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Features of physical therapy for lumbar hernias in military personnel during the late stage of rehabilitation

Abstract

Relevance. This study addresses the issue of rehabilitation for military personnel with lumbar disc herniation, which poses a critical challenge due to high levels of physical exertion and combat stress.

Aim. To investigate the effectiveness of manual therapy as a means of correcting the psychoemotional state and improving the quality of life of such patients within a long rehabilitation cycle.

Materials and methods. The study involved 30 military personnel (23 men and 7 women), randomised into two groups: basic (manual therapy + exercise (MT)) and control (exercise only + sham mobilisation (EX)). The assessment was performed using a number of tools: the McGill-Melzack Pain Questionnaire (pain), the HADS (anxiety/depression), the Tampa Scale of Kinesiophobia (kinesiophobia), the PCS (pain catastrophisation), and the Nottingham Health Profile (quality of life). Patients' condition was assessed in three stages: before treatment (T1), after a 5-week course (T2), and after three months of follow-up (T3).

Results. At baseline, the groups were homogeneous, although the MT group had higher levels of pain and catastrophisation. After the course (T2), both cohorts showed significant progress: in the MT group, pain intensity halved and quality of life improved by 64.1% (compared to 36.8% in EX). Only the MT group had a statistically significant reduction in anxiety and depression (49.2%) with a high effect size (0.432). Furthermore,

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in this group, the effect size for reducing pain catastrophisation (0.571) was twice that of the EX group (0.256). However, at the T3 stage, different trajectories were found: in the MT group, partial regression of results occurred, while the EX group showed a prolongation of the effect with a stable improvement in quality of life by 54.8%. Therefore, manual therapy is effective for rapid psychoemotional stabilisation, and physical exercises are effective for maintaining a long-lasting analgesic result.

Conclusions. Manual therapy is an effective tool in the comprehensive rehabilitation of service personnel, as it not only helps to reduce the intensity of pain but also successfully overcomes psychological barriers, such as fear of movement and depressive states. To achieve the most sustainable functional well-being, it is recommended to integrate manual techniques into long-term physical training programmes.

Keywords: kinesiotherapy; functional recovery; combatants; herniated disc; manual therapy; quality of life; kinesiophobia; psychoemotional state.

INTRODUCTION

In the context of a full-scale war in Ukraine, the rehabilitation of military personnel with lumbar hernias is a strategic challenge for the healthcare system. Combat-related factors – carrying heavy equipment, vibrations in armoured vehicles, and blast waves – contribute to the development of complex spinal pathologies, where intense pain is combined with profound psycho-emotional exhaustion, thereby threatening the combat readiness of personnel. Limited access to long-term inpatient treatment and the need for rapid recovery of personnel require the introduction of effective, mobile, and evidence-based physical therapy protocols. Of particular importance are integrated methods that allow simultaneously restoring the biomechanical integrity of the spine and levelling cognitive barriers to rehabilitation (kinesiophobia, post-traumatic stress), which is critical for preserving the human potential of the Defence Forces of Ukraine.

Contemporary scientific periodicals define lumbar hernias as a critical medical and social challenge that causes somatic deficits and a decrease in the quality of life of patients. J. Xu *et al*. [1] proved that the combination of manual manipulation with musculoskeletal modelling effectively restores the biomechanics of the spine. T. Ranger *et al*. [2] emphasised the inextricable link between chronic pain and psychological comorbidity, noting that ignoring mental disorders negates the results of physical therapy. Confirming this, D. Yi *et al*. [3] indicated that anxiety and depressive symptoms are a direct consequence of chronic pain syndrome. Such psychoemotional deviations create a pathological circle that significantly slows down the process of functional recovery. In the context of ongoing military operations, this issue is becoming an extremely pressing one for Ukraine's Defence Forces. Constant excessive axial loading, prolonged maintenance of antalgic or non-physiological postures, and mine-blast injuries and concussions, significantly contribute to the development of intervertebral disc herniation. For a serviceman, this pathology is transformed into a complex destructive factor: it not only limits combat capability, but also synergistically interacts with combat stress and post-traumatic stress disorder (PTSD). This leads to a high risk of chronic pain and depressive states, which dictates the need to implement integrated rehabilitation strategies aimed at simultaneously correcting physical and psychoemotional status.

The phenomenon of kinesiophobia, manifested as an irrational fear of physical activity, is a common comorbid condition in chronic low back pain, which in clinical practice is regarded as an unfavourable predictor that impedes the trajectory of recovery. C. de Freitas *et al*. [4] in their study proved that targeted physical therapy has a significant effect on the reduction of kinesiophobia; they concluded that overcoming this psychological barrier is a key condition for restoring motor functions. For military personnel, this task is strategically important, since their professional fitness directly correlates with successful integration into physical activity. According to the principles of the biopsychosocial model, pain intensity and the degree of disability are viewed as the outcome of a non-linear interaction between somatic and mental factors. In particular, W. Lu *et al*. [5], analysing risk factors in lumbar pathologies, showed that psychosocial determinants and structural features of spinal lesions have a dominant effect on the transformation of acute pain into chronic pain. Their data confirmed that a high level of psychological distress acts as a barrier that significantly limits the therapeutic potential of any analgesic measures.

