



## POTENTIAL BENEFITS OF PHYSICAL MODALITIES FOR IMPROVING THE FUNCTIONAL ACTIVITY IN MUSCULOSKELETAL SYMPTOMS AFTER COVID-19. A CLINICAL CASE

G. Mratskova\*

Department of Medical Rehabilitation and Ergotherapy, Physical Medicine and Sports,  
Faculty of Medicine, Trakia University, Stara Zagora, Bulgaria

### ABSTRACT

**The purpose** is to present the benefits of Physical modalities to reduce the musculoskeletal symptoms and increase the functional activity of a patient with post-COVID syndrome.

**Materials and methods:** The rehabilitation was applied to a 78-year-old woman, admitted to the Physical and Rehabilitation Medicine Department (PRM). In April 2021 she was hospitalized for acute-severe COVID-19. During the hospitalization, a surgical treatment was performed for acute-mechanical ileus with enterocolitis. Due to the persistence (6 months), hypokinesia, weakness, back pain, difficulty in locomotion and daily activities, the general practitioner referred her to the PRM Department. The rehabilitation included breathing and active exercises for the neck, thoracic-lumbar spine and lower limbs; verticalization with a walker, training in everyday activities, magnetic field and Nemeč's currents.

**Results:** The clinical symptoms were assessed before and after the therapy. A reduction was observed in the tests of Tom Mayer from 36 to 23 cm, Schober from 0.5 to 1.0 cm, Lateral slopes r/l 57/60 cm to 52/51 cm, SFTR from /S/10°-0°-40° to 15°-0°-50° and /F/20°-0°-25° to 30°-0°-25° and Modified OSW from moderate (38) to mild (17).

**Conclusion:** The rehabilitation including physical modalities and therapeutic exercises effectively reduced the musculoskeletal symptoms and increased the functional activity of a patient with post-COVID-19 syndrome. Studies should continue in order to better objectify the therapeutic benefits of the physical factors.

**Key words:** Post-COVID-19 Rehabilitation, post-COVID medical care, functional capacity, therapeutic exercises, Low intensity magnetic field therapy, Interferential Nemeč's currents.

### INTRODUCTION

The SARS-CoV-2 pandemic has posed new challenges to the health systems worldwide, both in terms of treatment, recovery, and recreation after infection with an acute and severe clinical picture, as well as with lasting up to several weeks to months post-COVID complications and persistent post-COVID symptoms. The number of patients who survived the coronavirus infection and who need to recover from COVID-19 and require long-term medical care and monitoring is

increasing. The long-term effects after COVID-19 are not yet fully understood, however, based on the experience of previous coronavirus infections, the problems of impaired lung and physical function, reduced quality of life and emotional stress are relevant. The persistent psychological, physical, and cognitive impairments are the reasons why many patients who survived COVID-19 require long-term medical care and rehabilitation. The growing number of patients with post-COVID syndrome requires new rehabilitation approaches (1).

There is a large amount of data and clinical experience describing the condition of post-acute COVID-19, persistent COVID-19, or post COVID-19 (PCS) syndrome. It is characterized by persistent symptoms for 4 weeks or more after the onset of the infection

\*Correspondence to: Galina Mratskova,  
Department of Medical Rehabilitation and  
Ergotherapy, Physical Medicine and Sports,  
Faculty of Medicine, Trakia University, Stara  
Zagora, Bulgaria, 11 Armeiska Str., +359 894  
781 999, galina.mratskova@trakia-uni.bg

and is manifested by respiratory, cardiovascular, neuropsychiatric, gastrointestinal, musculoskeletal, dermatologic, or other general symptoms without an ongoing active infection (2-3).

The clinical picture of PCS is complex, taking into consideration the variety of symptoms, and probably it is not fully described at present (4). Some authors suggest that this is due to the ability of the virus to enter cells through the ACE2 receptor, which is widely expressed (5-8). This suggests the possibility that many organs undergo acute and chronic changes, which can explain the diversity of the clinical symptoms (9).

COVID-19 primarily affects the lungs and the internal organs, but musculoskeletal damage has been increasingly reported (10) and is associated with significant elevations of creatine kinase and lactate dehydrogenase (6) and is likely related to the presence of hyperinflammatory reaction of the body (11), as well as with the increased frequency of thrombotic phenomena in the periphery, which disrupts blood flow to the muscles (12).

