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Low-Level Laser Therapy for Patients with Subacromial Impingement Syndrome: A Literature Review

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Review Article

Abstract

Introduction: Painful entrapment of subacromial structures versus the choraco-acromial arch is defined as subacromial impingement syndrome (SAIS). Many studies have been done on the use of low-level laser in the treatment of musculoskeletal disorders. However, as the results of the studies are controversial, this study reviewed the results of studies on the effect of low-level laser on the pain and function of patients with subacromial impingement syndrome.

Materials and Methods: PubMed, Scopus, Elsevier, Science Direct, ProQuest, and Medline databases were searched to retrieve clinical trials in English language that were published during the years 2000-2019. The keywords were as shoulder, subacromial impingement syndrome, and low-level laser.

Results: Using the keywords, initially 200 articles were obtained, out of which, 7 clinical trials in English language that met the inclusion criteria were evaluated.

Conclusion: Studies showed that low-level laser was an effective modality for reducing pain and improving the function in subjects with subacromial impingement syndrome.

Keywords: Subacromial impingement syndrome, Low-level laser therapy, Pain, Function, Shoulder

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Introduction

The shoulder joint is the most mobile joint in the human body, which is prone to many injuries (1). Shoulder pain with a prevalence of 16 to 21%, following low back pain (LBP), is one of the most common musculoskeletal pains (1-5). 10% of people complain of shoulder pain at least once in their lifetime (6). Subacromial impingement syndrome (SAIS) is a common shoulder disorder which affects about 44 to 65% of individuals who visit a doctor because of shoulder pain (7-9). There are no accurate statistics on the prevalence of SAIS in Iran.

About one-fifth of the cost of disabilities due to musculoskeletal disorders (MSDs) is spent on patients with shoulder problems. Pain is one of the first symptoms of patients with soft-tissue shoulder disorders (10). People with shoulder pain score lower on physical, social, and pain performance compared to the normal individuals on the 36-Short form (36-SF) scale (11,12).

Painful entrapment of structures in the subacromial space against the coracoacromial ligament is defined as SAIS (13). This syndrome can occur in a variety of forms, from inflammation to degenerative changes in the subacromial bursa, rotator cuff tendon, or biceps tendon. It may even cause a complete rupture of the rotator cuff tendon or degenerative changes in the shoulder (pectoral) girdle joints (14-16).

SAIS impairs upper limb function, reducing quality of life (QOL) (17). Patients complain of pain in the anterior and exterior regions of the acromion, which often spreads to the middle part of the humerus and is exacerbated by raising the arm (18,19). Painful symptoms are exacerbated during the night, especially when sleeping on the shoulder involved, as well as during abduction and resistance movements (20).

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Various non-surgical treatments have been employed to control and manage the symptoms of this syndrome, with surgery possibly being performed in patients who do not respond to conservative methods or in cases of complete rupture (20). The primary goal in the treatment of patients with shoulder disorders is to reduce pain and increase shoulder range of motion (ROM) (15).

Among physiotherapy interventions, low-level laser therapy (LLLT) is one of the modalities that reduces pain, accelerates wound healing, and improves the tissue healing process (21-23). Laser radiation (excited monochromatic light) is able to affect cellular and tissue function, and this ability depends on the properties of light such as wavelength, frequency, coherence, and other physical properties (24). Depending on the amount of energy, physiotherapy laser is one of the low level lasers; because the energy density of this type of laser is much lower than other types used for tissue destruction, cutting, and coagulation (24). Numerous studies have been carried out on the use of LLLT for the treatment of MSDs, but there have been conflicting results regarding the effectiveness of this method in SAIS (25-27). In the present study, the findings on the effect of LLLT on pain and function of people with SAIS were investigated in the form of a narrative review of the studies available.

Materials and Methods

The present study is conducted with the aim to evaluate the effect of LLLT on pain and function of patients with SAIS. The keywords "shoulder, subacromial impingement syndrome, and low level laser" were searched in PubMed, Scopus, Elsevier, ScienceDirect, ProQuest, and Medline databases between 2000 and 2019. It was tried to collect and review all clinical trial and systematic review studies published in English. The review exclusion criteria included qualitative studies, ecological studies, case studies and case series, descriptive studies, and narrative reviews.