The contemporary therapeutic strategy for lumbar hernias is differentiated into surgical intervention and conservative correction, which aims to restrain degenerative processes and improve the patient's quality of life. Analysing the structure and demand for such non-surgical measures, W.-J. Lee *et al*. [6] in their paper, based on large-scale surveys, demonstrated that the multimodal approach (which includes physical therapy, counselling, pharmacotherapy, and hardware treatment) is an economically and clinically justified basis for recovery, allowing most patients to avoid invasive surgery. Manual therapy occupies a special place amongst these treatments, as it is aimed at relieving pain, optimising myofascial tone and restoring joint mobility. Specifically, in their randomised clinical trial, B. Taşkaya *et al*. [7] concluded that the use of targeted manual techniques (such as high-speed impulse manipulation and soft rhythmic mobilisation) has a

powerful positive effect not only on somatic indicators, but also on psychological factors and the quality of life of patients with herniated discs, providing rapid improvement in joint play and reducing the level of distress.

Current scientific data show a clear correlation between the presence of hernias in the lumbar spine, the intensity of pain, and the development of anxiety and depressive states. In particular, Y.-C. Kao *et al*. [8] in their study confirmed a direct link between depressive disorders and chronic lower back pain resulting from disc degeneration, and pointed out that this pathology acts as a powerful destructive factor. In turn, M. Roiha *et al*. [9] concluded that the development of a hernia significantly limits the quality of life of patients, but timely elimination of the compression factor allows achieving favourable long-term results in restoring their overall well-being. In addition to the proven effect on pain intensity and functional state, manual therapy is highly effective in stabilising the psychological status of patients. Thus, in a randomised clinical trial, M. Danazumi *et al*. [10] proved that the use of spinal manipulation and mobilisation as an adjunctive treatment significantly accelerates the relief of radicular pain and improves the psychological and emotional well-being of patients with lumbar hernias. This opinion is shared by B. Cao *et al*. [11], who in their study indicated that the integration of conventional manual techniques has a pronounced therapeutic effect on alleviating the symptoms of depression and optimising the subjective assessment of quality of life due to the effective elimination of spinal dysfunctions. Additionally, C. Gong *et al*. [12], comparing different concepts of spinal mobilisation, concluded that targeted manual treatment provides a stable analgesic effect and improves the psychosomatic status of patients with chronic lumbalgia.

In the contemporary scientific literature, there is a certain shortage of comprehensive studies analysing the effectiveness of manual techniques in the context of psychological rehabilitation and improving the quality of life in spinal pathologies. Since the consequences of a herniated disc in the lumbar spine go beyond purely physical discomfort, affecting the emotional and social spheres, recovery strategies should be multi-modal in nature. Effective rehabilitation of patients with low back pain should focus on systemic correction of the state of health according to the biopsychosocial model, ensuring comprehensive functional restoration. The purpose of the study was to investigate the effectiveness of manual therapy as a means of improving the psychological and emotional well-being and quality of life of military personnel with lumbar disc herniation as part of a prolonged rehabilitation programme.

MATERIALS AND METHODS

To achieve this goal, a comprehensive methodological approach was applied, including theoretical analysis of professional literature and systematic collection of anamnestic data. The functional status was assessed in accordance with the principles of the International Classification of Functioning, Disability, and Health (ICF). The sensory-discriminatory and emotional-affective characteristics of the pain syndrome were assessed using the McGill Pain Questionnaire (SF-MPQ-2) [13]. The respondents' psychoemotional state was analysed on the Hospital Anxiety and Depression Scale (HADS) [14]. The degree of motor limitations and cognitive distortions was assessed using the Tampa Kinesiophobia Scale (TKS) and the Pain Catastrophisation Scale (PCS), respectively [15, 16]. The level of subjective well-being and integral quality of life indicators were determined using the Nottingham Health Profile (NHP) [17].

The study design involved the collection of demographic data and a multi-faceted assessment of the respondents' pain status, psycho-emotional profile, and overall quality of life. Dynamic monitoring of parameters was carried out at three time points: pre-test before the start of the intervention (T1), post-test immediately after completion of the therapeutic course (T2), and follow-up assessment after a three-month interval (T3). The initial phase included verification of clinical diagnoses and recording of anthropometric characteristics (gender, age, height, weight), followed by calculation of body mass index (BMI). Randomisation of the sample into two equivalent groups was performed on a 1:1 basis using the closed opaque envelope method. In order to minimise the subjective impact on the results, a "blind" distribution method was used, in which participants were not informed about belonging to a specific group.