Taking into consideration the diverse symptomatology and duration of complaints and based on their clinical experience, Augustin et al. (2021) recommend further research to be conducted, and new therapeutic strategies to be developed for patients with PCS. These therapeutic plans should include individualized care, the implementation of which should be carried out by multidisciplinary teams and special attention should be paid to the implementation of rehabilitation programs that include specific and general methods of physical rehabilitation (4).

At present, there is increasing evidence for the need and benefit of incorporating Physical Medicine Factors and conducting rehabilitation, both in patients with COVID-19 who lack contraindications (13-14) and in patients with persistent post-COVID symptoms (15).

**The purpose** of this paper is to present the potential benefits of the application of physical modalities to reduce the musculoskeletal symptoms and increase the functional activity of a patient with post-COVID-19 syndrome.

## MATERIALS AND METHODS

This report presents a clinical case of a 78-year-old female patient who was admitted to the Department of Physical and Rehabilitation Medicine and underwent rehabilitation in September 2021. In April 2021, she was hospitalized due to severe acute COVID-19. During hospitalization, emergency surgical treatment was required for acute mechanical ileus accompanied by enterocolitis. Due to persistent more than 6 months: hypokinesia and general weakness, accompanied by back and lower back pain, muscle weakness, difficult verticalization and locomotion and severely limited performance of everyday activities, the general practitioner referred the patient for rehabilitation to the hospital Department of Physical and Rehabilitation Medicine. According to anamnestic data before the COVID-19 infection, the patient was socially active, without experiencing functional limitations, and moving independently. The patient reports a right hip alloplasty performed years ago with optimal recovery of daily life and activity. Currently the patient reports feelings of depression and emotional instability.

The rehabilitation potential was determined based on the general clinical examination and the specific functional tests as follows:

**Test of Tom Mayer** – a test of general mobility in the lumbar region of the spine and hip joints. The distance from the tip of the third finger to the floor is measured in centimeters.

**Test of Schober**- The patient takes an upright position. 10 cm from the processus spinosus of L5 cranial are measured and marked. The increase in flexion distance in centimeters from L5 to the starting point is measured.

**Lateral flexion** to the left and right – the distance from the third finger to the floor is measured in cm. **Range of motion test** according to the SFTR system, in which the motor function is measured in degrees using a hand-held goniometer to determine the active and passive range of motion was applied.

**Modified Borg CR10 Scale** for assessment of exertion, shortness of breath and dyspnea, chest pain and musculoskeletal pain during physical activity (therapeutic exercises) (16, 17) and

**Modified Oswestry Low Back Pain Disability Questionnaire (OSW)** - The Disability Index (Oswestry - Back Pain Questionnaire) is an important tool for assessing impairments in the lower back. It consists of 10 sections (Pain intensity; Personal

Care; Lifting; Walking; Sitting; Standing; Sleeping; Social Life; Travelling; Employment/Homemaking). Score of 0-4 stands for no disability; 5-14 is for mild disability; 15-24 for moderate disability; 25-34

for severe disability; and score 35-50 shows complete disability (18). The result is recalculated using a percentage formula (**Table 1**).

**Table 1.** Interpretation of results of Modified Oswestry Low Back Pain Disability Questionnaire

Result	Disability Level	Characteristics of the disability
0% до 20%:	Mild disability	The patient can handle most activities of daily living. Training in standing up from a sitting position and therapeutic exercises is carried out.
21%-40%:	Moderate disability	The patient experiences more pain and difficulty with sitting, lifting, and standing. Travel and social life are more difficult, and they may be disabled from work. Personal care, sexual activity and sleeping are not grossly affected, and the patient can usually be managed by conservative means.
41%-60%:	Severe disability	Pain remains the main problem in this group, the everyday activities are affected. These patients require a detailed investigation.
61%-80%:	Very severe disability	Back pain impinges on all aspects of the patient's life. Positive intervention is required.
81%-100%:	Complete disability	These patients are either bed bound or are exaggerating their symptoms.

After the physical examination performed by a doctor - specialist in Physical and Rehabilitation Medicine and the specific functional tests, an individual rehabilitation program was developed.

