

# The Usefulness of Selected Physical Therapy Methods in the Management of Chronic Low Back Pain: A Review of Our Experience

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## Abstract

The aim of this study was to review our recent papers on the use of selected physiotherapeutic methods in the management of chronic low back pain (LBP). Some of the procedures under discussion have a significant analgesic effect and are helpful in supporting kinesiotherapy in improving the functional state of patients with LBP. The most effective procedures for LBP include radial shock wave therapy, electrotherapy with the use of interferential currents (IFC), and the use of a high-intensity magnetic field (10 mT). To some extent, electrotherapy in the form of transcutaneous electrical nerve stimulation (TENS) and high-voltage pulsed current electrical stimulation (HVPC ES) may also be useful, although the effectiveness of these methods is significantly lower than IFC stimulation. Our research clearly shows that laser therapy, treatment using a magnetic field with lower induction (5 mT), magnetostimulation, and electrotherapy with diadynamic currents are ineffective in the management of chronic LBP.

## Key words

physical therapy,  
physical medicine,  
chronic low back pain

## Introduction

Despite the continuously growing number of clinical studies on the use of physical modalities in the conservative management of degenerative changes of the lumbosacral spine, the clinical efficacy of these procedures still raises many controversies and uncertainties. An additional problem is the relatively low methodological quality of published papers, which significantly hinders a reliable, unambiguous assessment and objective verification of the level of evidence. The authors of many systematic reviews and meta-analyses on this topic have reported a number of limitations of the research conducted so far. The main ones are the lack of representative and well-chosen comparison groups, not estimating the placebo effect or not using sham procedures, and failing to assess follow-up outcomes and analyze symptom recurrence [1, 2, 3, 4].

On the other hand, it must be admitted that many in vitro and animal experiments support the effective analgesic and anti-inflammatory effects of selected physical therapeutic agents, which may lay the groundwork for judicious and documented use in everyday clinical practice [5, 6, 7]. Therefore, all that remains is to separate the helpful and effective physical methods from the questionable and ineffective ones, establish uniform and unquestionable technical parameters, and issue unambiguous methodological guidelines for the application of those treatments. It seems necessary to define protocols of management according to the principles of Evidence-Based Physiotherapy (EBP), which will end the controversy around this subject and enable physiotherapists to use only effective physical agents.

## Aims

The aim of this study was to review our longstanding experience with the use of selected physical therapy methods in the management of chronic pain syndromes in the lower back.

## A review of our own research on laser therapy

In 2018, we published an article in the journal *Clinical Intervention in Aging* under the title “Photobiomodulation Using High- Or Low-Level Laser Irradiations in Patients with Lumbar Disc Degenerative Changes: Disappointing Outcomes and Remarks” [8]. The primary objective was to objectively evaluate the intermediate and long-term outcomes of low-level laser therapy (LLLT) and high-intensity laser therapy (HILT). Sixty-eight patients were enrolled and randomized into four comparison groups: (1) the first group (n = 18) received continuous-wave non-contact stable HILT using a 30-cm<sup>2</sup> spot applicator with scatterer, 1064 nm wavelength, 60 J/cm<sup>2</sup> energy dose, and a treatment time of 10 minutes; (2) the second group (n = 17) received placebo HILT—sham treatments using a high-energy laser; (3) the LLLT group (n = 16) was treated with a continuous-wave laser using the contact method, the labile technique, and a spot applicator with a wavelength of 785 nm and an energy dose of 8 J/cm<sup>2</sup> for 8 minutes; and (4) the LLLT placebo group (n = 17) received sham treatments using a low-energy laser. All patients underwent a series of 15 treatments, applied 5 times a week (Monday to Friday) for 3 weeks. In addition, the patients performed stabilization training. The Visual Analogue Scale (VAS) and the Laitinen questionnaire were used to assess the level of pain, the Oswestry and Roland–Morris questionnaires were used to assess the degree of disability, and the Lasègue and Schober tests were used for functional assessment. Measurements were taken before and after treatment and one and three months later. Intragroup comparisons showed an improvement in the measured parameters after the treatment series but a gradual recurrence of discomfort in the follow-up results (between the first and third month). Apart from this, intergroup analysis showed no differences between the groups studied. It was noted that the LLLT and HILT methods were ineffective for patients with lumbosacral discopathy, both in the short and long term, and, most importantly,

did not show a significant advantage over the placebo effect. Combining photobiomodulation with LLLT and HILT had no significant effect on reducing patients' pain, increasing range of motion in the lower spine, or improving overall functional status with respect to standard exercise rehabilitation.

