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(CASE STUDY)

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Effectiveness of blood irradiation by modified intravenous laser (ILIB) on the clinical parameters of fibromyalgia

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Abstract

Pain control remains an urgent task. If the goal is to achieve permanent pain relief and not temporarily mask the pain (masking the pathology), then that goal can only be achieved by treating the pain with physiotherapeutic methods, the most universal and effective of them is low-level laser therapy intensity (LLLT). Treatment methods vary fundamentally in the case of neuropathic pain (nonspecific, primary), which includes pain with trigger point (PT) and nociceptive (specific, secondary) pain, which includes all types of pain resulting from trauma, inflammation, etc. When treating patients with fibromyalgia (FM), which is a chronic condition with high worldwide prevalence, auxiliary therapies have been indicated for the treatment of fibromyalgia including low-level laser. Currently, the low intensity laser has been attached to a bracelet over the radial artery, in order to irradiate blood cells, using a technique called modified ILIB (Intravascular Laser Irradiation of Blood), with improved control of fibromyalgia, of chronic inflammatory processes. This study evaluated the effectiveness of the modified ILIB in improving the clinical parameters of fibromyalgia used to treat a patient who had chronic pain for 20 years, who received conventional treatment associated with two laser applications using the modified ILIB technique.

Keywords: Pain; Fibromyalgia; Intravascular irradiation in the blood by low-level laser

1. Introduction

Pain is a clinical and pathogenetically complex and heterogeneous concept. It differs in terms of location, intensity and subjective manifestations that can be permanent or periodic. For pain control, appropriate medications and effective treatment methods are administered, particularly laser therapy. In order to make these choices, it is important to distinguish the two variants based on pathophysiological mechanisms: neuropathic pain that is nonspecific and primary; and nociceptive: specific and secondary [11].

An example of generalized and chronic muscle or joint pain is fibromyalgia (FM) - rheumatic disease of unknown origin, characterized by generalized muscle weakness (a feeling of fatigue) and the presence of multiple painful regions in characteristic areas of the body, considered sensitive points by some authors [9], trigger points by others8, tender points, especially in the axial skeleton [19]

Among the symptoms frequently associated with the syndrome, fatigue, sleep disorders, morning stiffness, anxiety and depression may be present [13].

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FM affects approximately eight times more women than men, especially in the age group between 35 and 60 years, causing a negative impact on the quality of life and activities of daily living of its patients [18].

According to studies on FM, although there is no distinct pathophysiological basis for the disease, these patients are easily recognized by the prevalence and localization of pain in their bodies. The experts came to the unequivocal conclusion that the treatment of patients with FM must be individual and requires a holistic approach; they need time, empathy and interaction with other professionals [2].

But most importantly, TP's (tender points or trigger points) are the result of the non-specific response of the central nervous system (CNS) in its interaction with the autonomic nervous system (ANS), which manifests itself in FM. In other words, the pain that occurs in PD is neuropathic (nonspecific, primary), and explains the recommended integrated approach to solve the problem of the management of painful syndrome in FM.

Despite a significant number of drugs and non-pharmacological methods of treatment for patients with FM, their effectiveness is not good enough. In addition, the prolonged use of analgesics, sedatives and non-steroidal anti-inflammatory drugs (NSAIDs) - commonly used for treatment - leads to the development of side effects, the worsening and the severity of the patients' condition [3].

Low-level laser therapy (LLLT) is the most universal therapeutic factor, which has no side effects or absolute contraindications, whereas unlike analgesics, it does not only aim at a link in painful reception, but essentially targets the entire hierarchy mechanisms of their origin and regulation16.The use of the integrated approach, which involves a wide range of LLLT methods, allows to restore any abnormalities in the functioning of various organs and systems of the human body, which, in addition to directly blocking pain, guarantees the elimination of the causes of the disease. This “universality” predetermines the exceptional effectiveness of LLLT in the reliable elimination of pain syndromes of different types, provided by the variation of the parameters of the techniques. A methodized laser therapy can promote a healing effect that can persist for months and years. It is even possible to talk about this treatment in a way that suggests that the patient will forget his pain, if not forever, then for a long time [16]

The methods of laser therapy are quite simple and absolutely safe. This stems directly from the known mechanisms of the LILI database, the illumination that causes the body's response through the initiation of Ca2 + dependent processes at a cellular level, after which the disturbed homeostasis is restored through the development of the secondary response of several regulatory systems and organs, resulting in patient recovery [17].