The study sample was differentiated into the main group where manual therapy (MT) was used, and the control group with exercise (EX). Participants in the EX group performed a programme of stabilising gymnastics in combination with sham (placebo) mobilisation, while in the MT group, an identical set of exercises was supplemented with authentic techniques of manual spinal correction. The physical therapy programme applied for both groups lasted 5 weeks, included 10 practical sessions conducted under the direct supervision of a specialist with a frequency of twice per week (each session lasting 45-60 minutes). After completing the active phase (point T2), participants in both cohorts switched to the mode of self-performing regulated complexes at home (lasting 30 minutes daily) until the final cut (point T3). Continuous monitoring of patients' adherence to the therapeutic programme and correction of motor mode were provided by weekly remote telephone assistance and self-monitoring diaries. The total number of respondents who completed the full cycle according to the inclusion criteria was 30 (23 men and 7 women). The strict study protocol provided for the complete refusal of participants to use analgesic drugs during the entire period of therapeutic exposure.

The study was conducted at the rehabilitation units in Kharkiv in 2025. The study group was formed according to the following inclusion criteria: MRI-confirmed diagnosis of hernias established by a specialist; chronic lumbalgia (lasting >8 weeks) with an intensity of 3 points for VAS; lack of physical therapy courses during the last 6 months; age range 18-65 years. The exclusion criteria were: a history of spinal surgery; systemic autoimmune, oncological, or inflammatory diseases; structural deformities (spondylolisthesis, fractures); severe concomitant pathologies (cardiovascular disorders, stroke); specific neurological complications (ponytail syndrome), and pregnancy status.

The study protocol, experimental design, participant selection criteria, and patient information sheets and written informed consent forms, were reviewed in advance, expert evaluated, and officially approved by the Bioethics Commission of the National University of Pharmacy (Protocol No. 4, dated 15 October 2025). The study was conducted in accordance with the ethical principles of the WMA Declaration of Helsinki and Law of Ukraine No. 2801-XII [18, 19]. All participants were thoroughly acquainted with the terms of the programme in written and oral forms, after which they confirmed their participation by signing an informed consent. The questionnaire was completed by the patients themselves, in accordance with confidentiality guidelines. The study was conducted in accordance with the ethical standards of the American Sociological Association's Code of Ethics [20]. Mathematical and statistical processing of the obtained results was carried out using the SPSS v. 25 software suite. In the previous stage, the data distribution was tested for compliance with the normal distribution by calculating the skewness and kurtosis coefficients (considering a reference interval of ±1.5). Intergroup comparison of nominal (demographic) indicators was performed using Pearson's χ^2 criterion, while Student's t-test for independent samples was used to analyse quantitative values on the MMPQ, HADS, TKS, PCS, and NHP scales. Estimation of the time transformation of parameters at three observation stages (T1, T2, T3) was performed by the method of variance analysis (ANOVA) with repeated measurements. To clarify the nature of the changes observed, a post-hoc comparison procedure was applied using the least significant difference (LSD) criterion. Results were considered statistically significant at a significance level of $p < 0.05$ and a 95% confidence interval.

The authors state that the opinions expressed in the submitted paper are their own, and do not represent the official positions of their institution.

RESULTS

The basis for developing a personalised physical therapy strategy was the development of a categorical profile of each participant. The latter was structured in accordance with the ICF methodology using a unified basic set of domains (Fig. 1). The model used not only identified the existing physical deficit, but also ensured a comprehensive approach to all components of the patient's biopsychosocial status throughout the long-term rehabilitation period.

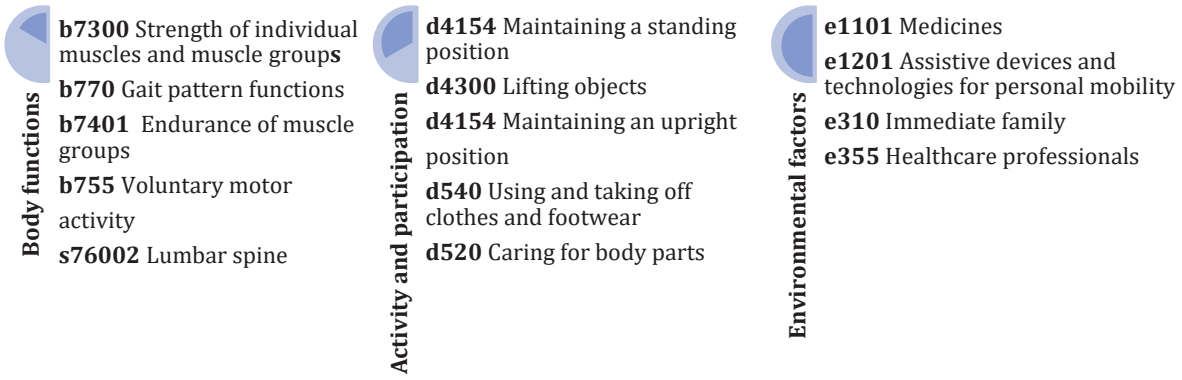

Figure 1. Categorical profile of ICF patients

Source: compiled by the authors

The use of the ICF categorical profile helped to implement the SMART goal strategy through a multimodal programme that combined manual spinal mobilisation and progressive strength training. In the short-term stage (1-2 weeks), efforts focused on pain relief, eliminating protective muscle spasms, and overcoming kinesiophobia through training in safe biomechanics of movement. Long-term goals (4-8 weeks) included restoring walking tolerance, forming a stable muscular corset to stabilise the spine, and gradually returning to military professional duties in compliance with ergonomic standards to compensate for structural changes.