**Main goal:** Optimal functional recovery and prevention of complications from hypokinesia.

**Tasks:** Reduction of the musculoskeletal pain in the cervical, thoracic and lumbar region of the spine; Improvement of the trophic and blood circulation in the skeletal muscles; Improvement of the muscle strength and tone of the back and lumbar muscles; Increasing the active range of motion in the axial skeleton and peripheral joints; Verticalization and training in walking with an aid; Training and practice in activities of daily life; Prevention of the effects of lung damage, digestive problems and hypokinesia.

The rehabilitation program was carried out under control of the vital signs, in compliance with all anti-epidemic measures and in accordance with the Declaration of Helsinki (1964) and after written informed consent of the patient.

**Intervention:** The program included therapeutic exercises: breathing exercises, active exercises for the thoracic-lumbar section and lower limbs; verticalization with a walker, training in everyday activities.

**Physical modalities:** Low intensity magnetic field transversally in the lumbar region 16000A/m, 1Hz, 0.2s, 15-20min. and medium-frequency Nemeč's currents (10-20 min, 90-100Hz; 0-100Hz) longitudinally along the spine from the cervical to the lumbar region, 10 procedures daily.

## RESULTS

The clinical symptoms and motor activity were assessed in two time periods before and after the rehabilitation. The basic vital signs were routinely monitored. There were no pathological changes in the activity of the cardiovascular and respiratory systems, no complaints and clinical symptoms from the digestive tract. After the rehabilitation (10 days), a reduction in the subjective and objective symptoms was observed in the following tests: Tom Mayer from 36 to 23.0 cm, Schober test from 0.5 to 1.0 cm, Lateral flexion right/left 57/60 cm. up to 52/51cm, Range of motion in the lumbar part according to SFTR from /S/ 10°-0°-40° to 15°-0°-50° and /F/ 20°-0°-25° to 30°-0°-25° and a reduction in the Modified Oswestry Low Back Pain Disability Questionnaire (OSW) from moderately severe (38 points) to mild disability (17 points). The dynamics of the results are presented in **Table 2**.

**Table 2** Dynamics of functional test results

Indicator	Before rehabilitation	After rehabilitation
Test of Tom Mayer	36.0 cm	23.0 cm
Test of Schober	0.5 cm	1.0 cm
Lateral flexion right/left	57/60 cm.	52/51 cm
SFTR /S/ Sagittal plane	10°-0°-40°	15°-0°-50°
SFTR /F/ Frontal plane	20°-0°-25°	30°-0°-25°
Borg CR10 Scale	4 points	2 points
Modified Oswestry Disability Questionnaire	Moderate (38 points)	Mild (17 points)

The patient was discharged from the hospital with improved functional activity and locomotion with a walker. No complications and side effects from the applied physical factors were observed.

## DISCUSSION

The severe COVID-19 infection leads to catabolic muscle wasting, feeding difficulties, and general weakness, which is probably one of the reasons for a poor treatment outcome (19). According to Karaarslan F. et al. (2022) from a cohort study, 89.0% of the survivors of acute COVID-19 infection in a period of 3 months had at least one symptom, 74.6% had at least one rheumatic and musculoskeletal symptom, and 82.1% had at least one other symptom of post COVID-19. Within 6 months period, 59.6% of the survivors had at least one symptom, 43.2% had at least one rheumatic and musculoskeletal symptom, and 51.2% had at least one other symptom of post COVID-19. Regarding rheumatic and musculoskeletal symptoms, 31.6% had fatigue, 18.6% had joint pain, and 15.1% had myalgia (20).

There are data from many studies after acute COVID-19 that assess the health-related quality of life and functional capacity and report significant functional deficits, even 6 months (21) after the infection. At present, the early rehabilitation programs are generally accepted to be both advisable, safe, and effective (2). In the recovery period after an acute infection, the low levels of physical activity are also associated with a deterioration in the quality of life (22).

When developing and conducting a rehabilitation program, it is essential to follow the individual approach. It is necessary to consider the specific characteristics of each patient, assessing clinical symptoms, comorbidities, pre-morbid level of the physical activity and functional capacity. The applied therapeutic approach in this particular patient was consistent with the opinion of Jimeno-Almazán et al. (2021) who recommend strongly

individually targeted therapeutic exercises as a non-pharmacological treatment for rheumatic and musculoskeletal disorders in which there is chronic pain, muscle weakness, physical limitations, fatigue and low exercise tolerance (23).

