

THE EFFICIENCY OF THERAPEUTIC PHYSICAL EXERCISE APPLIED ONLINE IN COMBATING CHRONIC PAIN LUMBAR SPINE

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Abstract: With the onset of the pandemic, the world has changed and everyone was forced to stay in the house for a few weeks, and after that period, nothing was the same. The researchers point out that online physiotherapy should become an integral part of the post-COVID-19 treatment mix. Through this study we want to highlight the effectiveness of therapeutic physical exercise applied online in patients with chronic low back pain. This clinical condition is characterized by pain in the lumbar area between 2 and 7 (VAS), over a period of more than 3 months and negatively affects labor productivity, affecting more and more people. According to the WHO, 60% to 70% of adults in industrialized countries suffer from chronic low back pain. The most affected age is 50-55 years. Our study was conducted on a sample of 50 participants aged 40 to 50 years with chronic low back pain - VAS initially assessed between 5 and 6. Another selection criterion was the presence of pain of at least 6 months. In addition to assessing pain using VAS, participants performed a set of functional tests. The implemented program consisted of 20 sessions broadcast live, the duration of each session was 40 minutes, the pace of the sessions being 3 times / week. Following the final evaluation using VAS, but also as a result of the resuming of the battery of functional tests, the results showed a significant reduction in pain felt by participants (paired t test was used) and a significant improvement in body function.

Keywords: *chronic low back pain, online physiotherapy, online exercise, online recovery, quality of life*

Introduction

The spine is an extremely complex structure, managing to perfectly combine bones, joints, nerves, ligaments, and muscles [1]. All together they provide support, strength and at the same time flexibility to the human body. The lumbar region of the spine supports the weight of the entire upper train and provides complete mobility allowing all simple movements, but also complex ones. Also, the muscles in the lumbar area are involved in flexion and rotation of the hips while walking, and the nerves that have their roots at this level ensure the transmission of information to and from the pelvis and lower limbs. Therefore, any damage to the structures in this area has and can have major implications on daily life, making it difficult or even impossible to perform simple daily tasks.

Sooner or later, throughout life, most people experience low back pain. Back pain and its associated symptoms are currently ranked second among the most common diseases worldwide [2]. The temporary incapacity for work caused by low back pain is surpassed

only by the common cold, and in the case of people over 45 years of age, it is even in the first place [3]. Low back pain is classified as acute or chronic low back pain, depending on the time elapsed from the time the pain occurred until the time of evaluation. Thus, in the case of pain that persists from a few days to a few weeks, we are talking about acute low back pain. If the symptoms do not go away by 3 months, it is already talking about chronic low back pain [4].

The increased incidence of chronic low back pain is a major concern and the need to identify effective ways to treat is immediate, but in order to achieve effective treatment it is mandatory to fully understand the mechanisms that trigger the condition. The main risk factors for low back pain are represented by Schmidt & Willis [5]:

- age - with age progression, muscle elasticity is lost, and bone density begins to decline; most people between the ages of 30 and 50 experience low back pain;
- a low level of fitness;

- pregnancy - increased pressure on the pelvis, as well as weight gain often triggers back pain;
- sudden weight gain;
- genetic factors (e.g. ankylosing spondylosis);
- factors related to mental health - depression and anxiety can trigger somatic reactions, including low back pain. It is also known that anxious people take a greater stimulation risk in what regards the intensity of stimuli, in other words they act, in everyday life, according to the principle of "all or nothing" [6] engaging in activities in which the injury risk is increased. We mention in this context the very important role that sport plays in: it releases tensions (depression, anxiety), the thinking becomes clearer, alert, the benefits of exercising being found in the nervous system, cardiovascular, pulmonary, skeletal muscle, regarding the body's immunity, etc. [7]. For example, long-term combined exercises prevent the risks of arteriosclerosis [8].

