

STUDY ON THE INFLUENCE OF ULTRASOUND INTENSITY IN CHRONIC BACK PAIN TREATMENT

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Abstract: The paper aims at studying the effects produced by different levels of ultrasound intensity with the frequency of 1 MHz used to treat chronic back pain. The study was conducted over a period of two years, comprising a number of 312 patients with lumbo-sacral disease, aged between 10 and 20 years old. We used a device that produces BTL-07 ultrasonic frequency of 1MHz. Continuous ultrasonic waveform with an intensity of 0.2 W/cm², respectively 0.4 W/cm² was applied for 4 minutes. Clinical-functional parameters were followed on the onset and at the end of the recovery programme: pain, functional impotence, spinal syndrome, radicular syndrome, dural syndrome, fascial syndrome, psychological syndrome, muscle testing, gait evaluation. For the statistical processing of the data obtained, the "t" Student test was applied. It could be observed that the treatment combining Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) with ultrasounds of 0.4 W/cm², applied in chronic low back pain allows a significant increase of the results during the recovery programme.

Cuvinte cheie: durere lombo-sacrată, ultrasunete, scală de evaluare

Rezumat: Lucrarea își propune să studieze efectele produse de diferite valori ale intensității ultrasunetului cu frecvența de 1 MHz atunci când acestea sunt folosite în tratamentul lombalgiei cronice. Studiul a fost efectuat pe o perioadă de 2 ani, fiind urmăriți 312 de pacienți cu afecțiuni lombo-sacrate cu vârsta cuprinsă între 10 și 20 de ani. S-a utilizat un aparat BTL-07 care produce ultrasunete cu frecvența de 1MHz. S-au aplicat timp de 4 minute ultrasunete cu forma de undă continuă și cu intensitatea de 0,2 W/cm², respectiv 0,4 W/cm². S-au urmărit parametri clinico-funcționali la începutul și la sfârșitul programului de recuperare: durere, impotență funcțională, sindrom rahidian, sindrom radicular, sindrom dural, sindrom fascial, sindrom psihic, testare musculară, evaluare mers. Pentru prelucrarea statistică a datelor obținute s-a utilizat testul „t” Student. Se observă că tratamentul care combină AINS cu ultrasunetele de 0,4 W/cm², aplicat în lombalgia cronică, permite o creștere semnificativă a rezultatelor parcursul programului de recuperare.

INTRODUCTION

Ultrasound is a well known treatment method that has proven its effectiveness in joint and soft tissue pathology, both in the acute stage, subacute and in the chronic stage. Depending on the frequency and intensity, ultrasounds are spasmolytic, analgesic, antiinflammatory and are used to treat rheumatic conditions, in neuralgia, in musculoskeletal disorders and peripheral nerve in circulatory diseases, acute inflammation etc.

The optimal frequency for therapy is of 1 MHz. In choosing this method, the principle according to which at tissue level, a sufficient energy should reach, has been taken into account, knowing that the energy absorption input depends on frequency. Thus, at high frequency, energy is absorbed mainly at the surface and will not reach the target, while in too low frequencies, ultrasound penetrates deeper and the ongoing energy dissipation is too high. For values of ultrasound intensity ranging between 0.1 W/cm² and 0.8 W/cm², the results are beneficial to the human body.

By using ultrasonophoresis, the medicinal substances incorporated into the contact solution easily penetrate the targeted area. By penetrating the tissues, ultrasounds produce thermal and mechanical effects. Locally, tissue temperature may increase, favouring blood circulation and therefore, healing may occur. Ultrasounds can be used continuously or in pulsed mode, but for an increased thermal effect, the continuous mode is

preferred.

Chronic back pain is one of the main disorders of the lower axial segment, its major causes being the muscular and ligament imbalance, static and kinetic behaviour unadapted to different burdens of the lumbosacral segment that is being submitted to in daily conduct. Most commonly, chronic low back pain is related to L4-L5-S1 segment.

PURPOSE

The paper aims at studying the effects produced by different levels of ultrasound intensity with the frequency of 1 MHz used to treat chronic back pain.

METHODS

We used a BTL-07 device that produces ultrasounds with a frequency of 1MHz. Ultrasonic continuous waveform, with an impulse rate at 1:1 time was applied for 4 minutes. Ultrasounds with an intensity of 0.2 W/cm² and 0.4 W/cm² were used.

A number of 312 patients were included in the study, coming for consultations at the Children's Hospital Ambulatory of Botosani. The patients were selected among those who saw a doctor for pain and functional symptoms, complaining about at least one painful lumbosacral episode and who were not registered with other diseases. The patients' consent was

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CLINICAL ASPECTS

required in order to implement the recovery programme. They formed three study groups. Batch 1, which comprised 98 people, who had been treated with ultrasonic intensity of 0.2 W/cm². Batch 2, which included 108 people, was treated with ultrasonic intensity of 0.4 W/cm² and batch 3, which contained a total of 106 persons and which was considered the control group and was not submitted to the ultrasound treatment. All three groups received NSAID medication.

The evaluation of patients was performed in the ambulatory surgery at the onset, during and at the end of the recovery treatment that lasted ten days. The clinical-functional parameters were followed at the onset and at the end of the recovery programme: pain, functional impotence, spinal syndrome (static and dynamic), radicular syndrome (Lassegue maneuver), dural, fascial syndrome, psychological syndrome, muscle testing, gait evaluation. In considering the clinical and functional status of the patients with lumbosacral pain, Low-Back-Pain Module (LBP) scale has been used. This was done to monitor the therapeutic outcomes in the patients with acute, subacute and chronic lumbar-sacralgia.