The rehabilitation protocol for the EX group included a combination of stabilisation gymnastics with sham mobilisation, while in the MT group, a similar set of exercises was supplemented with authentic manual techniques. The course lasted five weeks and consisted of 10 sessions (twice a week), after which patients

switched to independent home exercises until a three-month catamnestic examination. To ensure adherence to therapy and monitor exercise performance, the researchers conducted weekly remote monitoring by telephone assistance.

The stabilisation training system was aimed at restoring the muscular corset and ensuring long-term stabilisation of the spine by maintaining the functional capacity of the "neutral zone". The main focus shifted to isolated and synergistic activation of the deep core muscles – the transverse abdominis muscle (m. *transversus abdominis*) and multi-split muscles (mm. *multifidi*). The programme was implemented in three stages with a progressive level of difficulty (Table 1), where the transition to the next phase took place only under the condition of full technical control over the movements of the previous level, the absence of pain, and maintaining a neutral position of the spine.

Table 1. Stabilisation training exercises

Phase	Purpose and functional tasks	Composition of exercises
Phase 1 Cognitive (local)	Activation of deep stabilisers in a neutral position, differentiation of local and global muscles	⬡ Local muscle activation ⬡ Stretching of the piriformis muscle ⬡ Torso rotation left/right ⬡ Correction of the neutral position of the lower back
Phase 2 Dynamic stabilisation	Strengthening stabilisers during limb movements, developing coordination between local and global muscle groups	⬡ Hip and knee flexion while lying down ⬡ One-legged bridge ⬡ Diagonal lifts of the limbs lying on the stomach ⬡ "Bird-Dog" exercise (diagonal limb lifts in quadruped position)
Phase 3 Functional (progressive)	Improving balance, stability, and proprioception when integrated into complex functional movements on unstable supports	⬡ Mini squats in a vertical stance ⬡ Fitball leg extension ⬡ Side bridge using a ball ⬡ Knee extension with resistance (expander) in a quadropedal position

Source: compiled by the authors

Within the manual therapy block, techniques of grade 4 passive mobilisation according to the Maitland concept were applied. Manipulations were performed with a series of low-amplitude rhythmic movements at the limit of the available activity range, observing the individual threshold of pain sensitivity of the patient (Table 2).

Table 2. Manual therapy practices

Mobilisation techniques	Patient's position	Dosage	Execution technique and manual contact
1	2	4	3
Anterior-posterior mobilisation	Lying on the stomach (prone)	Each lumbar vertebra: 20 repetitions	The ulnar border of the hand is placed over the spinous process of the vertebra, while the other hand reinforces the grip. Pressure is applied vertically downwards with straight elbows (low-speed rhythmic presses)
Rotary mobilisation	Lying on the side (painful side up)	20 repetitions for each side	Hip and knee are bent at 90°, the lower leg is straightened. One arm stabilises the shoulder, the other on the wing of the ilium. Rotational force is created by pressure on the pelvis in the direction of the therapist
Mobilisation in the flexion position	Lying on the side in the lower back flexion position	Each lumbar vertebra: 20 repetitions	One hand on the sacrum, the other on the lower thoracic region. Caudal arm shifts the lower vertebra in the transverse plane, and the cranial arm pushes the upper vertebra up (distraction effect)
Sham (placebo) mobilisation	Similar to the above techniques	Similar to active groups	Physiotherapist performs manual contact in the appropriate areas, but does not apply any mechanical force or pressure

Source: compiled by the authors

To implement sham (placebo) mobilisation, the specialist was limited exclusively to passive tactile contact of the hands with the patient's body. The procedure simulated a therapeutic position, but any active manipulations aimed at dislocating the vertebrae, mobilising joints, or overcoming tissue resistance were completely excluded. At the initial stage, a comparative analysis of the anthropometric and demographic characteristics of respondents was carried out. The results of statistical processing confirmed that there were no significant differences between the groups by age, body weight, height, and BMI ($p > 0.05$). The uniformity of the sample ensured high internal validity of the experiment, minimising the influence of interventional factors on rehabilitation results. The initial data of patients in the MT and EX groups are systematised in Table 3.

Table 3. Distribution of demographic information by group

Continuous variables	MT (n = 15)	EX (n = 15)	t	p*
Age (years)	38.80 ± 9.44	37.30 ± 9.11	0.454	0.653
Weight (kg)	88.61 ± 12.95	81.74 ± 11.54	2.043	0.050
Height (cm)	174.93 ± 9.43	171.50 ± 7.01	1.848	0.074
BMI (kg/m^2)	29.06 ± 4.22	26.69 ± 2.81	0.988	0.330

Note: * – independent selective t-test; MT – manual therapy group; EX – exercise group
Source: compiled by the authors

The gender distribution of the sample was 76.6% male and 23.3% female. Statistical analysis confirmed the equivalence of MT and EX groups by demographic characteristics ($p > 0.05$), which indicates their comparability at the initial stage. Below are the results of a comparative analysis of the health indicators of military personnel with lumbar herniated discs, in particular, according to the McGill-Melzack Pain Questionnaire (MMPQ) (Table 4). The results obtained indicate a pronounced positive dynamics of pain intensity reduction in both groups, but with a different trajectory of changes. At baseline (T1), the MT group had significantly higher levels of pain compared to the EX group ($p = 0.000$). After the end of therapy (T2), both methods showed high effectiveness: the MT group scores decreased by more than half, and the EX group – up to 22.43 points, which levelled the statistical difference between them ($p = 0.196$) and confirmed a similar short-term effect of interventions. However, during the follow-up assessment (T3), the EX group showed greater stability in their results compared with the MT group, which again resulted in a statistically significant difference in favour of exercise ($p = 0.036$).