On the triggers for low back pain - most often, low back pain is the result of damage caused by mechanical factors [9]. Specifically, poor posture and biomechanics of the spine, maintained by a sedentary lifestyle. In the case of people with hypotonic, poorly developed muscles, seemingly trivial actions such as bending, sneezing, coughing can cause herniation of an intervertebral disc, previously overworked. Lumbar pain due to mechanical causes is defined as pain caused by overloading normal anatomical structures, for example, muscle contractions, or as an effect of trauma or deformity of an anatomical structure, such as herniation of the nucleus pulposus. Mechanical pain in the lumbar spine (muscle contractions, hernias, disc diseases, osteoarthritis, spinal canal stenosis, etc.) totals 98% of all cases [10].

For most patients diagnosed with low back pain, the treatment of choice is physiotherapy [11]. Typically, the course of events would be as follows: selecting a medical recovery office, scheduling each physiotherapy session according to the availability of the therapist and the patient, recalculating free time so as

to include travel to and from the office, plus at least one hour treatment.

But what solution do we find given the current situation - the COVID-19 pandemic? At the moment, humanity is facing an unprecedented reality. We are put in the situation of distancing ourselves for an indefinite period for personal and collective good, and the solutions did not take long to appear. The majority of the service sector has made the transition to online in recent months, and a large part of the population has shown a high level of adaptability from this point of view with a considerable reduction in costs [12]. This fact, together with the decision of many recovery clinics to close their doors for a period in the lockdown phase, as well as the countless requests from patients to identify a viable solution, led us to conduct this study.

Our main goal is to improve the quality of life of patients with chronic low back pain through online physiotherapy. Health is an essential life domain, together with Goals, Self-Esteem, Values, Money (according to the Quality of Life Inventory) among youth, athletes and not only [13]. A new study published by Sara Mageit on July 14, 2020 [14], conducted on 27,000 patients who received online kinetic treatment, concluded that online physiotherapy should become an integral part of the post-COVID-19 treatment mix. For a recovery program to be successful, good planning is essential [15]. In this regard, we selected the most effective exercises in reducing low back pain and organized them according to the basic principles of physiotherapy [16] in 20 online physiotherapy sessions. We offered participants the opportunity to access the sessions 24 hours a day, 7 days a week, thus eliminating the stress generated by the obligation to perform an action at a strictly previously set time.

Materials and method

Participants

A total of 50 participants (42 women and 8 men) took part in the study, aged between 40 and 50 years, who complained of chronic low back pain. We specify that the initial results for VAS were between 5 and 6. Another

criterion for selecting participants was the presence of pain for at least 6 months. The evaluation of each participant was performed with the help of basic tests - joint balance of

the spine and tests that highlight neurological aspects. Also, each subject highlighted the presence of low back pain in the daily life routine on a scale from 0 to 10.

Measures

Table number 1 shows the tests used in our research.

Table 1. Functional tests and General VAS

Test name	Objective
1. Finger index on the ground	Frontal non pain mobility testing
2. Trunk extensions from orthostatism	Postoperative non-pain mobility testing
3. Right side tilt	Non-pain mobility testing for straight tilt movement
4. Left side tilt	Non-pain mobility testing for left tilt movement
5. Rotation of the trunk from orthostatism in both directions	Non-pain mobility testing for twisting movement
6. Dorsiflexions / planting from supine position	Testing the level of inflammation of the sciatic nerve + Testing the possible motor deficit
7. Lasegue	Testing the level of inflammation of the sciatic nerve
8. Bragard	Testing the level of inflammation of the sciatic nerve
9. Knee extension with dorsiflexions from sitting on the bed	Testing of posterior chain mobility + Testing the level of inflammation of the sciatic nerve
10. Slump	Testing the level of localized inflammation in the dural sac
11. VAS General	Perception of pain in everyday life

Procedure

The study took place between August 3 - October 3, 2020. The venue was the home of each subject, the stimulus / intervention system being applied online. The specialized literature specifies the importance of the existence of a favorable climate (the space of the house offering such a benefit), the satisfaction felt by a person in an activity influencing his intention to continue or change the space in which he carries out his activity [17].

The 50 participants were given the system of therapeutic physical exercises through the RestartiX platform. Subjects were able to watch the sessions on their phone, laptop or tablet, having access to materials 24 hours a day. We mention that no subject significantly changed their lifestyle or diet during the study; the participants also avoided the consumption of substances (alcohol, psychoactive substances), being known the dysfunctional patterns of behavior characteristic in such situations [18]. No subjects administered

NSAIDs or other drugs that could influence the results of the study. Also, participants did not work with a psychologist on pain reduction techniques - we refer to hypnosis, relaxation techniques, meditation or other altered state of consciousness, situations in which the muscles tend to release tension.

