

KINESIOPHOBIA IN NEUROPATHIC PAIN FOLLOWING SPINAL INJURIES: DIAGNOSTIC TOOLS AND GRADED EXPOSURE STRATEGIES IN PHYSICAL REHABILITATION

Fedotova I. F., Danylchenko S. I., Morozenko D. V.

INTRODUCTION

Spinal injuries are among the most severe consequences of combat trauma and represent one of the leading causes of long-term functional impairment, disability, and loss of work capacity among military personnel. Even with timely surgical intervention, advanced spinal stabilization techniques, and successful bone fusion, a considerable proportion of patients fail to achieve the expected level of functional recovery. This indicates that anatomical restoration of damaged structures alone does not guarantee a return to daily activities, professional duties, or military service.

One of the major factors contributing to poor rehabilitation outcomes is the development of kinesiophobia (fear of movement/(re)injury), which is defined as an excessive, irrational, and persistent fear of movement or physical activity caused by concerns about reinjury, pain exacerbation, or deterioration of functional status. Within the contemporary concept of chronic pain, kinesiophobia is recognized as an important biopsychosocial factor that sustains the Fear-Avoidance Model, promotes physical inactivity, accelerates muscle deconditioning, reduces functional independence, and negatively affects patients' quality of life ^{1,2}.

This issue is particularly relevant for military personnel who have sustained combat-related spinal injuries. In this population, pain is frequently accompanied by psychological distress, combat-related stress reactions, increased anxiety, post-traumatic symptoms, and uncertainty regarding return to professional and military duties. Consequently, even after successful surgical treatment, fear of movement may become the principal barrier to effective physical rehabilitation and successful social and occupational reintegration ^{3,4}.

¹ Verbunt J.A., Smeets R.J.E.M. Graded Exposure: Een cognitief gedragsmatige aanpak van chronische pijn. Houten: Bohn Stafleu van Loghum, 2016. 183 c. DOI: 10.1007/978-90-368-1106-4

² Yao Y., Tian J., Dai X., et al. Postoperative kinesiophobia level in patients with spinal fracture and its correlations with rehabilitation self-efficacy and rehabilitation compliance. *Journal of Clinical Medicine in Practice*. 2024. Vol. 28, No. 21. P. 127–131. DOI: 10.7619/jcmp.2024061

³ Kiliachenkova K.Ye., Fursenko A.O., Shevchenko A.S. et al. Qigong in physical therapy for patients with chronic low back pain: a narrative review. *International Medical Herald*. 2026. Vol. 1, No. 5. P. 17–27. DOI: 10.64108/imh.2026.1.5.17

⁴ Leontieva F.S., Fedotova I.F., Morozenko D.V., et al. Stress and spinal overload: clinical and pathogenetic mechanisms and associated biochemical markers. *Actual Problems of Modern Medicine: Bulletin of Ukrainian Medical Stomatological Academy*. 2026. Vol. 26, No. 2. P. 290–295. DOI: 10.31718/2077-1096.26.2.290

In clinical practice, treatment outcomes in patients with spinal injuries are traditionally assessed primarily by pain intensity using the Visual Analogue Scale (VAS). In contrast, psychological factors that determine a patient's willingness to engage in physical activity are often overlooked by the multidisciplinary rehabilitation team. Contemporary evidence indicates that kinesiophobia is one of the strongest predictors of poor adherence to rehabilitation programmes, reduced physical activity, inferior functional outcomes, and chronicity of pain. These findings highlight the need to incorporate standardized assessment tools for the evaluation of kinesiophobia and to implement evidence-based rehabilitation interventions. Such interventions include Graded Exposure Therapy (GET), therapeutic exercise, Pain Neuroscience Education (PNE), and cognitive behavioural strategies designed to reduce fear of movement and restore functional capacity^{5,6}.

The aim of this chapter is to substantiate, based on contemporary scientific evidence and the results of the authors' own study, the need to incorporate the assessment and management of kinesiophobia into the standards of physical rehabilitation for military personnel with neuropathic pain following spinal injuries.