In 2019, we also published extended results on the application of the above physical methods. In that study, we used biomechanical analysis of center of gravity displacements in subjects on a stabilometric platform. The aim of the study was to record any changes in the measured parameters and determine the potential effect of laser beam irradiation at different doses on improving postural control and enhancing central stabilization. Unfortunately, the results were again disappointing, as the use of these therapeutic measures did not lead to a significant improvement in postural stability in patients with LBP caused by discopathy compared to standard exercise training based on both short- and long-term analysis [9].

The above studies scored 6/10 on the Physiotherapy Evidence Database (PEDro) methodological validity scale.

### **A review of our own research on magnetotherapy and magnetostimulation**

Our next article was published in 2018 in the journal *Advances in Clinical and Experimental Medicine* under the title "Impact of Selected Magnetic Fields on the Therapeutic Effect in Patients with Lumbar Discopathy: A Prospective, Randomized, Single-Blinded, and Placebo-Controlled Clinical Trial" [10]. Patients with discopathy at the L5-S1 level who had chronic radiating pain lasting more than six months and pseudoradicular pain syndrome were included in our study. These patients had not undergone previous spinal surgery. The study participants had to be at least 18 years of age and have current magnetic resonance imaging (MRI) examinations confirming the diagnosis (at least Modic grade III lesions in the lumbosacral

spine). The allocation of patients who passed the eligibility procedure to each group was randomized. The patients were assigned to five comparison groups. The exclusion criteria included patients who were diagnosed with acute spinal pain (occurring for less than six months, as complaints of longer duration were treated as chronic), radicular syndrome, discopathy at another level of the spine (patients with early Modic grade I and II lesions were not excluded from the study; however, Modic grade III degeneration was a basis for exclusion), absence of lumbosacral pain and decreased mobility, other spine disorders (vertebro-sis, fractures, tumors, rheumatic diseases, and cauda equina syndrome), pregnancy, pacemaker, loss-of-function symptoms, cardiovascular diseases, metal implants (such as hip and/or knee replacement), psychiatric disorders, cancer, psoriasis, scleroderma, and viral and bacterial infections. Patients who had undergone spinal surgery and were taking painkillers or anti-inflammatory drugs were also excluded from the study. We also excluded patients with damage to the vestibular and/or part of the vestibulocochlear nerve, Meniere's disease, sudden loss of inner ear function, and damage to the cerebellum, spinal cord, and brainstem, which manifest as balance disorders. The patients in group A were treated with magnetotherapy (rectangular pulses with a magnetic induction of 10 mT, a frequency of 50 Hz, and a duration of 20 minutes for a single treatment using an induction coil with a 60-cm diameter). The participants in group B were also treated with magnetotherapy (rectangular pulses with a magnetic induction of 5 mT, a frequency of 50 Hz, and a duration of 20 minutes for a single treatment using an induction coil with a diameter of 60 cm). In turn, the patients in group C were treated with quasi-magnetotherapy (this was a sham treatment: the treatment parameters were set on a switched-on device, but no magnetic signal was applied). This group constituted a single blind, which means that the patients had no knowledge of group membership; the purpose of this was to estimate the placebo effect during the study for this type of therapy. The patients in

group D were treated with magnetostimulation (rectangular pulses with a magnetic induction of 49.2  $\mu$ T, a frequency of 195 Hz, and a duration of a single treatment of 20 minutes using a pillow with dimensions 45 cm  $\times$  24 cm  $\times$  3 cm). On the other hand, the patients in group E were treated with quasi-magnetostimulation (the treatment parameters were set, but—as in group C—they were not applied); therefore, this group received a sham treatment for real magnetostimulation as part of our blind method. In addition to physical treatment, the patients in all groups received uniform primary treatment with exercise rehabilitation in the form of functional training (45 minutes once a day for 5 days a week). Standard stabilization training included the following elements: musculoskeletal relaxation techniques for the erector spinae muscle, techniques for activating the neutral position of the lumbar-pelvic-hip complex and deep muscles, activation of proper breathing and work of the transversus abdominis muscle, coordination of superficial and deep muscle activity, and postural and dynamic training. At the end of the project, it was concluded that the magnetic fields studied in combination with specialized rehabilitation (five times a week for three weeks) may be effective in reducing selected symptoms of discopathy of the lower back at the level of L5-S1 vertebrae, but they only bring short-term remission (without further kinesiotherapy). The study also showed that the use of magnetotherapy (10 mT and 50 Hz for 20 minutes) significantly reduces pain and leads to an improvement in the functional status of patients with LBP based on the analysis of subjective, as well as objective, parameters. On the other hand, the use of magnetotherapy with an induction of 5 mT and magnetostimulation seems to be ineffective in the course of lumbosacral discopathy.