The 20 sessions respected the principles of progressivity and complexity, being composed of 100 mixed exercises according to the stated principles, their objectives being [16]:

Table 2. Online sessions and objectives

Online sessions	Objectives
sessions 1-5	<ul style="list-style-type: none"> • reduction of sciatic nerve inflammation, softening of the posterior chain of the lower train;
sessions 5-10	<ul style="list-style-type: none"> • idem1-5; • increase of the muscular strength of the lower train and of the stabilizing muscles of the spine;
sessions 10-15	<ul style="list-style-type: none"> • increase of muscular strength - of the stabilizing muscles of the spine • regaining the basic functions of the spine related to daily tasks;
sessions 15-20	<ul style="list-style-type: none"> • consolidating the obtained results; • increasing the functional capacity of each subject in relation to daily tasks.

We offer, in table number 3, an example of an online session.

Table 3. Example of online session

Online sessions - no 1	No. Repeats	No. Series
Dorsiflexions from the antalgic position	10	2
Triple flexion with cushion between the legs	10	2
Lateral knee extension with pillow between legs	10	2
shell	10	2
Diaphragmatic mobilizations	3	2
POSTERIOR PELVIC TILT/Posteriorization of the pelvis	10	2
Lumbar mobilizations in the dorsal decubitus axis	10	2
Diagonal MS in supine position	10	2
Dorsal arm flexions	10	2
Mobilization of the pelvis from supine position	10	2

We mention the fact that each exercise was performed after the subjects received precise

explanations regarding the correct performance, but also regarding the possible

mistakes that may occur during the repetitions. The execution speed was a constant one, being generated by the execution model performed by the physiotherapist. The amplitude of movement was individualized according to the appearance of the painful threshold in the case of each subject.

Quasi-experimental design

In the case of our research, the results recorded by patients in the VAS test and in the case of the ten functional tests play the role of dependent variables, and the intervention program through therapeutic physical exercises applied online is the independent variable. If the difference between the values of the dependent variables - before and after the intervention by kinetic means - is statistically significant, probably this difference is not due to chance, a very important role being played by the

independent variable (therapeutic exercise system).

This study respects the international ethic recommendation about the confidentiality of the data, the anonymity and security of participants.

Results

Through the paired t test (SPSS 20 was used) we checked if there are statistically significant differences between the results reported by participants in chronic low back pain, but also between the results recorded in the ten functional tests, before and after the implementation of the intervention program through therapeutic exercise applied online. We specify that the dependent variables follow a normal distribution both in the pretest condition and in the posttest condition - the skewness coefficient in absolute value is less than 1[19].

Table 1. Participants' results - descriptive statistics

	Tests	Mean	N	Std. Deviation	Std. Error
1	initial Slump	3.56	50	.501	.071
	final Slump	1.90	50	.614	.087
2	initial R	2.62	50	.602	.085
	final R	.94	50	.712	.101
3	initial Lasegue	2.38	50	.602	.085
	final Lasegue	.54	50	.503	.071
4	I initial	2.76	50	.797	.113
	I final	1.24	50	.716	.101
5	IL initial	2.18	50	.720	.102
	IL final	.68	50	.794	.112
6	IR initial	2.28	50	.948	.134
	IR final	.74	50	.876	.124
7	F initial	1.76	50	.555	.079
	F final	.36	50	.485	.069
8	ETR initial	3.68	50	.978	.138
	ETR final	1.36	50	.776	.110
9	EGEN initial	3.22	50	.507	.072
	EGEN final	1.84	50	.548	.078
10	Bragard initial	2.98	50	.553	.078
	Bragard final	1.28	50	.640	.091
11	VAS initial	5.34	50	.557	.079
	VAS final	2.28	50	.948	.134

Note: R: Trunk rotation in orthostatism; I: Finger index finger; IL: Left lateral tilt; IR: Right side tilt; F: Plantar dorsiflexions from supine position; ETR: Trunk extensions in orthostatism; EGEN: Knee extension with dorsiflexion from sitting on the bed.