Results

Using the abovementioned keywords, first 200 articles were found and among them, 7 articles that met the inclusion criteria were examined. To select the articles, two members of the research group first separated the relevant articles by reading the titles (100 articles) and this process was repeated twice. Articles that were not related to SAIS were excluded from the study. The two people then reviewed the abstracts of the articles, and if the abstracts were not sufficient for decision-making, the full text of the articles was also studied, and finally, 7 studies were finalized (Table 1).

Table 1. Studies related to the effect of low power laser therapy (LLLT) in reducing pain and improving the function of patients with subacromial impingement syndrome (SAIS)

Author(s)	Population	Laser type	Study objective	Results
Yeldan et al. (30)	SAIS	GaAs	Evaluation of the effect of LLLT combined with exercise therapy on shoulder pain and function	Despite exercise therapy, there was no difference between LLLT and placebo in improving performance.
Bal et al. (27)	SAIS	GaAs	Investigating the effect of adding LLLT to exercise therapy on shoulder pain and function	LLLT with exercise therapy had no superiority over exercise therapy alone.
Dogan et al. (29)	SAIS	AlGaAs	Evaluation of the effect of AlGaAs laser on shoulder pain, ROM, and function	LLLT had no advantage over placebo laser in reducing pain, increasing ROM, and improving performance.
Calis et al. (31)	SAIS	GaAs	Evaluation and comparison of the effect of laser, ultrasound, and exercise therapy in the treatment of patients with SAIS	LLLT and ultrasound were not superior to each other in reducing pain and improving function.
Abrisham et al. (26)	SAIS	Pulsed infrared	Comparison of the effect of LLLT combined with exercise therapy and exercise therapy alone in reducing pain and increasing ROM in treating patients with SAIS	LLLT combined with exercise therapy was more effective than exercise therapy alone.
Yavuz et al. (28)	SAIS	AlGaAs	Comparison of LLLT and ultrasound in the treatment of patients with SAIS	Both treatments were effective in reducing pain and improving the function of the patients and in cases of contraindications, the use of LLLT-ultrasound was a suitable alternative.
Kelle and Kozanoglu (25)	SAIS	GaAs	Evaluation of the effect of LLLT and topical injection of corticosteroids in patients with SAIS	Both methods had similar effects in reducing pain and improving function and both treatments were more effective than the placebo laser.

SAIS: Subacromial impingement syndrome; GaAs: Gallium arsenide; AlGaAs: Aluminum gallium arsenide

Most articles were discarded due to reporting shoulder pain for reasons other than SAIS or being out of the desired interval (before 2000).

Number and type of samples: The study population in all articles consisted of women and men with SAIS. Additionally, the number of subjects was between 30 and 80 (25-31) and the number of patients was 150 in only one article (31).

LLLT treatment protocol: In four, two, and one articles, gallium-arsenide (GaAs) laser with a wavelength of 904 nm (25,27,30,31), aluminum-gallium-arsenide laser (AlGaAs) with a wavelength of 850 nm (28,29), and pulsed infrared laser with a wavelength of 890 nm (26) were used, respectively. The treatment lasted for 5-10 minutes (26-30), 150 seconds (25), and 20 minutes respectively in five articles, one article, and one article (31). In all studies, the treatment was performed in between 9 and 15 sessions.

Indicators examined: In all articles, pain was measured based on the visual analogue scale (VAS), performance based on questionnaires [Shoulder Pain and Disability Index (SPADI)] (27-29), [University of California, Los Angeles (UCLA)], [Nottingham Health Profile (NHP)] (25), [Disabilities of the Arm, Shoulder and Hand (DASH)], and [Shoulder Disability Questionnaire (SDQ)] (30), and shoulder ROM (26,29,31). In one study, muscle strength was measured using a hand-held dynamometer (30).

Discussion

In the present study, 7 randomized clinical trial studies performed on the effect of LLLT and its comparison with other physiotherapy treatments to reduce pain and improve the performance of patients with SAIS were reviewed.