The above studies scored 7/10 on the Physiotherapy Evidence Database (PEDro) methodological validity scale.

## A review of our own research on electrotherapy

Our research team also came to interesting conclusions about the differential effectiveness of electrotherapy modalities in the symptomatic treatment of chronic LBP, although the results of our 2017 clinical paper [11] were only graded 4/10 on the PEDro scale.

A total of 127 patients were eligible for treatment (123 patients ultimately completed the study) and were assigned to 6 comparison groups. Group A consisted of 20 patients (all participants in this group completed the therapeutic program). The patients were treated with conventional-mode transcutaneous electric nerve stimulation (TENS) using the following treatment parameters: alternating waveform, rectangular impulse shape, 100  $\mu$ s impulse duration, 100 Hz frequency, subjective dosage (to induce a clear sensation of current flow, during the habituation of the patient to the electrical stimulus, the therapist increased the intensity successively during the treatment to maintain the assumed sensation), and a 60-minute duration of a single treatment. Group B also consisted of 20 patients (as before, all patients completed the therapy). The patients were treated with pseudo-acupuncture TENS using the following treatment parameters: alternating waveform, rectangular impulse shape, an impulse duration of 200  $\mu$ s, a frequency of 10 Hz, subjective dosage (up to a pronounced muscle contraction, during habituation phase and the decrease of the motor effect, the therapist increased the intensity successively during the treatment to maintain the assumed threshold of muscle stimulation), and a duration of 60 minutes for a single treatment. Group C initially consisted of 22 patients, although 2 patients dropped out due to a viral infection and did not complete the treatment series (1 participant dropped out after 4 treatments and another after 6 treatments). One patient also had to discontinue treatment after three treatments due to skin lesions due to the electrode applications. The final group, C, consisted of 19 patients who were treated with hi-

gh-voltage pulsed current electrical stimulation (HVPC ES) using the following treatment parameters: 100-V output voltage, alternating waveform, pin-shaped impulse, 100- $\mu$ s impulse duration, 100-Hz frequency, subjective dosage (for a clear sensation of current flow, during the habituation of the patient to the electrical stimulus, the therapist increased the intensity successively to maintain the assumed sensation), and a 50-minute duration of a single treatment. Group D initially consisted of 22 patients; however, 1 patient had to drop out from the study due to an exacerbation of symptoms and having to begin taking analgesics. Finally, 21 patients completed the therapy in the form of electrotherapy with medium-frequency interferential currents (IFC) using the following treatment parameters: alternating pulses, sinusoidal impulse shape, 100- $\mu$ s pulse duration, 4000-Hz basic frequency, 50–100-Hz variable frequency, subjective dosage (to induce a clear sensation of current flow, during the habituation of the patient to the electrical stimulus, the therapist increased the intensity successively to maintain the assumed sensation), and duration of a single treatment of 20 minutes. Group E consisted of 22 patients treated with diadynamic current electrotherapy using the following treatment parameters: pulsating waveform, sinusoidal impulse shape, impulse duration and frequency of 10 ms, 100 Hz (DF, diphase fixe, full-wave), 10 ms, 50–100 Hz (CP, courtes periodes, short periods), and 10 ms, 50–100 Hz (LP, longues periodes, long periods), applied successively but with variable amplitude, subjective dosage (for a clear sensation of current flow, during the patient's habituation to the electrical stimulus, the therapist increased the intensity successively during the treatment to maintain the assumed sensation), and a single treatment time of 9 minutes (3 minutes each for DF, LP, and CP). On the other hand, the 21 patients in the control group (F) were treated only with exercises (stabilization training). The duration of the training session was 45 minutes (5 times a week from Monday to Friday). In the A, B, C, D, and E comparison groups, the patients who received electrotherapy performed

basic exercises according to the same methodology as those in group F. The participants from all comparison groups (except group F, where only daily stabilization training was conducted for 3 weeks) underwent a series of 15 treatments, 5 times a week (Monday to Friday) for a period of 3 weeks. The study concluded that the electrotherapy methods used in this study are effective in the management of LBP but mainly in short-term observation. It was noted that only the use of IFC can have a beneficial effect on long-term results, prevent the exacerbation of discopathy symptoms in the long term, and be a reasonable adjunct method for primary rehabilitation. The conducted research also shows that the use of IFC stimulation reaches significantly deeper into tissues, reduces pain for much longer, and leads to the improvement of patients' function based on the analysis of both subjective and objective parameters. TENS and HVPC are also helpful in the treatment of discopathy-related LBP but do not allow for the long-term remission of symptoms. On the other hand, the use of diadynamic currents seems to be ineffective, as the obtained results were similar to those of the control group treated with stabilization training only.

