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Effect to the Synergistic Action of Photobiomodulation and Therapeutic Ultrasound on Psoriatic Arthritis and Fibromyalgia - Case Report

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Abstract

Psoriasis is a chronic inflammatory, autoimmune disease that affects the skin, and over time, can also affect the joints, evolving into psoriatic arthritis. The pathogenesis is related to genetic conditions and etiopathogenic mechanisms, which affect about 2% of the world population. In the aspect of psoriatic arthritis, the chronic peripheral inflammatory process affects the joints, bones and muscles, generating hyperalgesia and allodynia. This process can lead to the development of fibromyalgia, which is a chronic disease with generalized muscle pain, related by genetic and psychosocial factors and concomitant diseases, such as psoriatic arthritis. In this study, the synergistic interaction of photobiomodulation and therapeutic ultrasound was used in a picture of associated diseases of psoriasis, psoriatic arthritis and fibromyalgia. In the evaluation mechanism, the Fibromyalgia Impact Questionnaire (FIQ), Quality of Life in Psoriatic Arthritis (PsAQoL) and the Visual Analogue Scale (VAS) were used. It was observed, in a period of 14 sessions, that the synergistic action of photobiomodulation and therapeutic ultrasound, presented benefits and improvement in the patient's quality of life (FIQ and PsAQoL), as well as pain reduction (VAS).

Keywords: Psoriatic arthritis; Fibromyalgia; Photobiomodulation; Therapeutic ultrasound; Ultra Laser; Synergic treatment

Introduction

Psoriasis is an immunologically mediated chronic inflammatory disease that manifests itself in the skin by erythematous and scaly lesions, with a genetic predisposition and etiopathogenic mechanisms. It affects about 2% of the world population, where about a third of those affected report the onset of the disease before 16 years of age. In general, psoriasis may precede the onset of psoriatic arthritis [1-3].

Psoriatic arthritis is a seronegative form of arthritis, found between 5% and 42% of psoriasis patients and affects men and women in similar proportions (1:1), and the mean age of disease onset is between 30 and 55 years [4].

The most frequent form of psoriatic arthritis is monoarthritis or asymmetric oligoarthritis, which mainly affects the joints of the hands and feet, and may appear on average ten years after the onset of psoriasis [5-7]. Therefore, psoriatic arthritis is a peripheral inflammatory process that affects the joints, bones and muscles, leading to peripheral nerve sensitization, increased production of nociceptive neuropeptides, a state in which the hyper-responsive neuron generates hyperalgesia and allodynia, both in the inflammation site as well as other parts of the body unharmed, developing fibromyalgia [8]. This acute process of psoriatic arthritis can become chronic, making the treatment prognosis unfavorable.

Fibromyalgia is a chronic disease, with persistent pain in the generalized skeletal muscle, associated with symptoms of fatigue, cognitive and sleep disorders, and may be genetically determined and influenced by psychosocial factors and concomitant diseases, such as psoriatic arthritis [8,9].

The vast majority of treatments have pharmacological origins, both in relation to psoriasis and psoriatic arthritis and fibromyalgia, relieving signs and symptoms, inhibiting structural progression, thus improving the patient's quality of life [10]. However, non-pharmacological physiotherapeutic processes, such as photobiomodulation and therapeutic ultrasound, are recommended for treatment. In this sense, the synergistic use of photobiomodulation and ultrasound has been widely used in the treatment of osteoarthritis and fibromyalgia [11, 12]. Photoacoustic therapies can be considered alternative treatments in patients who contraindicate the use of conventional medication or even complementary treatments in order to optimize the effectiveness of treatments already instituted in medicine.

The constant technological evolution in the area of rehabilitation, observed mainly in the areas of osteoarthritis [11], fibromyalgia [12], Parkinson [13], temporomandibular disorders [14], facial paralysis [15] and adhesive capsulitis [16], developed by our research group at the Biophotonics Laboratory of the Instituto de Física de São Carlos has marked the improvement in quality of life of patients affected by different diseases Photobiomodulation, through therapeutic laser, allows the absorption of light stimulus through cytochrome C chromophores, which stimulates a response for each type of lesion, promoting the release of histamine, serotonin, bradykinin, prostaglandins, with changes in the action enzyme, promoting increased energy synthesis (ATP), which favors the reduction of pain, inflammation and tissue repair [17,18].

Therapeutic ultrasound acts due to the effect of it longitudinal waves,

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of deep penetration, being transmitted to biological tissues, producing cellular changes by mechanical effects, reducing pain and inflammation [19,20]. Thus, through extensive use of photobiomodulation and therapeutic ultrasound resources, the objective of this study was to analyze the effect of synergistic photobiomodulation therapy and therapeutic ultrasound on a picture of associated diseases of psoriasis, psoriatic arthritis and fibromyalgia.

