Analysis of the treatment of knee osteoarthritis using Photobiomodulation performed with a low power laser

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INTRODUCTION

Osteoarthritis is a progressive degenerative process without cure, where the patient will present as main symptoms the increase of joint stiffness and pain, characterized mainly by the decrease or loss of articular cartilage, this situation may appear due to trauma, infections, heredity and even unknown causes, osteoarthritis of the knee (KOA) is a major cause of functional limitation, with a tendency to increase considerably throughout the world (1) (2). The main symptoms of KOA are functional disability and pain that is usually aggravated by movement and improvement with rest. Pain can become continuous and lead to functional disability, which reduces the quality of life.

To establish a treatment plan for a patient with KOA, a multidisciplinary team should be involved and consider all components involved in this disease, from the degree of pain and its impact, affective aspects, quality of life, degree of joint damage, and also joint instability and deformities need to be evaluated in order to establish an adequate treatment plan (3).

The main goals of the treatment of KOA involve patient awareness, pain control, improvement of function and reduction of motor incapacity. The treatment can include medication, surgery and physiotherapy.

The physiotherapy with therapeutic exercises is fundamental for rehabilitation of patients with KOA, currently it is the most requested resource before any other intervention, its main objective is the reduction of pain, restoration or maintenance of physical mobility and to act in a preventive way in the degradation of joint tissue, because KOA is a chronic progressive disease (4).

Electro physical agents should be associated with physiotherapy in order to obtain better results, such as ultrasound, shortwave, transcutaneous electrical nerve stimulation and low-power laser photobiomodulation (PBM) have been used to

promote analgesic and anti-inflammatory effects reducing drug consumption and its side effects besides cost to patients.

The low-power laser photobiomodulation (PBM) promotes therapeutic effects by biomodulation of cellular and tissue physiological responses, in the case of KOA it can provide relief of pain by changing the nerve cells membrane potential. Another form of action that may occur in the long term is the synthesis of collagen and related proteins that can provide tissue repair by increasing chondrocyte activity and increasing local blood circulation (6) (7).

This study evaluated the effects of laser photobiomodulation as non-pharmacological therapy for pain reduction and improve the quality of life in patients diagnosed with osteoarthritis of the knee.

TRIAL DESIGN / MATERIALS AND METHODS

We performed a longitudinal clinical trial, with an experimental and qualitative / quantitative character. The research protocol was carried out using the Visual Analogue Scale (VAS), WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) and assessment of knee range of motion measured by goniomemetry.

The study was carried out over 4 weeks including an initial screening procedure to determine the eligibility of each subject to take part in the study, pre-measurements, treatments and post-measurements.

Data collection was performed at two points: The first evaluation was done before the therapeutic intervention (where the patient answered the questionnaires and the knee goniometry was performed) and in the last session, after the 10 interventions, where the patient answered the same questionnaires and the goniometry was performed again.

Ethical Statement:

The patients were invited to participate the protocol study, where the objectives were explained, they received and signed the informed consent form. The project was evaluated and approved by the Research Ethics Committee of Universidade Brasil under the CAAE: 74515917.6.0000.5494.

Participants and Sample Size:

After screening 15 patients were included with ages ranged from 47 to 78 year. The patients were randomly selected from a waiting list to receive physiotherapy treatment through a lottery. The research was carried out at the Physical Therapy Clinic of UNIFEV - Centro Universitário de Votuporanga.

Eligibility criteria for participants

The inclusion criteria were patients with a clinical diagnosis of KOA by a physician and exams as radiography, magnetic resonance or ultrasound, who accepted to participate in the study. The exclusion criteria: were patients using KOA drug therapy including chondroprotectors or analgesics, patients performing any treatment for KOA such as hydrotherapy, acupuncture and physiotherapy, pregnant women, patients with changes in tactile, thermal and pain sensitivity, patients presenting with other pathologies in the knee and patients who were on cancer treatment.