2. Blood irradiation by intravenous laser - modified ILIB

ILIB is an acronym for the English language which means irradiation in the blood by intravenous laser. This low intensity laser application technique was developed in Russia in the mid-1970s. This therapy aims to irradiate blood cells, showing its effectiveness in the treatment of various chronic and acute condictions 12].

According to [10], ILIB promotes a cascade of reactions in the immune system and results in anti-pain effects, modulation of the inflammatory response, decreased edema and reduced healing time. There are two techniques in the literature for the application of ILIB [15].

Direct technique: an intravenous catheter is inserted in one of the upper limbs, coupled to an optical fiber that radiates blood with the laser, directly and continuously at the application site, distributing this irradiated blood through the circulation to the entire organism10. Non-invasive technique: it can also be called transcutaneous, indirect or modified ILIB. In this technique, the laser light indirectly irradiates the blood, being guided by a bracelet placed at the height of the radial artery, on which the low-intensity laser will be attached, passing through different layers of skin, mucosa and adipose tissue15. The treatment with ILIB has an antioxidant effect, through the stimulation of the enzyme Superoxide Dismutase (SOD), which is the main component of the endogenous antioxidant system. It is responsible for the demutation of the superoxide anion (O_2 * -) to hydrogen peroxide (H_2O_2), thus, it protects aerobic beings against the reactivity and toxicity of the superoxide radical, which is the first to form from oxygen. If this radical is not neutralized, it can evolve to the formation of the hydroxyl radical (HO *), which is responsible for the cellular toxicity associated with Reactive Oxygen Species (ROS) [10].

When HO * is formed, it will quickly react with the nearest molecule, such as lipids, proteins or DNA bases, causing cell damage and signaling the cascade of inflammatory reactions. In cases of SOD deficiency, there will be an imbalance in the enzyme immune system, resulting in a large accumulation of HO * in the body. For this reason, it is important to regulate the quantity and functioning of SOD [14].

Another important action of ILIB occurs in the circulatory system. It is known that diseases of circulatory nature, local or systemic, result from mechanical dysfunctions of blood vessels, mainly in the microcirculation. ILIB therapy by SOD stimulation acts on the cascade of arachidonic acid producing prostacyclin (PGI2), formed in the vascular wall, which is a strong antiplatelet agent with vasodilating action [10].

Rearding the red blood cell, ILIB promotes an increase in its hemorheological capacity, facilitating the passage of red blood cells through capillaries of narrow diameter, improving oxygenation and removing toxic metabolisms14. Under laser blood irradiation, anti-inflammatory effects were observed that improved the immunological activity of the blood1.

A decreasing tendency for thrombocyte aggregation and an improved deformability of erythrocytes results in a better oxygen supply and, therefore, a decrease in the partial pressure of carbon dioxide, which is particularly relevant for wound healing4. In addition, the activation of the phagocytic activity of macrophages has been proven in conjunction with structural changes. A positive effect on the proliferation of lymphocytes and subpopulations of B and T cells can also be seen5. Tissue hypoxia is improved, which leads to a normalization of tissue metabolism. In addition, fibrinolysis will be activated. In addition to eliminating hypoxia and normalizing tissue metabolism, there is an increase in ATP synthesis with a normalization of the cell membrane potential. Additional vasodilation is leading to the unblocking of capillaries and collateral vessels in connection with the improved rheological properties described in the blood, along with better tissue trophicity and normalization of sensorineural stimulation6. Mitochondria are marked by a relative increase in the surface of mitochondrial ridges due to the absorption spectrum of cytochrome-C-oxidase in the respiratory chain and ATP4 synthesis.

This therapy can be used to treat clinical conditions in the respiratory system (asthma, changes triggered by smoking); diabetes and its complications; inflammatory conditions; cardiovascular conditions (infarction and angina); conditions of the peripheral vascular system and healing in general [15].

In fibromyalgia, due to the results obtained, intravenous laser therapy in the 90's was considered an effective and safe therapeutic option, with no significant contraindications and side effects7. Gasparyan described the improvement in microcirculation, especially in central nervous structures. In particular, this is more important in the hypothalamus, which has a highly developed vascular microsystem. He assumes that intravenous blood irradiation is stimulating the functional activity of the hypothalamus and limbic system leading to an activation of hormonal, metabolic, immunological and vegetative processes with mobilization of adaptive reserves [2].