Case Report

The study was approved by the Research Ethics Committee of the Santa Casa de Misericórdia de São Carlos, under C.A.A.E 13789319.5.0000.8148. A 51-year-old Caucasian woman was admitted to our clinical research center (Photodynamic Therapy Unit) for screening with a diagnosis of scalp and body psoriasis (16 years ago). Psoriatic arthritis and fibromyalgia shortly after (3 years ago). She related about her troubled childhood. In November 2021, she was positive for Sars-Cov-2 where she had an emotional shake and is undergoing treatment with a psychiatrist. She uses medication for high blood pressure, diabetes, depression and constant pain. Regarding the evaluation mechanism, the FIQ (Impact of Fibromyalgia), PsAQoL (Quality of Life in Psoriatic Arthritis) and the VAS (Visual Analogue Scale) were used, all in initial and final evaluation.

Equipment: In this study, it was equipment developed by the Technological Support Laboratory at the Institute of Physics of São Carlos (IFSC), University of São Paulo (USP) and made to MMOptics. The concept of this equipment allows the therapeutic ultrasound and photobiomodulation, resulting in concomitant application a overlapping of the sonic and photonic wave fields.

Intervention Protocol: There were 14 sessions, twice a week. The parameters used during the conjugate session were: pulsed ultrasound of 1 MHz, frequency 100 Hz, 50% duty cycle, and spatial average temporal average of 0.5 w/cm² (SATA). The laser, wavelength of 808 nm, continuous mode, power of 100 mW and power density of 60W/cm². The application was carried out for 5 minutes on each palm of the hands and on the soles of the feet, totaling 20 minutes of application.

Results

Figure 1 shows the quality of life questionnaire in psoriatic arthritis. It is possible to observe the difference of 75% through the action of the treatment in the before and after visualizations for the "truth" condition, which the higher, the lower the quality of life.

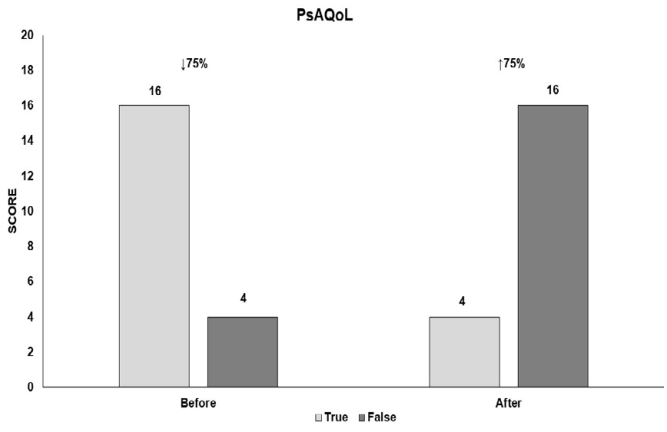

Figure 1: Comparative between before and after condition through Psoriatic Arthritis of Life Quality questionnaire (PsAQoL), considering intervention model used with synergic treatment.

Figure 2 represents the Fibromyalgia Impact Questionnaire, which shows a 57.5% reduction between before and after situations. In this case, the lower the value, the higher the quality of life obtained after the intervention.

Figure 3 represents the comparison between the before and after values of the visual analogue scale. This scale represents the patient's attributed improvement after the 14 intervention sessions, representing a 60% reduction in pain.

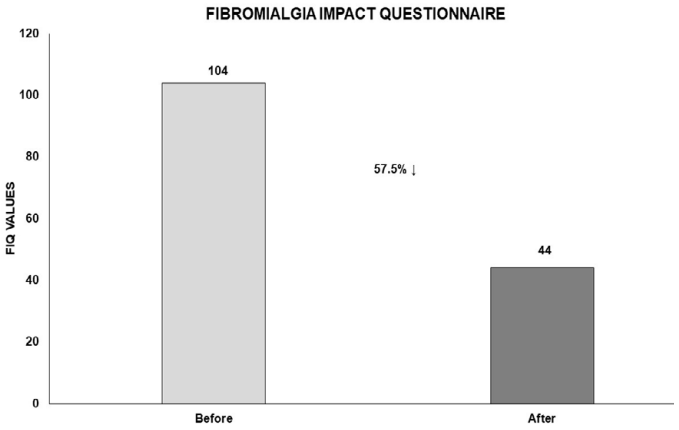

Figure 2: Comparative between before and after condition through Fibromyalgia Impact Questionnaire (FIQ), considering intervention model used with synergic treatment.

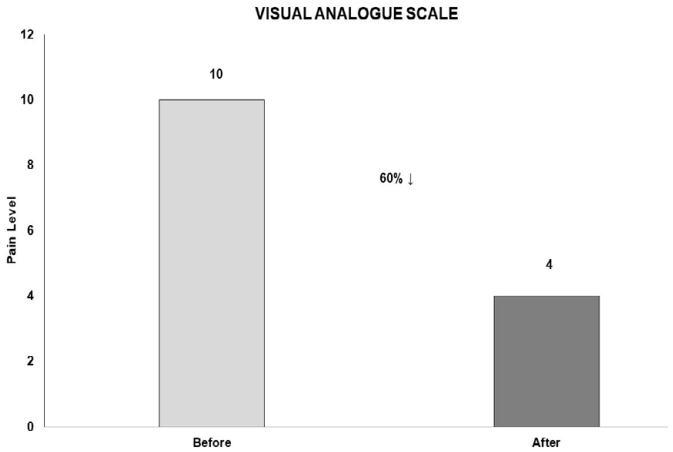

Figure 3: Comparative between before and after condition through Visual Analogue Scale (VAS), considering intervention model used with synergic treatment.