Table 4. Intra-group and inter-group comparisons of the McGill-Melzack Pain Questionnaire

Variables	MT (n = 15)	EX (n = 15)	p*
T1	57.56 ± 11.18	41.62 ± 9.85	t: 4.814 p: 0.000
T2	27.62 ± 10.73	22.43 ± 12.51	t: 1.317 p: 0.196
T3	32.02 ± 14.68	20.31 ± 11.70	t: 2.182 p: 0.036
Effect size	0.754	0.588	

Note: * – independent selective t-test; MT – manual therapy group; EX – exercise group; T1 – before treatment; T2 – after treatment; T3 – 3-month follow-u
Source: compiled by the authors

Analysis of the results using the McGill-Melzack questionnaire confirmed the high effectiveness of both rehabilitation approaches. It was found that both methods have a significant effect size, while in the MT group this indicator was slightly higher – 0.754 against 0.588 in the EX group. This discrepancy is probably conditioned by a more pronounced primary dynamics of pain reduction in the MT group, whose participants had significantly higher baseline pain levels at T1 point. Analysis of long-term results indicates a higher effectiveness of physical exercises to stabilise the achieved effect. Whilst the MT group showed regression after three months (T3), with a slight increase in pain intensity – from 27.62 to 32.02 points – the EX group recorded a continued positive trend, with the score falling from 22.43 to 20.31. This confirms that the stabilisation exercise programme provides a longer and more stable analgesic effect in military personnel with lumbar spine hernias compared to manual exposure. The results of assessing the psychoemotional status of military personnel on the HADS scale confirm the positive impact of both rehabilitation strategies, although the intensity of dynamics of indicators in the groups had certain discrepancies (Table 5).

Table 5. Hospital Anxiety and Depression Scale

Variables	MT (n = 15)	EX (n = 15)	p*
T1	12.83 ± 6.12	10.58 ± 6.64	t: 0.991 p: 0.333
T2	6.52 ± 5	9.33 ± 5.66	t: −1.474 p: 0.151
T3	9.16 ± 5.25	9.28 ± 6.13	t: −0.062 p: 0.951
Effect size	0.432	0.127	

Note: * – independent selective t-test; MT – manual therapy group; EX – exercise group; T1 – before treatment; T2 – after treatment; T3 – 3-month follow-up
Source: compiled by the authors

Immediately after the end of the intervention (T2), the MT group showed the most pronounced positive dynamics: the average score on the HADS Scale decreased by 49.2% from the initial level, while in the EX

group the improvement was moderate – 11.8%. During the catamnestic examination (T3), partial regression of symptoms was observed in the MT group, but the final indicator remained 28.6% lower than the initial one. The EX group at the T3 stage showed high stability, maintaining an improvement of 12.3%. Despite the absence of a statistically significant difference between the groups at all stages of monitoring ($p > 0.05$), the effect size in the MT group (0.432) significantly exceeded the same indicator in the EX group (0.127), which indicates a stronger short-term clinical effect of manual therapy on the psychoemotional state of patients. The results of assessing the level of Kinesiophobia on the Tampa Scale (TSK) confirm that both rehabilitation approaches contributed to the reduction of fear of movement in military personnel with lumbar herniated discs (Table 6).

Table 6. Tampa Scale of Kinesiophobia

Variables	MT (n = 15)	EX (n = 15)	p*
T1	40.52 ± 7.57	37.58 ± 7.11	t: 1.114 p: 0.264
T2	34.43 ± 6.31	31.71 ± 9.66	t: 1.268 p: 0.201
T3	35.83 ± 7.01	34.66 ± 6.12	t: 0.580 p: 0.550
Effect size	0.238	0.133	

Note: * – independent selective t-test; MT – manual therapy group; EX – exercise group; T1 – before treatment; T2 – after treatment; T3 – 3-month follow-up

Source: compiled by the authors

At the T2 stage, the MT group showed a decrease in the level of kinesiophobia by 15.0%, and in the EX group – by 15.6%. During the follow-up assessment (T3), both groups maintained the stability of the result, despite a slight regression: the indicator remained lower than the initial one by 11.6% in the MT group and by 7.8% in the EX group. There was no statistically significant difference between the groups at all stages ($p > 0.05$), but a higher effect size in the MT group (0.238 vs. 0.133) indicates a more significant clinical effect of manual techniques on reducing fear of movement. Results on the Pain Catastrophisation Scale (PCS) confirm a significant reduction in cognitive-emotional stress in pain perception in both groups of military personnel (Table 7).

