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Efficacy of Low-Level Laser Therapy for the Treatment of Nonspecific Chronic Neck Pain: Low-Level Laser Therapy vs. Sham Laser

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Abstract

Introduction: The most common type of neck pain is chronic nonspecific pain. There are conflicting opinions about the beneficial effects of a low-level laser in reducing chronic nonspecific neck pain. The aim of this study was to evaluate the efficacy of low-level laser therapy (LLLT) for the treatment of non-specific chronic neck pain.

Methods: This study was conducted as a prospective randomized clinical trial. Forty-four patients were randomly divided into two groups: (1) Intervention group (n=22): LLLT in the red spectra range with a wavelength of 980 (nm) and a power of 16 (J/cm^2) was irradiated in the affected areas of the neck, the muscles along the spine, and the upper trapezius; (2) sham group (n=22): A low-level laser was irradiated with a passive probe (non-laser red light) in the affected areas of the neck, the muscles along the spine, and the upper trapezius. The treatment protocol consisted of 12 sessions (15 minutes, three times a week, for four weeks). These patients were evaluated for pain using the visual analog scale (VAS) (0-10). The patients were followed up for four weeks.

Results: This study showed a statistically significant reduction in chronic nonspecific neck pain in the LLLT group ($P<0.05$).

Conclusion: It is concluded that LLLT was effective in reducing chronic nonspecific neck pain. LLLT is a non-invasive, safe and effective method that can improve chronic nonspecific neck pain in patients in the short term.

Keywords: Low-level laser; Red spectra; Treatment; Nonspecific neck pain; Chronic neck Pain.

Introduction

In recent years, chronic neck pain, after low back pain, has been the second most common cause of musculoskeletal disability and one of the most common musculoskeletal pains reported by patients.[1,2] The most common type of neck pain is chronic nonspecific pain, which is a postural or mechanical disorder that affects approximately two-thirds of people.[3,4] The prevalence of neck pain in the general population of developed countries is 30% to 50%.[5,6] It is more common in women than men.[1,7] Its annual prevalence worldwide varies from 12.1% to 71.5%, and the annual prevalence of activity-limiting neck pain is reported to be 11.5%.[8,9] The International Neck Pain Task Force recently reported that neck pain affects social relationships, family issues, occupations, health care, and community economies.[1,2,8]

In nonspecific chronic neck pain, the pathological cause of pain is unknown.[10,11] In Iran, with the modernization of society, the expansion of technology, and changes in job duties, the prevalence of neck pain has increased from 20% to 70%. In women with nonspecific chronic neck pain, severe tenderness occurs with the highest prevalence in the scapula levator, cervical extensor, and infraspinatus (18%-30%), and in the upper trapezius, occipital margin, and supraspinatus, a low prevalence rate occurs (13%-19%), in men, the prevalence of severe tenderness is in the scapula levator (13-21%) and in other anatomical areas (0 to 8%).[12]

Various treatment strategies such as medication, electrotherapy, patient education, spinal manipulation, stretching exercises, behavioral therapy, and low-level laser therapy (LLLT) are used to treat neck pain.[13,14] However, there is little evidence to justify their use. Evaluating the effectiveness of chronic neck pain treatments is very important to have a good basis for treatment decisions. Today, there is growing evidence to support the use of LLLT in the treatment of conditions such as wound healing, reduction of inflammation,

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edema, and painful conditions.[12] LLLT is especially useful in treating pains associated with chronic joint disorders, musculoskeletal pain, and chronic back pain.[15-17]

Two systematic studies have shown the effect of LLLT in reducing neck pain and patient recovery over 22 weeks.[18,19] In contrast, some review studies have found that LLLT is ineffective in treating neck pain.[20] Considering the prevention of unnecessary surgery, the use of safe and minimally invasive methods, the benefits of using the therapeutic effects of LLLT, and the existence of conflicting views on the use of LLLT in the treatment of non-specific chronic neck pain, this study is the first attempt to evaluate the effect of LLLT in the treatment of patients with non-specific chronic neck pain in the Iranian population.

Materials and Methods

Forty-four patients were selected sequentially using the simple non-random sampling method, and they were randomly divided into two groups of 22.

This study was performed as a prospective randomized clinical trial (identifier: IRCT201706258146N21; https://www.irct.ir/trial/8579) in patients with non-specific chronic neck pain who were referred to the pain clinic of Shohada-e-Tajrish and Imam Hossein hospitals from 2017 to 2019. Patients with consent to participate in the project, patients aged 20 to 60 years, patients with chronic neck pain for more than three months without red flags (nonspecific), patients with spinal tenderness, and patients without psychiatric disorders entered the project. Patients with no consent to participate in the project, patients with chronic neck pain with red flags, and the ones unwilling to cooperate with the project were excluded from the study.