Discussion

Psoriasis is a chronic, immune-mediated inflammatory disease of the skin and joints, with lesions characterized by erythematous plaques of varying sizes and silvery scaling that affect the scalp, face, trunk and limbs. The immune system has the function in our body to protect the body against infections and diseases. This protection occurs by a reaction of antigen and antibody, which are proteins. An immune response is the immune system's reaction to a protein known as an antigen. T lymphocytes are cells with immunological functions of effecting immune responses, either through the production of cytokines or eliminating infected cells. The psoriasis patient has T cells that mistakenly recognize and attack the skin cells. Skin cells then multiply rapidly and swell.

Psoriasis can follow with psoriatic arthritis, which is characterized by a chronic inflammatory disease that affects small and large joints. With this chronic inflammatory process in the joints that also affect bones and muscles, they lead to peripheral nerve sensitization, resulting in fibromyalgia, which is also an inflammatory disease that generates pain throughout the body, which reduces the patient's quality of life both in terms of professional as well as personal.

In this context, the proposed non-pharmacological and non-invasive treatment is essential for analgesia and anti-inflammatory action. Photobiomodulation and therapeutic ultrasound have previously published significant results [11-16] and are increasingly authentic for the treatment of psoriasis, psoriatic arthritis and fibromyalgia [1,12].

Photobiomodulation is a resource that promotes anti-inflammatory and analgesic action, in order to allow, through a modulatory process, a greater production of ATP (Adenosine Triphosphate), as well as having a positive effect on protein synthesis and cell proliferation [21,22], providing homeostasis in cells or organisms in a state of suppression or disease.

Panhóca, et al. [14], in a study of this intervention model for the temporomandibular joint, describes that Therapeutic Ultrasound transmits energy through molecules and vibrations through some medium, being absorbed by the tissues, transforming into molecular energy, in addition to a cavitational effect that promotes the increased membrane permeability. Furthermore, it causes several effects such as increased vascularization and modulation of cytokines, generating an anti-inflammatory effect; Furthermore, there is a modulation of nerve conduction velocity and an increase in the nociceptive threshold, allowing the treatment of pain.

Likewise, Aquino Jr, et al. [12], through a new approach in the treatment of fibromyalgia, made it possible to reduce pain and improve quality of life, performing a pattern of application on the palms of the hands, using the Therapeutic Ultrasound and Photobiomodulation resources in a synergistic way. Thus, through the conduction of these stimuli through afferent pathways, such stimuli reach the brain, providing a positive modulation and consequent reduction of changes in the pain center next to the prefrontal cortex. These findings in the literature corroborate the restorative effects found in this study of tissue repair in psoriatic arthritis, as well as in treating fibromyalgia and arthritis more efficiently.

In our study, we achieved an improvement in the values of the questionnaires (PsAQoL, FIQ and VAS), due to the intervention used with synergistic treatment. In the PsAQoL questionnaire, which is a specific instrument developed to assess the quality of life in patients with psoriatic arthritis, we observed in the initial assessment a greater "Truth" condition, in which it is related to a lower quality of life, and after the end of treatment , in the final evaluation, a greater "False" condition, referring to a better quality of life, therefore, we obtained a difference of 75%, in the comparison between before and after the treatment action. In the FIQ questionnaire, which assesses functional capacity, work status, psychological disorders, physical and painful symptoms of patients with fibromyalgia, which in turn, the greater the impact of the disease, the higher the score found. Therefore, we visualized between the situations of before and after the treatment a reduction of 57.5%, therefore, the lower the value, the greater the quality of life of the patient. And finally, in the VAS questionnaire, which is an instrument to verify the intensity of pain in the patient during treatment, in the comparison between the values of before and after in the visual analogue scale, we obtained an improvement attributed to the patient after the 14 intervention sessions , representing a 60% reduction in pain.

Such associations, of physiotherapeutic resources and form of application, allow the reduction of the inflammatory potential of the combined diseases in the patient, allowing the reduction of pain and the improvement of the quality of life, both in the evaluation of fibromyalgia and psoriatic arthritis.

Conclusion

The synergistic action of Therapeutic Ultrasound and Photobiomodulation resources have become great instruments in the treatment of chronic diseases. The present study reinforces its performance in analgesia and anti-inflammatory action, advocating the patient's quality of life and promoting the return of their professional, personal and family actions, without limitations related to diseases. This case report shows great potential of the resources used in therapy and demonstrates the importance of carrying out a broader study.

Ethical approval

This study was approved by the Research Ethics Committee and the National Research Ethics Committee through CAAE13789319.5.0000.8148.

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