Table 7. Pain Catastrophisation Scale

Variables	MT (n = 15)	EX (n = 15)	p*
T1	26.22 ± 10.74	14.33 ± 12.52	t: 2.709 p: 0.009
T2	12.83 ± 11.06	8.20 ± 9.98	t: 1.350 p: 0.183
T3	10.33 ± 8.35	8.28 ± 12.00	t: 0.623 p: 0.544
Effect size	0.571	0.256	

Note: * – independent selective t-test; MT – manual therapy group; EX – exercise group; T1 – before treatment; T2 – after treatment; T3 – 3-month follow-up

Source: compiled by the authors

In the MT group, which had a higher initial level of catastrophisation ($p = 0.009$), after treatment (T2), a decrease of 51.1% was recorded, and after three months (T3) – by 60.6%. In the EX group, the improvement was 42.8% at T2 stage and stabilised at 42.2% at T3 stage. Despite the absence of a statistically significant difference between the groups in the long-term period ($p > 0.05$), a significantly higher effect size in the MT group (0.571 vs. 0.256) indicates a more intense effect of manual techniques on reducing patients' negative psychological attitudes towards pain. Analysis of the results for the Nottingham Health Profile (NHP) confirms the pronounced positive dynamics of indicators of the quality of life of military personnel in both groups (Table 8).

Table 8. Nottingham Health Profile

Variables	MT (n = 15)	EX (n = 15)	p*
T1	186.13 ± 116.55	144.27 ± 107.71	t: 1.100 p: 0.270
T2	66.79 ± 63.65	91.22 ± 82.66	t: −0.914 p: 0.362
T3	82.44 ± 89.40	65.23 ± 76.28	t: 0.622 p: 0.532
Effect size	0.403	0.413	

Note: * – independent selective t-test; MT – manual therapy group; EX – exercise group; T1 – before treatment; T2 – after treatment; T3 – 3-month follow-up

Source: compiled by the authors

At the initial stage (T1), the groups were statistically homogeneous ($p = 0.270$). After completing the course (T2), the MT group showed an improvement of 64.1%, while the EX group showed an improvement of

36.8%. During the follow-up assessment (T3), the EX group showed a prolongation of the effect (an additional decrease in indicators by 28.5% relative to T2, a total of 54.8%), while in the MT group there was a regression with an increase in the score by 23.4% relative to the T2 result. Despite the absence of a statistically significant difference between the groups ($p > 0.05$), the slightly higher effect size in the EX group (0.413 vs. 0.403) confirmed the high therapeutic value of both methods with a long-term benefit from exercise.

Thus, at the initial stage, the MT and EX groups were identical in terms of kinesiophobia and indicators of the hospital anxiety and depression scale ($p > 0.05$), which confirms the uniformity of the sample. However, after completing the therapeutic course, statistically significant positive dynamics in these parameters was observed mainly in the MT group, which led to the appearance of a likely intergroup difference ($p < 0.05$). As for the pain catastrophisation scale, the initial values of the MT group significantly exceeded similar data of the exercise group ($p < 0.05$). Although after treatment, the intensity of catastrophisation significantly decreased in both cohorts ($p < 0.05$), the effect size in patients in the MT group was more than double that observed in the EX group. Simultaneously, analysis of the McGill-Melzack questionnaire and the Nottingham Health Profile showed pronounced positive changes in both groups ($p < 0.05$). A post hoc analysis showed that overall statistical differences in pain intensity and quality of life parameters were determined by the respondents' significant progress relative to their primary condition (T1).

This study was devoted to the clinical analysis of the impact of manual techniques on the psychoemotional status and quality of life of patients with lumbar herniated discs. It was found that the integration of manual therapy into the rehabilitation process provides a pronounced positive trend in overcoming kinesiophobia, and symptoms of anxiety and depression. Both follow-up groups showed a significant reduction in pain syndrome, a decrease in the level of pain catastrophisation, and an overall improvement in quality of life indicators. The obtained results confirm that manual intervention is an effective tool for the correction of pain manifestations, stabilisation of the psychological state, and restoration of patients' functional well-being.

DISCUSSION

Recent evidence-based studies confirm the high clinical significance of conservative treatment for lumbar hernias. In particular, a large-scale systematic review and meta-analysis published by S. Thavarajasingam *et al*. [21] has shown that the differentiated use of manual manipulation, traction therapy, and targeted physical exercises provides statistically and clinically significant reduction of pain syndrome and is a financially justified basis for first-line therapy, which allows most patients to avoid invasive surgical intervention. The importance of combining manual techniques with advanced hardware techniques for rapid relief of neurological deficits was investigated by D. Lytras *et al*. [22] in their randomised clinical trial. The researchers concluded that the integration of manual therapy enables a rapid short-term analgesic effect, significantly reduces radicular pain intensity, and effectively alleviates functional limitations in chronic conditions. Active kinesiotherapy remains critical for maintaining a long-term result and regenerating the spinal muscular corset. As demonstrated in the meta-analysis by S. Du *et al*. [23], regular exercise programmes targeting deep stabilising muscles (in particular the transversus abdominis and multifidus muscles) not only restore spinal stability and locomotor biomechanics, but also exert a strong positive effect on patients' mental health, significantly improving overall quality of life indicators.