Table 2. Participants' results before and after the intervention through kinetic programs

Variables	95% Confidence Interval		t	df	p	d
	Lower	Upper				
Slump before - after intervention	1.473	1.847	17.837	49	.000	2.97
R before - after intervention	1.470	1.890	16.039	49	.000	2.55
Lasegue before - after intervention	1.684	1.996	23.738	49	.000	3.33
I before - after intervention	1.275	1.765	12.457	49	.000	2.02
IL before - after intervention	1.242	1.758	11.667	49	.000	1.98
IR before - after intervention	1.269	1.811	11.437	49	.000	1.70
F before - after intervention	1.210	1.590	14.774	49	.000	2.71
ETR before - after intervention	2.117	2.523	23.022	49	.000	2.64
EGEN before - after intervention	1.229	1.531	18.401	49	.000	2.65
Bragard before - after intervention	1.476	1.924	15.236	49	.000	2.84
VAS before - after intervention	2.801	3.319	23.707	49	.000	3.97

Note: R: Trunk rotation in orthostatism; I: Finger index finger; IL: Left lateral tilt; IR: Right side tilt; F: Plantar dorsiflexions from supine position; ETR: Trunk extensions in orthostatism; EGEN: Knee extension with dorsiflexion from sitting on the bed.

The analysis of the results obtained in the case of chronic lumbar spine pain, as well as in the case of the ten functional tests, highlighted in Table 1 and 2, highlights:

- the average in case of chronic lumbar spine pain felt by the participants at the end of the intervention program through therapeutic physical exercises applied online (mVAS = 2.28) is significantly lower ($p < 0.01$) than the average of chronic lumbar spine pain felt during the beginning of the study (mVAS = 5.34);

- the effect size index ($d = 3.97$) indicates a very strong difference [20] between the results obtained by the participants before and after the kinetic means intervention program, in the case of chronic lumbar spine pain. In other words, the intervention program had a very strong effect on reducing lumbar spine pain.

- the confidence interval (95%) for the difference between the averages is between the lower value 2.80 and the upper value 3.31.
- the average, in the case of the Slump, Lasegue and Bragard tests, functional tests

involving rotations of the trunk in orthostatism, dorsiflexion plantar flexion, trunk extensions in orthostatism, knee extensions with dorsiflexion in bed, and in Finger index, Left and right lateral tilt tests case, at the end of the therapeutic physical exercises intervention program, applied online is significantly lower ($p < 0.01$) than the average obtained by the participants, in the case of these functional tests, at the beginning of the study ;

- the effect size index (Cohen 'd) shows a very strong difference between the results obtained by the participants (Table 2), before and after the intervention program by kinetic means, in the case of the ten functional tests. In other words, the intervention program had a very strong effect in terms of improving the functional capacity of the patient's body.

Conclusion

This study investigated the effectiveness of therapeutic physical exercise applied online in combating chronic low back pain. The analysis of the obtained results showed that the intervention program had a very strong effect on the reduction of lumbar spine pain. Also, the effect size index (Cohen 'd) showed a very strong difference between the results obtained by the participants, before and after the intervention program by kinetic means, in the case of the ten functional tests used. In other words, the therapeutic physical exercises applied online had a very strong effect in terms of improving the functional capacity of the patients' body.

We mention the fact that the subjects, being relieved of the time spent in traffic, can carry out the program in total safety against the risk of infection with SARS-COV-2. At the same time, there is a reduction in costs, if we consider that for 20 sessions, in a physiotherapy office, a patient would spend, on average, 2,000 lei (participants in the study paid a price of 250 lei for all the 20 sessions). Basically, this online method has proven to be in many cases more effective than the offline one.

Using therapeutic physical exercise applied online in case of chronic low back pain, the pain felt by the participants was statistically

significantly reduced. We believe that this form of therapeutic exercise delivery has generated the perfect solution for the continuity of programs offered to patients who initially use our offline physiotherapy services to reduce acute and subacute pain, but also to those with chronic low back pain, and for reasons of time and money can not attend a weekly physiotherapy office.

Authors' Contributions

All authors have equally contributed to this study.

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