### Review of our own research on radial shock waves

In recent years, low-energy shock wave treatments have become very popular; hence, our team has taken on this subject in the context of LBP.

A total of 40 patients were enrolled in the study and assigned to two comparison groups: group A (n = 20) was administered radial shock wave treatments (2000 shocks with an energy flux density of 0.10 mJ/mm<sup>2</sup>, a frequency of 5 Hz, and a treatment time of 7 minutes) and group B (n = 20) received sham shock wave treatments. The participants from both comparison groups were subjected to a series of 10 treatments, applied twice a week for a period of 5 weeks, during which they also received stabilization training. The VAS scale, the Laitinen, Oswestry, and Roland-Morris qu-

estionnaires, the Lasègue and Schober tests, and a stabilometric platform were used to assess study outcomes. Measurements were taken before and after treatment and one and three months later. Intragroup comparisons showed an improvement in the measured parameters after the shock wave treatment series but also a gradual recurrence of discomfort in the follow-up results (between one and three months). In addition, intergroup analysis showed differences between the study groups in favor of group A in all the outcome measures examined in this study, especially in the follow-up observations. The radial shock wave modality studied was very effective for patients with lumbosacral discopathy, both in the short term and especially in the long term, showing a significant advantage over the placebo effect. In addition, the use of this therapy significantly reduced the patients' pain, increased the mobility of the lower spine, and improved their overall functional status in relation to standard exercise rehabilitation. The use of radial shock waves led to a significant improvement in postural stability in patients with discopathy-related LBP, both in the short term and especially in long-term observations.

The results of the above project have been published in two eminent scientific journals in 2019 [12] and 2020 [13]. It is also worth mentioning that

this research received as high as 9/10 points on the Physiotherapy Evidence Database (PEDro) scale.

### Summary

Based on our year-long experience of studying the effectiveness of selected physical therapy methods, we conclude that some of them showed significant analgesic effects and are helpful in supporting kinesiotherapy for improving patients' functional status. The effective procedures include radial shock wave therapy, electrotherapy with the use of IFC, and the use of a high-intensity magnetic field (10 mT). Electrotherapy using TENS and HVPC ES may also be useful to some extent, although their effectiveness is lower than that of electrotherapy with IFC. However, our studies clearly show that laser therapy, magnetotherapy with lower induction (e.g., 5 mT), magnetostimulation, and electrotherapy with diadynamic currents are ineffective in the treatment of chronic lower back pain syndromes.

It should also be noted that our previous publications have a number of limitations (Table 1), for which reason the obtained results should be verified by other research centers.

**Table 1.** Limitations of the publications presented.

Publication	Study limitation
Taradaj et al. [8]	Lack of blinding of treatment providers and outcome assessors Lack of following the <i>intention-to-treat</i> principle
Taradaj et al. [9]	Lack of blinding of treatment providers and outcome assessors Lack of following the <i>intention-to-treat</i> principle
Taradaj et al. [10]	Lack of blinding of treatment providers and outcome assessors
Rajfur et al. [11]	Lack of blinding of treatment providers and outcome assessors Lack of following the <i>intention-to-treat</i> principle
Walewicz et al. [12]	Lack of blinding of treatment providers
Walewicz et al. [13]	Lack of blinding of treatment providers

## Abbreviations

- CP – short periods (*courtes periodes*);  
 DF – full-wave (*diphase fixe*);  
 EBP – Evidence-Based Physiotherapy;  
 HILT – high-intensity laser therapy;  
 HVPC ES – high-voltage pulsed current electrical stimulation;  
 IFC – interferential currents;  
 LLLT – low-level laser therapy;  
 LP – long periods (*longues periodes*);  
 MRI – magnetic resonance imaging;  
 PEDro – Physiotherapy Evidence Database;  
 TENS – transcutaneous electric nerve stimulation;  
 VAS – Visual Analogue Scale.

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