3. Clinical case report

Female patient, 47 years old, diagnosed with fibromyalgia for 20 years, using antidepressants, sought dental care in an emergency room because her teeth were aching. After the clinical examination, panoramic radiography was performed as an examination of the patient's initial diagnosis. The image and the intraoral clinical examination showed no significant changes. The patient reported that all teeth hurt, face, neck, hips, knees and hands hurt and burned. The patient reported that she had already attempted suicide with her husband's gun, to try to end the pain she felt every day. Low-intensity red laser therapy was proposed at pain trigger points (right and left TMJ, neck region and between the fingers of the right and left hand) (figure 1) and the modified ILIB laser therapy used for 30 minutes each session, one performed on the right wrist and the other on the left wrist (figure 2), using the DUO MMO portable laser device that contains two wavelengths in the same device, red laser (660nm) and infrared laser (808nm), 600 mW/cm^2 of intensity and 200 J/cm^2 of fluency. Output area of the laser beam at the tip of the laser pen: 3mm^2 (Figure 3). All treatment took place in just two sessions with an interval of 5 days between them.

The patient reported that her pains are gone, that she felt much better, as she is more patient with the events of life and with the people around her. The patient was completely pain free for 2 months after performing point laser therapy and modified ILIBE and did not take analgesics, anti-inflammatories and muscle relaxants during this period. After that period, she reported that the pains were coming back.

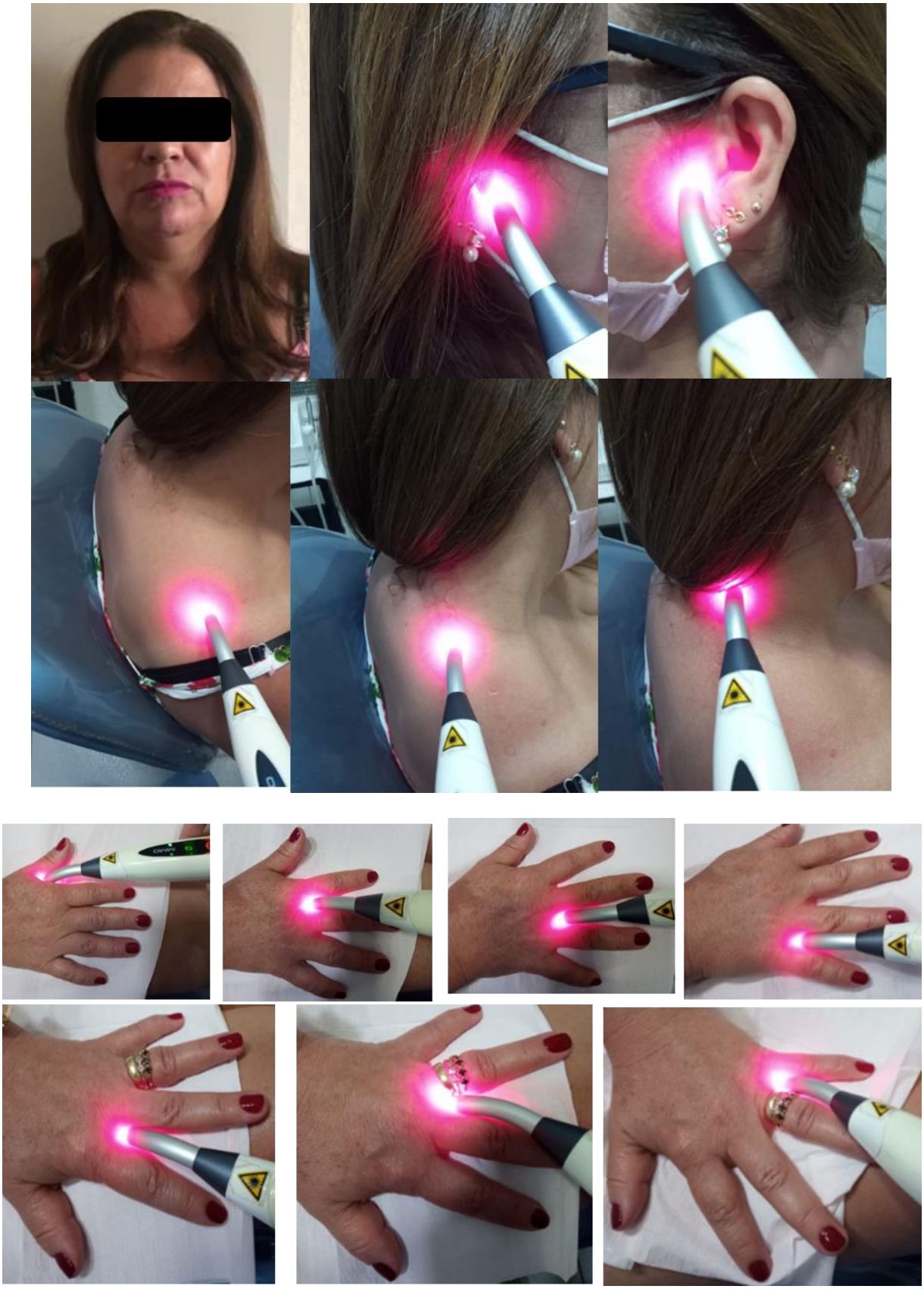

Figure 1 Female patient with fibromyalgia, 47 years old, receiving laser therapy at pain trigger points (right and left TMJ, neck, right and left hand). Source: images made by the author.