The patients were randomly divided into two groups based on a table of random numbers: Intervention group (n = 22): LLLT in the red spectra range with a wavelength of 980 nm and a power of 16 J/cm^2 was irradiated in the affected areas of the neck, the muscles along the spine, and the upper trapezius; sham group (n = 22): A low-level laser was irradiated with a passive probe (non-laser red light) in the affected areas of the neck, the muscles along the spine, and the upper trapezius. The treatment protocol consisted of 12 sessions (15 minutes, three times a week for four weeks) in two groups (Figure 1).

It should be noted that in both of the groups, other treatment protocols included patient education, exercise, and similar medication (non-steroidal anti-inflammatory

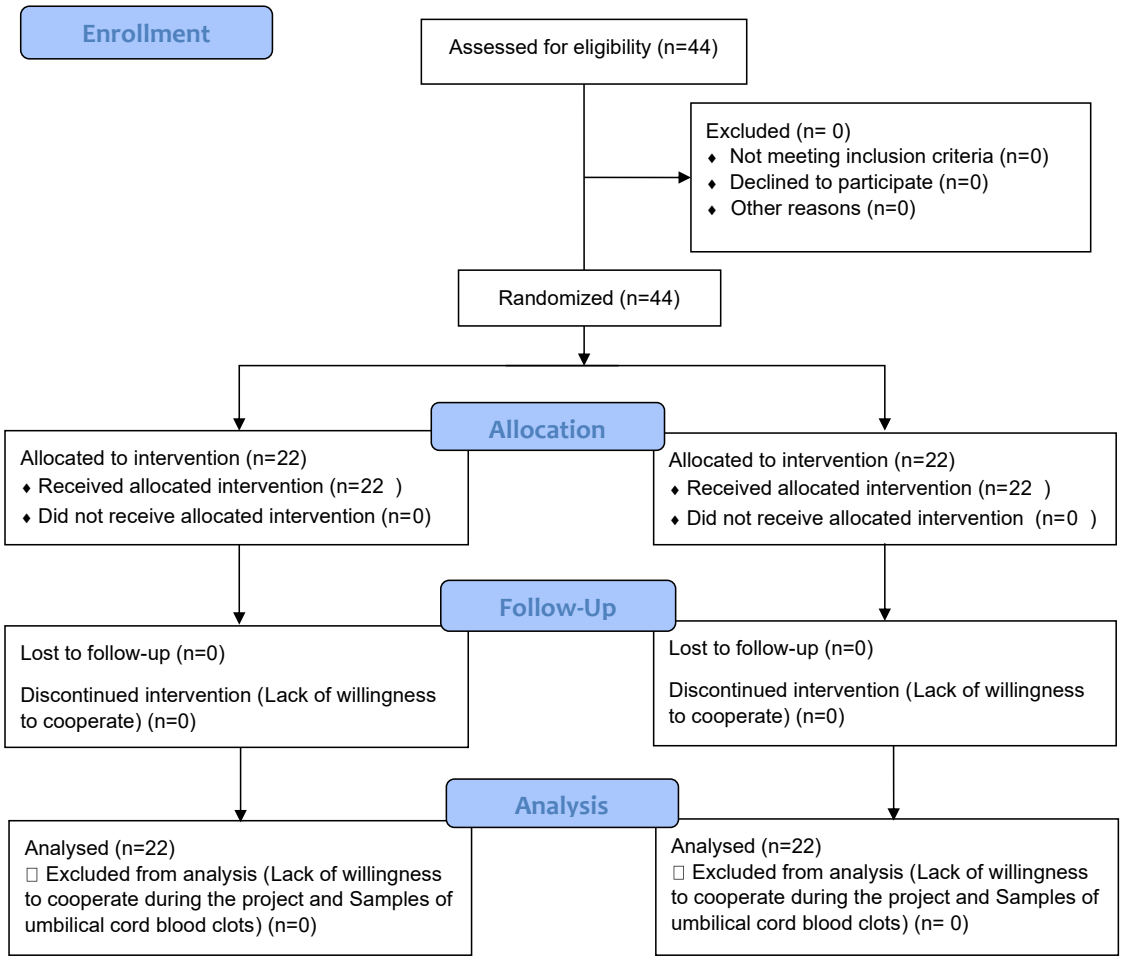

Figure 1. Consort Diagram of the Study

drugs (NSAIDs)).

The patients were asked to show their pain score based on the visual analog scale (VAS) before and a week after the treatment for pain.

The patients were asked to avoid other treatments after enrollment and were only allowed to take NSIAD if they had a VAS > 3.

The occurrence and type of complication were recorded. In order to observe the maximum blinding of the patient and the mentioned people, they were blinded to the type of treatment.

Statistical Analysis

The required information for the project was recorded in the prepared sheets using the information in the patient's file and the data obtained from the follow-up interview and visits of the patient, and the collected data were entered into the statistical SPSS software version 19. After examining the normality of quantitative data by the Kolmogorov-Smirnov test, the mean of quantitative variables between the groups was compared by the t-test and Mann-Whitney U test, and qualitative variables were compared by chi-square, and $P < 0.05$ was considered statistically significant.