The results obtained in the course of the clinical study confirm the complex, multi-vector and non-linear biopsychosocial nature of the course of lumbar spine pathology in military personnel of the Defence Forces of Ukraine. It was established that in the context of combat operations, the development of intervertebral disc herniations is determined by the aggressive synergy of somatic and extreme environmental factors (carrying heavy personal equipment, prolonged exposure to vibrations in armoured vehicles, the effects of mine and explosive shock waves, and prolonged periods spent in forced, non-physiological postures). As noted by J. Xu *et al*. [1], degenerative and dystrophic lesions of the spine and directly herniated discs are a critical medical and social problem, accompanied by somatic deficits and a sharp decrease in the quality of life of patients. According to W. Lu *et al*. [5], psychosocial determinants combined with structural features of tissue destruction have a dominant effect on the transformation of acute pain syndrome into chronic, creating a stable barrier to successful rehabilitation.

The analysis of the initial data (point T1) is fully consistent with the current literature on the presence of deep comorbidity between chronic vertebrogenic pain and psychoemotional disorders of patients. Military personnel in both groups showed marked levels of distress, anxiety, depressive states, kinesiophobia, and pain catastrophisation at the time of inclusion in the programme. This is confirmed by the conclusions of B. Taşkaya *et al*. [7] on the indissoluble connection of chronic pain with mental pathology. This problem is particularly acute for combatants, whose intense pain interacts synergistically with combat stress and post-traumatic stress disorder.

The key theoretical and practical conclusion of the conducted study is the demonstration that manual therapy according to the Maitland concept (grade 4 passive mobilisation) acts as a powerful and rapid catalyst for the reduction of cognitive and emotional

distortions and the stabilisation of psycho-emotional state in patients in the short-term perspective (T2). Immediately after completing the 5-week course, the MT group showed a 49.2% reduction in anxiety and depression on the HADS Scale, while the isolated exercise (EX) group showed only 11.8% improvement. A significant advantage in effect size in the MT group (0.432 vs. 0.127 in EX) demonstrates a pronounced clinical effect of targeted manual techniques. This effect correlates with conclusions of B. Taşkaya *et al*. [7] that high-speed and soft rhythmic manual manipulations optimise myofascial tone, provide rapid improvement in the articular play of the spine, and have a powerful regulatory effect on the psychological factors of patients. Similar data was provided by M. Danazumi *et al*. [10], emphasising that spinal mobilisation as an adjunctive method can significantly improve the psychoemotional background and stop radicular pain.

Special attention was paid to the dynamics of overcoming mental barriers to rehabilitation, in particular kinesiophobia and pain catastrophisation. The phenomenon of irrational fear of movement is considered an unfavourable predictor of recovery. C. de Freitas *et al*. [4] emphasised that the reduction of kinesiophobia is a basic condition for the restoration of motor functions. According to the data, although both approaches reduced the level of fear of activity, the effect size in the MT group was twice as high (0.238 vs. 0.133 in EX). A similar pattern was found on the Pain Catastrophisation Scale (PCS), where the effect size in the MT group reached 0.571 compared to 0.256 in the EX group. This indicates that manual exposure by immediately eliminating mechanical irritation and decompression creates a positive sensory experience, destroying negative cognitive attitudes about own motor ability, which is fully consistent with the provisions of papers by B. Cao *et al*. [11] and C. Gong *et al*. [12].

Analysis of long-term results (catamnestic point T3 after three months of follow-up) revealed fundamentally different trajectories of long-term adaptation in the groups. In patients of the MT group, after discontinuation of direct supervision by a specialist, a partial regression of results occurred: the intensity of pain in MMPQ slightly increased (from 27.62 to 32.02 points), and the quality of life in NHP worsened by 23.4% compared to the T2 stage. In contrast, the EX group (which performed progressive stabilisation exercises targeting the deep core muscles, namely the transversus abdominis and multifidus muscles) demonstrated a more pronounced persistence of the treatment effect. In the control group at the T3 stage, a stable improvement in quality of life was recorded by 54.8% with a subsequent reduction in pain, which led to a statistically significant intergroup difference in favour of active exercise ($p = 0.036$).

This phenomenon of long-term stabilisation due to the active kinesiotherapy component confirmed the principles of the multimodal approach described by W.-J. Lee *et al*. [6], as the most clinically and economically justified basis for recovery. The observed long-term trajectories are also consistent with the findings of M. Roiha *et al.* [9], who noted that sustained maintenance of high quality of life and complete elimination of somatic deficits are only possible under the condition of forming long-term adaptive mechanisms of the musculoskeletal system. Manual techniques are indispensable for the initial "breakthrough" through acute pain syndrome and psychological distress, but stable long-term remission and restoration of professional combat capability of military personnel depend entirely on the development of a muscular corset during regular training. Thus, in the controversial field of physical rehabilitation of combatants with herniated discs, the study substantiated the feasibility of introducing an integrated rehabilitation model. It should combine passive manual manipulations in the initial stages (for elimination of protective muscle spasm, rapid psycho-emotional stabilisation, and reduction of kinesiophobia) with a mandatory subsequent transition to long-term individualised programmes of stabilisation and strength exercises to ensure sustained functional well-being.