Figure 2 Patient receiving modified ILIB laser therapy. Right wrist. Source: images made by the author**.**

Figure 3 MMO DUO portable laser device and bracelet for performing the modified ILIB technique. Blue light-emitting diode (LED) device for photodynamic therapy (PDT). Source: images made by the author

4. Discussion

The symptoms of fibromyalgia include fatigue, sleep disorders, morning stiffness, anxiety and depression [13]. According to the reported clinical case, the patient fits the factors described above, having been diagnosed with fibromyalgia 20 years ago. She reported taking antidepressant medication and not sleeping well at night. And that she wakes up with her hands hurting and burning.

FM affects more women than men, especially in the age group between 35 and 60 years, causing a negative impact on the quality of life and activities of daily living of their patients [18]. The patient left work outside the home because of fibromyalgia. In severe pain for consecutive days, she felt insecure to dedicate herself to the activity outside the home. The patient is 47 years old and is in line with the age range expected for the disease.

According to studies on FM, experts have come to the unequivocal conclusion that the treatment of patients with FM must be individual and requires a holistic approach; they need time, empathy and interaction with other professionals2. The patient reported having been accompanied by a psychologist and physiotherapist and even so, with all the interaction of the professionals, she was unable to stop her pain.

But the most important thing is that the TP's (tender points or trigger points) are the result of the non-specific response of the central nervous system (CNS) in its interaction with the autonomic nervous system (ANS), which is manifested in FM3. The points of trigger of the patients are neck, ATM (temporomandibular joint), hip, knees and hands.

A significant number of drugs and non-pharmacological methods of treatment for patients with FM may not be sufficiently effective. In addition, it leads to the development of side effects, the worsening and thw severity of the patient's condition [3]. The patient uses Escitalopram (20 mg), Pregabalin (150 mg), Bupropion (150 mg), Topiramate (25 mg) and Miosan (10 mg). And she describes that the drugs are not effective in alleviating her pain.

ILIB promotes a cascade of reactions in the immune system and results in anti-pain effects, modulation of the inflammatory response, reduced edema and reduced healing time. During the first application of ILIB, the patient slept sitting in the dental chair while waiting for the 30 minutes of its application. She got up from the chair much better than when she arrived for the treatment proposed by laser therapy. She felt a sense of improvement as soon as we completed the laser therapy applications at the trigger points and after using the ILIB10 application.

Non-invasive technique can also be called modified ILIBE. In this technique, the laser light indirectly irradiates the blood, being guided by a bracelet placed at the height of the radial artery, to which the low-intensity laser will be attached, passing through different layers of skin, mucosa and adipose tissue [15]. This was the technique proposed and used for this clinical case.

A methodized laser therapy can promote a healing effect that can persist for months and years. It is even possible to talk about this treatment in a way that suggests that the patient will forget about her pain, if not forever, then for a long time [17, 19]. For the two months we performed laser therapy on the patient, she told us that she no longer felt the pain she had been feeling. She already had the courage to travel with her husband.

Under laser blood irradiation, anti-inflammatory effects were observed that improved the immunological activity of the blood1. The patient reported that she had not been in pain for two months.

In fibromyalgia, due to the results obtained, intravenous laser therapy in the 90's was considered an effective and safe therapeutic option, without significant contraindications and side effects [7]. The patient is painless with just two treatment sessions and more patient with the occurrences of life and with the people around her. She reported that she seems to have changed, thinks about being someone else.

5. Conclusion

Current procedures for the treatment of chronic pain and fibromyalgia consist mainly of drugs, physiotherapeutic and psychotherapeutic forms, which do not always achieve a significant reduction of symptoms. Intravenous blood irradiation with red light laser has achieved a significant improvement in the symptoms of the disease that affects patients. The observations presented in this work show a significantly positive trend for a clinical record that was otherwise difficult to treat.

Compliance with ethical standards

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Disclosure of conflict of interest

We authors declare a total conflict of interest.

Statement of informed consent

Consent form is attached

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