on cell cultures and animals (6). The second possible biological mechanism resembles the non-steroidal anti-

inflammatory drugs (NSAIDs) and steroids. Controlled laboratory trials have deduced that LLLT could be beneficial in reducing inflammation by decreasing the prostaglandin E2 (PGE2) concentrations and inhibiting cyclooxygenase 2 in cell cultures (7).

In a human experimental model of healthy Achilles tendons, the loading of tendon cells increased the cyclooxygenase 2 expression and released PGE2 *in vitro* and peritendinous PGE2 concentrations (8).

Laser energy can reduce both thermal and non-thermal biological effects. However, to produce significant thermal effects on human tissues, the average power of the laser beam must be about 500 mW. Most of the laser equipments used in physiotherapy have an average power density between 1 and 50 mW/cm² and therefore, fail to produce the required thermal effects but are functional in terms of their non-thermal or biological effects. Hence, we conducted a prospective single-blind trial to assess the efficacy of LLLT in the treatment of impingement syndrome (rotator cuff tendinitis).

Table 1. Mean WORC -IR (WORC) total score and internal rotation in both groups before and after treatment (*IR: Internal Rotation)

	Mean WORC-IR*, pretreatment	Mean WORC-IR at 12 th session	Mean WORC-IR at 1 month	Mean WORC-IR at 2 months
Group A	70.3-65.2	57.1-70	46.3-68.1	40.5-72
Group B	63.1-70.1	50.2-68.1	38.0-72.5	36.4-70.8

Materials and Methods

Fifty-four patients with typical rotator cuff tendinitis were selected for this the study. However, patients diagnosed with rotator cuff tear having inability to read or experiencing severe pain were excluded from the study. The selected patients were randomly divided into two groups. Group A was treated with "off" placebo laser machine and a ten days treatment of NSAIDs therapy, whereas Group B was treated with "on" laser machine (GaAlAs Laser) along with similar NSAIDs therapy. Our laser therapeutic protocol included 12 sessions of machine laser treatment with a power density of 20–30 mW/cm² to administer a dose of 4–8 J/cm² energy at four critical points of the shoulder in 3 minutes for each patient. The laser light was applied with 810 nm wave length (5).

The patients were evaluated in two phases. The first phase included the pretreatment evaluation before one and two months of the treatment, and the second phase was after the completion of 6th and 12th sessions of the treatment. The Range of Motion (ROM) and Western Ontario Rotator Cuff Index (WORC) questionnaires were implemented to conduct the comprehensive shoulder examination of the patients. The WORC comprises 21 items that address symptoms in five domains, i.e., physical (6 items), sport/recreation (4 items), work (4 items), lifestyle (4 items), and emotions (3 items) related symptoms. Each item's response is recorded on a visual analog scale of 0–100, where 0 represents the least amount of symptoms and 100 represents the worst possible count of symptoms. The results can be calculated for each separate domain with the score ranging from 0 (least symptoms) to 2100 (worst symptoms) (10–12). The informed consent was obtained from all the participants, and the present study was approved by the Ethics Committee of the Tehran University of Medical Sciences.

The data were analyzed using SPSS (version 11.5.0, Chicago, IL), and the P value was based on the student t test for continuous variables. P values for categorical variables were generated using Chi-Square test. A P-value of <0.05 was considered significant.

Results

Out of 54 patients, 40 were men and 14 were women. The mean age of the patients was 36 years in group A and 41 years

in group B. The mean duration of symptoms was 2.1 months in group A and 1.9 months in group B. The mean pretreatment WORC total score was 70 in group A and 63 in group B. There was no significant difference in terms of age, duration of symptoms, and WORC scores between the study groups.

After one month of treatment, the patients in group B had better WORC score compared to group A (38 versus 46), which was significant ($P=0.03$). But after one more month, the value changed to 40 for group A and 36 for group B, which was not statistically significant (Table 1). In each group, WORC score changed after treatment with significant difference (P -value=0.023 in group A and 0.04 in group B), but the difference between both groups was not significant after the final visit (Table 1).

Pre- and post-treatment physical examination showed that there was no significant improvement in shoulder mobility, especially in case of internal rotation of shoulder, after treatment in both the groups. There was no significant difference in the shoulder movement before and after treatment in both groups (Table 1).

Analysis of each item of the WORC questionnaire (including physical symptoms, sports restriction, work, lifestyle, and emotion) was not concluded because of the limited number of the patients.

Discussion

The recent reviews published on the efficacy of the treatment methods for painful shoulder problems suggest that there is not enough evidence to support or refute the efficacy of physiotherapy in treating shoulder pain (13, 14).

One of the recent physiotherapy modalities is LLLT. Many in-vivo and in-vitro studies showed the efficacy of LLLT in the treatment of tendinopathy or low back pain and Achilles tendinitis (15–18). The in-vitro trials reported that the higher energy doses of LLLT (higher than 0.6 J/cm²) and power density (greater than 7.5 mW/cm²) can suppress inflammation (19, 20). This effect is dose dependent with an optimal range of 1.9–6.3 J/cm² and power density of 21 mW/cm² (21). Hence, we used 810 nm GaAlAs laser beams with a dose of 4–8 J/cm² and power density of 20–30 mW/cm² to reduce the inflammation of rotator cuff tendinitis.

If internal rotation is considered a sensitive shoulder mobility indicator, the changes will not be significant after the treatment in both groups. In spite of some primary amelioration in WORC

total score, the present study failed to find any positive objective or subjective therapeutic response from LLLT in patients with rotator cuff tendinitis. The positive response in each group was similar and might be due to the effect of NSAIDs therapy in both groups. Several treatment options exist for tendinopathy, but none has been reported to be irrevocably effective.

Conclusion

Our study has several limitations. We only used a fixed LLLT dose and short follow-up duration of two months. Thus, it would also be inappropriate to conclude that LLLT is completely ineffective for rotator cuff tendinopathy. More and larger laboratory trials are needed with longer duration to determine the optimal dosage range and intervals between applications.

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Conflict of interest:

None

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Authors' contributions:

All authors made substantial contributions to conception, design, acquisition, analysis and interpretation of data.

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