In restoring the functional capacity, strength training and multicomponent exercise programs have been recommended as safe and effective in reducing weakness and fatigue (24). In addition, the regular exercises can have a positive impact on the psycho-emotional sphere, on the one hand, by reducing the symptoms of depression, anxiety, and psychological stress, and on the other - they can modulate the perception of pain, which in turn leads to an improvement in the quality of life (25).

To reduce the pain and stiffness in the thoracolumbar region, as well as to improve the trophic and muscle condition during the complex rehabilitation, medium-frequency Nemeč's currents were used in pain-relieving trophic and stimulating parameters and a low-intensity magnetic field. The advantage of the medium-frequency currents is that they are well tolerated by the patients, their application lacks the undesirable effects of low-frequency and low-voltage currents, and they penetrate and localize deep into the tissues.

The electrotherapy has a number of advantages and few contraindications and combines well with the therapeutic exercises. This therapy can improve the functional state of the muscles and it can prevent the deepening of trophic disturbances (26,27). Nemeč's currents are successfully applied in physical practice for musculoskeletal disorders (28-30).

The interferential currents (Nemeč's currents) exhibit an analgesic effect, which is realized by several different mechanisms: on the one hand, by activating the "Pain gate" mechanism by inhibiting C - nociceptive fibers in connection with the pain control theory of "Malzack and

Wall" and, on the other hand, by improving and increasing the blood circulation in the area of application, and subsequently by faster removing the body fluids and pain-producing substances and by production of natural pain-relieving substances (28, 31, 32).

The low intensity magnetic field therapy is a safe and easy treatment method that is applied non-invasively. It acts locally and effectively at the site of injury and affects the source of pain and inflammation (33, 34). Currently, there is evidence that the low-intensity magnetic field therapy could also be applied to pneumonic changes after a COVID-19 infection. A pulsed electromagnetic field has an anti-inflammatory effect and regulates the ROS-signaling pathways. The inclusion of a low-intensity magnetic field in the complex rehabilitation of patients after a COVID-19 pneumonia helps to reduce respiratory disorders, anxiety and depression, and pain and discomfort that lead to a reduced quality of life (35, 36).

The applied complex rehabilitation in the clinical case described in this paper showed a positive impact in terms of the musculoskeletal symptoms. The observed positive effects are consistent with the effects reported by Debeuf, R. et al. (2022) from the administration of physical therapy in patients with COVID-19, with the possibility this type of therapy to improve the pulmonary, physical, and psychosocial function in these patients. However, they consider that the effect may differ depending on the clinical setting in which the physical modalities are applied: home care, intensive care unit, or other inpatient units, suggesting that studies in this area should continue to draw conclusions about the effectiveness of the physical therapy for disability in patients with COVID-19 (37).

The report describing the present clinical case has the following limitations. On one hand, although there is a large number of evidence for an association between the post- COVID-19 infection and the persistent musculoskeletal symptoms, it is also possible that a causal relationship does not exist in the observed patient. The functional assessment tools used, the Borg CR10 Scale and the Modified Oswestry Disability Questionnaire, may be subjectively influenced, although they show a high degree of sensitivity to change in status and are reliable in use.

## OUTCOMES AND CONCLUSION

Conducting physical therapy and rehabilitation in patients who have recovered from COVID-19 is necessary and requires an accurate assessment of the functional capacity.

The rehabilitation program must be complex and individual, tailored to the functional disorders of the patient.

It is necessary to take into account the specific characteristics of each patient, assessing the clinical symptoms, co-morbidities, pre-morbid level of physical activity and the functional capacity.

Incorporating training into activities of daily life increases independence and improves the self-care abilities of patients with post-COVID-19 syndrome and musculoskeletal disorders.

No side effects were observed in the complex application of Nemec's medium-frequency current, Low intensity magnetic field and therapeutic exercises.

The rehabilitation, including physical modalities and therapeutic exercises, effectively reduced the musculoskeletal symptoms, on the one hand, and - on the other, the same increased the functional activity of the described patient with post-COVID-19 syndrome.

Studies should continue to better objectify the therapeutic efficacy and potential benefits of the application of physical modalities in patients with musculoskeletal symptoms of post-COVID-19 syndrome.

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