Results

The comparison of patients' demographic information between the two groups is shown in Table 1.

The comparison of the changes in neck pain level at different times in the two groups is shown in Table 2 and Figure 2, which showed a statistically significant neck pain relief at different times after LLLT ($P < 0.05$).

Complications of LLLT were not reported in any of the patients over the study period.

Table 1. The Comparison of the Demographic Information Between the Two Groups

	Low-Level Laser (n = 22)	Sham Laser (n = 22)	*P* Value
Age (y), Mean ± SD	50.8 ± 1.6	52.1 ± 3.2	0.541
BMI (kg/m^2), Mean ± SD	29.4 ± 2.5	30.2 ± 3.4	0.265
Gender, No. (%)			
Male	10 (45.5)	8 (36.4)	0.244
Female	12 (54.5)	14 (63.6)	
Neck pain side, No. (%)			0.241
Right	11 (50)	12 (54.5)	
Left	5 (22.7)	4 (18.2)	
Nape	6 (27.3)	6 (27.3)	

Table 2. Comparison of Changes in Neck Pain Based on the VAS in the Two Groups

	Low-Level Laser (n = 22)	Sham Laser (n = 22)	*P* Value
VAS before	8.2 ± 0.5	8.4 ± 1.3	0.435
VAS 1 week after	1.5 ± 0.8	2.5 ± 1.7	0.008
VAS 2 weeks after	3.2 ± 1.4	5.7 ± 3.3	0.014
VAS 3 weeks after	3.1 ± 1.2	6.2 ± 2.5	0.0001
VAS 4 weeks after	2.5 ± 0.2	6.0 ± 2.8	0.0001

Discussion

In this study, we compared the therapeutic effect of the two groups of LLLT and sham laser, and the results of the study were reported weekly for 12 sessions over four consecutive weeks. This study is probably the first one that examined the therapeutic effect of the low-level laser on the treatment of nonspecific chronic neck pain.

In the present study, the neck pain score based on the VAS one week, two weeks, three weeks, and four weeks after the start of LLLT showed a significant decrease compared to the sham group. Numerous studies have examined the effects of LLLT on various diseases such as osteoarthritis, lumbar discopathy, radiculopathy, and neck pain. Therefore, in comparison with previous studies, in this study, the mechanism of the effect of LLLT on improving the pain and function of patients has been considered. However, the results of the therapeutic effect of the low-level laser in this study were consistent with other studies.[15-18]

In our study, pain relief started from one week onwards, which was one of the advantages of the type of laser used in our study. However. in some studies, which used the low-level laser (6 J/cm^2) for 10 sessions (3 minutes on each spot, three times a week), it started 22 weeks later.[21,22]

Other variables that may affect the effectiveness of LLLT are light frequency, level density, and output energy,[15] while the mechanism of the laser in creating the beneficial effects of LLLT remains unknown and studies in this field are still ongoing. In a study, Chung et al presented what is currently known as the complex cellular effects of the low-level laser.[12]

LLLT is not a suitable treatment for injuries with painful conditions, and it is important for patients with these problems to seek proper medical care, but it can be used as an adjuvant treatment in such conditions. Review studies have shown that LLLT is used to improve the

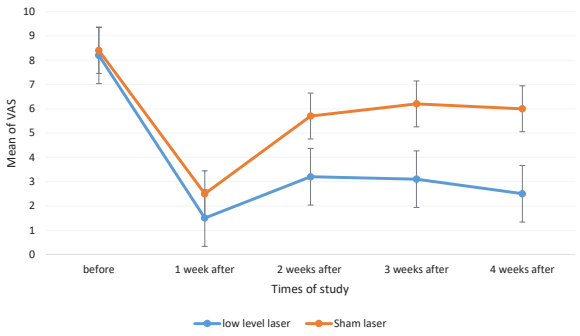

Figure 2. The Comparison of Changes in Neck Pain Level at Different Times in the Two Groups

chiropractic[23,24] effect of physiotherapy,[25,26] postoperative analgesia,[27,28] and the treatment of various painful diseases from carpal tunnel syndrome to fibromyalgia.

From the findings of this study, it can be concluded that LLLT is a minimally invasive, beneficial, safe and effective method of reducing neck pain in patients with nonspecific chronic neck pain.

Conclusion

It seems that LLLT is effective in reducing chronic nonspecific neck pain. LLLT is a non-invasive, safe and effective method that can improve chronic nonspecific neck pain in patients in the short term. Pain specialists and neurosurgeons are advised to consider the use of LLLT in the red spectra range with a wavelength of 980 (nm) and a power of 16 (J/cm^2) was irradiated in the affected areas in 15 minutes, three times a week for four weeks for the treatment of patients with non-specific chronic neck pain.

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Conflict of Interests

The authors claim no conflict of interest.

Ethical Considerations

The present study was conducted after the approval of the Ethics Committee of Shahid Beheshti University of Medical Sciences (approval code number: IR.SBMU.RETECH.REC.1395.383).

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