LBP-scale module comprises 5 aspects of the patient's life: physical activities, daily activities, health, support and recreational activities. Each of the 5 aspects has 10 questions rated from 0 (minimum level of the assessed aspect) to 3 (maximum). The final score is obtained by summing the 10 quotes, with 0 being the minimum score and 30 being the maximum score. The patients' data from the three groups were recorded in a file. The following values were calculated: mean, proportions (%), standard deviation. In order to compare the average values of the quantitative variables, the "t" Student test has been used, and in order to correlate the ranges of values between the quantitative variables, the Pearson's correlation coefficient has been calculated.

RESULTS

Age distribution: The patients within the three study batches were aged between 10 and 20 years old. The batch 1 had 98 people and received ultrasonic intensity of 0.2 W/cm². The chart below showed the age distribution of the patients (frequency and percentage).

Figure no. 1. Distribution of patients in the group treated with ultrasound of 0.2 W/cm², depending on age

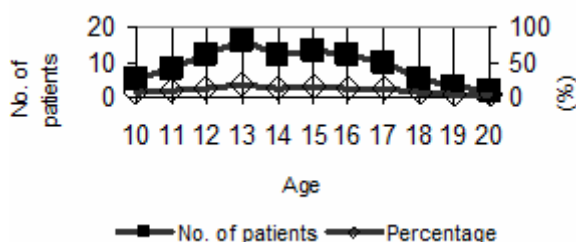
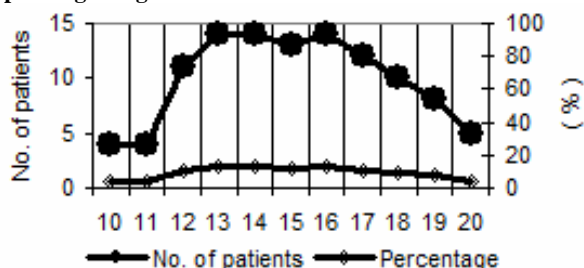


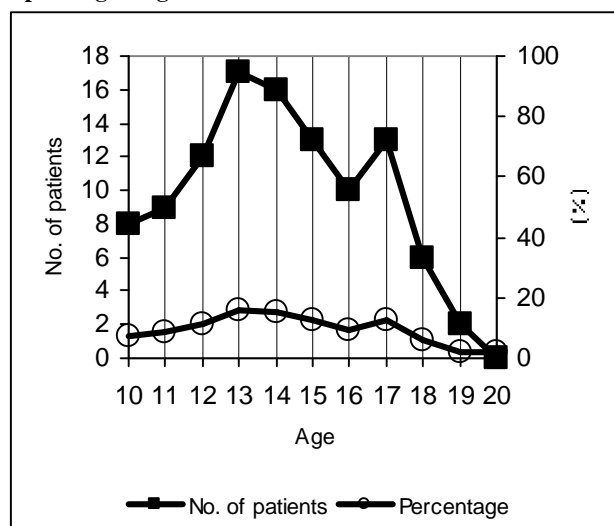
Figure no. 2. Distribution of the patients within the second group who were treated with ultrasound of 0.4 W/cm², depending on age



The batch number 2 had 108 patients who were treated with ultrasonic intensity of 0.4 W/cm². The chart below showed the age distribution of the patients (frequency and percentage).

The batch number 3 had 106 patients and they did not receive ultrasound treatment.

Figure no. 3. Distribution of the patients in the group 3, depending on age



The results of the treatment applied: The therapeutic results were monitored in the patients with acute, subacute or chronic back pain. In considering the clinical and functional status of the patients with lumbosacral pain, the LBP Module was applied. The results obtained by the statistical processing of the patients' files are presented in Table 1.

Table no. 1. Distribution of mean and standard deviation for the three batches before and after treatment

BATCH		Before treatment	After treatment
B1 US:0,2W/cm ² +NSAID	Mean	11,0702	14,8323
	Standard deviation	2,2113	2,4897
B2 US:0,4W/cm ² +NSAID	Mean	10,1076	21,3426
	Standard deviation	2,1864	2,6125
B3 NSAID	Mean	10,8113	13,1477
	Standard deviation	2,3444	2,4768

There are highly significant differences between the mean scores, as well as for the standard deviation values calculated for each batch. Calculating the correlation between the mean scores of the patients within the three batches, it results that the patients in batches 1 and 2 registered generally higher scores after treatment, as against the scores calculated before treatment. It can be observed that $p < 0.001$ and the difference between the mean scores is highly significant.

DISCUSSIONS

The batches under consideration are homogeneous in terms of age distribution. By analyzing the statistical data, it can be argued that the recovery programme that used NSAIDs and 0.4 W/cm² ultrasounds is the most effective. The results obtained after applying 0.2 W/cm² ultrasound and NSAIDs (0.2 W/cm² intensity ultrasonophoresis) in batch 1 did not differ significantly from the results obtained by applying NSAIDs in the patients from batch 3.

CONCLUSIONS

A significant difference can be observed between the treatment with 0.4 W/cm^2 intensity ultrasonophoresis and the other treatments applied. This treatment applied in chronic low back pain allows the significant increase of the results of the recovery programme.

The application of ultrasound treatment reduces the painful component, decreases stiffness and muscle contracture, and by raising the local temperature, it leads to an increase of the blood flow.

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