CONCLUSIONS

1. Patients in both groups had high levels of anxiety, depression, kinesiophobia, and pain catastrophisation at the start (especially in the MT group, $p < 0.05$). This confirms the need for a comprehensive impact on both somatic and psychoemotional factors.

2. Developed protocol combined physical exercises with manual therapy techniques. The programme was aimed at biomechanical correction, decompression of nerve structures, and reduction of sensory perception of pain, which created conditions for effective functional recovery.

3. Both approaches showed positive dynamics of pain intensity and quality of life ($p < 0.05$). However, only the MT group achieved statistically significant correction for anxiety, depression, and kinesiophobia. The effect on pain reduction in the MT group was more than twice that of the control group.

4. Manual therapy was highly effective in the long-term rehabilitation of military personnel. It provided not only physical recovery, but also acts as a powerful factor in correcting the psychoemotional state, helping to overcome the fear of movement ($d = 0.238$ vs. $d = 0.133$ in the control group).

The main limiting factors of this study were the relatively small sample size (30 people), pronounced gender asymmetry with a predominance of men (76.6%), and a short three-month period of catamnestic follow-up. In addition, the effectiveness assessment was based mainly on subjective scales and questionnaires of patients without the use of instrumental

control methods (repeated MRI, electromyography or goniometry), and rehabilitation in a full-scale war imposed additional uncontrolled psychoemotional stress on the participants.

Prospects for further research include scaling up the experiment to involve a larger number of combatants (in particular, women) and extending the monitoring period to 6-12 months to assess the recurrence rate. Given the identified different temporal dynamics of effects, it is critically important to create and investigate a consistently integrated rehabilitation model, where manual therapy will serve as a quick tool for relieving distress and pain at the initial stage, with the obligatory subsequent transition to long-term stabilisation training for long-term retention of the result in under combat conditions. It is also advisable to supplement the methodology with objective biomechanical metrics of the spine and an assessment of the impact of physical therapy on patients with concomitant PTSD.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Особливості фізичної терапії при поперекових грижах у військовослужбовців на віддаленому етапі реабілітації

Анотація

Актуальність. Робота присвячена проблемі реабілітації військовослужбовців із грижами міжхребцевих дисків поперекового відділу, що є критичним викликом через високі фізичні навантаження та бойовий стрес.

Мета. Вивчення ефективності мануальної терапії як засобу корекції психоемоційного стану та підвищення якості життя таких пацієнтів у межах тривалого реабілітаційного циклу.

Матеріали та методи. У дослідженні взяли участь 30 військовослужбовців (23 чоловіки та 7 жінок), рандомізованих на дві групи: основну (мануальна терапія + вправи (МТ)) та контрольну (тільки вправи + плацебо-мобілізація (ФВ)). Оцінка проводилася за допомогою низки інструментів: опитувальника Макгілла-Мелзака (біль), шкали HADS (тривога/депресія), шкали Тампи (кінезіофобія), шкали PCS (катастрофізація болю) та Ноттінгемського профілю здоров'я (якість життя). Оцінка стану пацієнтів проводилася у три етапи: до початку лікування (Т1), після 5-тижневого курсу (Т2) та через три місяці спостереження (Т3).

Результати. На вихідному етапі групи були однорідними, хоча в групі МТ спостерігався вищий рівень болю та катастрофізації. Після курсу (Т2) обидві когорти продемонстрували значний прогрес: у групі МТ інтенсивність болю знизилася вдвічі, а якість життя покращилася на 64,1 % (проти 36,8 % у ФВ). Тільки в групі МТ зафіксовано статистично значущу редукцію тривоги та депресії (49,2 %) з високим розміром ефекту (0,432). Також у цій групі розмір ефекту щодо зниження катастрофізації болю (0,571) удвічі перевищив показники групи ФВ (0,256). Однак на етапі Т3 було виявлено різні траєкторії: у групі МТ відбулася часткова регресія результатів, тоді як група ФВ продемонструвала пролонгацію ефекту зі стабільним покращенням якості життя на 54,8 %. Отже, мануальна терапія є ефективною для швидкої психоемоційної стабілізації, а фізичні вправи – для утримання тривалого анальгетичного результату.

Висновки. Мануальна терапія є ефективним інструментом комплексної реабілітації військовослужбовців, оскільки вона дозволяє не лише знизити інтенсивність болю, а й успішно долати психологічні бар'єри, такі як страх перед рухом та депресивні стани. Для досягнення максимально стійкого функціонального благополуччя рекомендовано інтегрувати мануальні техніки в довготривалі програми фізичних тренувань.

Ключові слова: кінезіотерапія; функціональне відновлення; комбатанти; грижа міжхребцевого диска; мануальна терапія; якість життя; кінезіофобія; психоемоційний стан.