Four articles showed the positive effect of LLLT in reducing pain and improving the performance of patients with SAIS. Based on the study by Kelle and Kozanoglu, LLLT was as effective as topical injection of corticosteroids into the subacromial space in improving pain and function in these patients (25). The results of the study by Calis et al. also revealed that LLLT is as effective as ultrasound in reducing pain and increasing ROM in these patients (31). Three of the articles reported the lack of superiority of LLLT over other lasers in reducing pain and improving the patients' shoulder function, in which LLLT was applied in conjunction with exercise therapy (27,29,30). However, among the studies reporting the positive effect of LLLT, exercise therapy was also used. In their study, Abrisham et al. compared LLLT and placebo laser with exercise therapy and reported the superior performance of LLLT. The number of subjects in their study was 80 and the treatment was performed in three points of anterior (coracoid), posterior (glenohumeral joint), and exterior (rotator cuff tendon) (26), but the studies by Bal et al. (27) and Dogan et al. (29) which reported the lack of superiority of the LLLT to placebo, used fewer samples (44 and 52, respectively). Dogan et al. performed laser treatment on painful points (29) and Bal et al. performed the treatment on the anterior and posterior portions of the glenohumeral joint capsule and the subacromial space (27).

In the study by Abrisham et al., lasers was applied in areas where there was more access to the subacromial space, and the positive effect of LLLT was reported in combination with exercise therapy (26), but other studies, in addition to smaller sample sizes, did not use the laser exactly on the subacromial space (27,29,30), and this may have prevented the positive effect of the LLLT from being observed in conjunction with exercise therapy. In the study by Bal et al., a 12-week home exercise therapy program was used alongside the LLLT, and the evaluation was performed after 2 and 12 weeks after the completion of the LLLT. At the end of the second week, there was no significant difference between the groups in the rate of nocturnal pain reduction and SPADI improvement, but after the twelfth week, a significant difference was observed between the group receiving LLLT and the group that had only exercise therapy in favor of the LLLT group. Although long-term exercise therapy was more effective than LLLT in improving performance, laser was more effective in reducing pain after 12 weeks by reducing inflammation (which is the major role in this modality) (27).

In their study, Calis et al. (31) and Yavuz et al. (28) compared LLLT and ultrasound, both of which showed the effect of LLLT and ultrasound in reducing pain and improving performance in subjects with SAIS to the same extent. The positive effect of ultrasound in the treatment of patients with SAIS has been proven in previous investigations (32,33). Therefore, LLLT is as effective in the treatment of these patients as ultrasound.

Limitations

The present study was a narrative review and no qualitative evaluation was performed on the studies. Moreover, only clinical trials were reviewed.

Recommendations

It is suggested that by conducting a systematic review, the quality of the existing studies on the effects of LLLT in people with SAIS be evaluated. It

would also be desirable to retrieve all types of studies to discuss more precisely the effect of this modality on the pain and performance of these individuals.

Conclusion

A review of previous studies indicated that exercise therapy is an important part of the treatment of patients with SAIS who suffer from muscle imbalance and, consequently, narrowing of the subacromial space. The LLLT can be employed as an effective tool to reduce pain and improve the function of patients with SAIS by reducing inflammation and improving repair. Determining the appropriate indicators and also performing laser in the lesion areas is effective in improving the treatment results.

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Authors' Contribution

Zohreh Zaki: study design and ideation, attracting financial resources for the study, data collection, analysis and interpretation of results, manuscript preparation, specialized evaluation of the manuscript in terms of scientific concepts, approval of the final manuscript to be sent to the journal office, responsibility for maintaining the integrity of the study process from beginning to publication, and responding to the referees' comments; Roya Ravanbod: study design and ideation, attracting financial resources for the study, support, executive, and scientific study services, providing study equipment and samples, data collection, analysis and interpretation of results, specialized statistics services, manuscript preparation, specialized evaluation of the manuscript in terms of scientific concepts, approval of the final manuscript to be sent to the journal office, responsibility for maintaining the integrity of the study process from beginning to publication, and responding to the referees' comments; Marc Schmitz: study design and ideation, analysis and interpretation of results, specialized evaluation of the manuscript in terms of scientific concepts, approval of the final manuscript to be sent to the journal office, responsibility for maintaining the integrity of the study process from the beginning to publication, and responding to the referees' comments; Kambiz Abbasi: study design and ideation, support, executive, and scientific study services, providing study equipment and samples, specialized evaluation of the manuscript in terms of scientific concepts, approval of the final manuscript to be sent to the journal office, responsibility for maintaining the integrity of the study process from the beginning to publication, and responding to the referees' comments.

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Conflict of Interest

The authors declare non conflict of interest. Dr. Roya Ravanbod attracted funding for basic studies related to this study from TMU. Zohreh Zaki has been a Graduate Student of Physiotherapy, School of Medical Sciences, Tarbiat Modares University since 2016.

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