Interventions:

The patients that meet all criteria received PBM (n=15)). The laser used was a low power diode laser (100mW) wavelength of 808nm (Twin laser – MMOptics São Carlos, SP-Brazil). The irradiation parameters were 6J (60 seconds) per 1cm, covering the entire joint/knee region. Irradiation was performed 3 times a week on alternate days, ten sessions were performed in total. The PBM protocol was standardized in the design and the same protocol was used for all patients, followed the guidelines proposed by the World Association for Laser Therapy for the treatment of KOA. Five points in the knee articular region - medially and laterally - were irradiated and two points in anterior knee region were irradiated in all patients, according to the anatomy of the knee.

The Womac questionnaire, the VAS scale and the range of motion was measure and the data was statiscally analised using a paired Student T test.

RESULTS AND DISCUSSION

Fifteen patients participated in the study, of which 80% were female. The age was 68.13±7.97 years (ranging from 47 to 78 years). All patients had knee osteoarthritis and a total of 22 knees were phototreated.

Visual Analog Scale (VAS)

Regarding the total sample, PBM therapy significantly reduced pain ($p=6.10E^{-5}$) (Figure 1). The pain values of VAS score of each patient correspond to mean of three different situations: rest, lay down and performing physical activities.

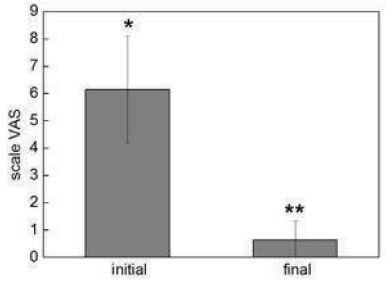

Figure 1. Comparison of visual analog scale (VAS) scores after and before PBM therapy. *P<0.05, n=15. Data presented are the mean±SD.

Range of joint motion (ROM)

Frequently low ROMs are associated with high levels of disability in patients with KOA. According to our results after treatment occurred a significant increase of ROM ($P=6.10E^{-5}$) (Figure 2).

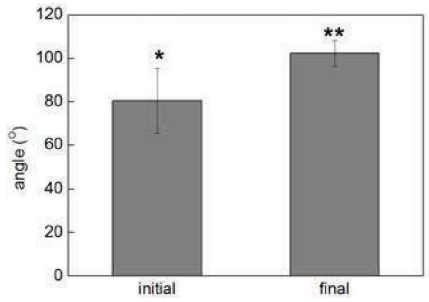

Figure 2. Graph representing the values of range of joint motion (ROM) after and before PBM therapy. *P<0.05, n=15. Data presented are the mean±SD.

Western Ontario McMaster Osteoarthritis Index (WOMAC)

The version of the WOMAC used was 5-point Likert scale with a range of 0-96. the WOMAC questionnaire was used to assess pain, stiffness, and difficulty to perform daily activities. The results showed there was difference in baseline WOMAC total score, pain, stiffness and physical function in treatment group. The total WOMAC score significantly decreased compared to before treatment ($P=2.50E^{-10}$) (Figure 3).

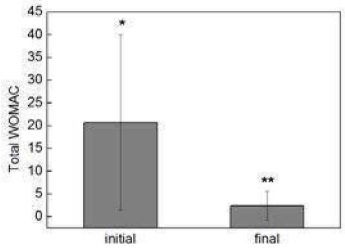

Figure 3. Total WOMAC index score after and before PBM therapy. *P<0.05, n=15. Data presented are the mean±SD.

In PBM group, pain was significantly reduced as well as stiffness after treatment ($P=1.22E^{-4}$ and $2.44E^{-4}$, respectively) (Figure 4). Significant decreases in difficulty to perform daily activities were observed in PBM group compared to before treatment ($P=1.22E^{-4}$).

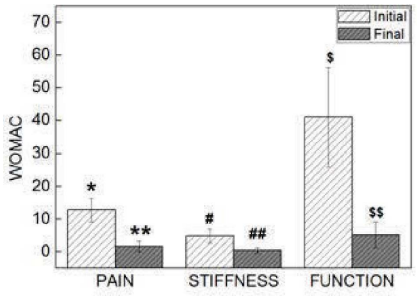

Figure 4. WOMAC sub-scores: pain, stiffness and physical function after and before PBM therapy. *P<0.05, n=15. Data presented are the mean±SD.

After analyzing all the results, we can conclude that PBM is an efficient non- pharmacological therapy for the management of KOA.

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