Relationship with academic programs, plans and themes. The research was conducted within the framework of the scientific project "Clinical and Pathophysiological Mechanisms of Metabolic Disorders in Humans Induced by Spinal Overload under Stress Conditions" (2026–2028), state registration number 0125U003187, at the Prof. M.I. Sytenko Institute of Spine and Joint Pathology of the National Academy of Medical Sciences of Ukraine.

1. Kinesiophobia in the Biopsychosocial Model of Pain

Pain is one of the leading causes of functional impairment, reduced quality of life, and prolonged disability following spinal injuries. Despite substantial advances in neurosurgery, traumatology, and physical rehabilitation, pain remains the primary factor limiting physical activity, delaying recovery, and negatively affecting rehabilitation outcomes. This issue is particularly important in military personnel with combat-related spinal injuries, as pain is frequently accompanied by psychological distress, elevated stress levels, and anxiety, all of which further complicate the rehabilitation process⁷.

According to the current classification of the International Association for the Study of Pain (IASP), pain is categorized as nociceptive, neuropathic, or nociplastic, depending on the predominant underlying pathophysiological mechanism. This classification is of fundamental importance for selecting appropriate treatment strategies and developing

⁵ Pawełczyk A., Lusa W., Radek M. Do patients in neurosurgical wards benefit from psychotherapy? A brief discussion on the application of cognitive-behavioural therapy in patients treated for spinal conditions. *Psychiatria i Psychologia Kliniczna*. 2023. No. 4. P. 338–345. DOI: 10.15557/PiPK.2023.0042

⁶ Ovdii M. Cognitive behavioural therapy as an important component of a multidisciplinary rehabilitation programme for patients with chronic lower back pain. *Mental Health*. 2026. Vol. 1. P. 147–154. DOI: 10.32782/3041-2005/2026-1.24

⁷ Danylchenko S.I., Tkachuk A.V., Yesselbayeva A.K., et al. The Role of Innovative Physical Rehabilitation Tools in the Recovery of Amputee Veterans. *Clin Prof Med*. 2026. Vol. 1, No. 47. P. 149–159. DOI: 10.31612/2616-4868.1.2026.18

individualized physical rehabilitation programmes, as each pain type requires a distinct therapeutic approach (**Figure 1**).

Nociceptive pain arises from the activation of peripheral nociceptors following injury to muscles, ligaments, fasciae, facet joints, or other components of the musculoskeletal system. During the acute phase of spinal trauma, nociceptive pain represents the predominant pain mechanism and serves a protective biological function by signalling tissue damage and the need to limit excessive mechanical loading. As tissue repair progresses and structural integrity is restored, the intensity of nociceptive pain generally declines.

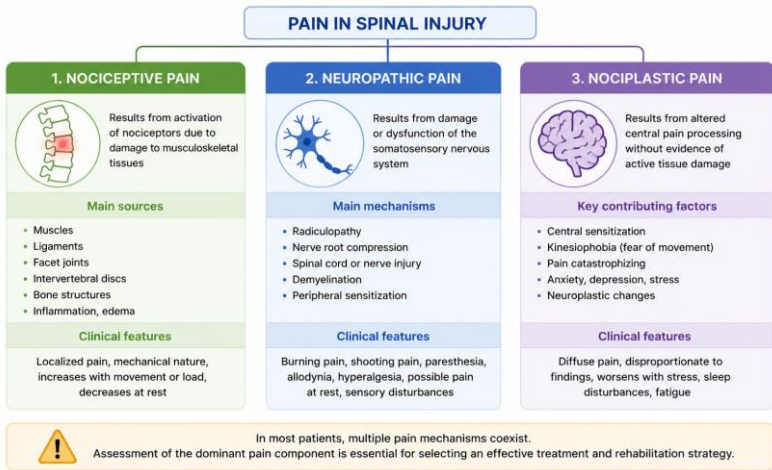


Fig. 1. Contemporary classification of pain following spinal injuries and the underlying pathophysiological mechanisms

Neuropathic pain develops as a consequence of direct injury to the somatosensory nervous system and is commonly associated with nerve root compression, traumatic radiculopathy, spinal cord injury, and postoperative neurological complications. It is characterised by burning sensations, paraesthesia, allodynia, hyperalgesia, and the persistence of pain even after the primary mechanical cause has been eliminated. The neuropathic component frequently determines the severity of the clinical course following spinal injuries and is associated with significantly poorer functional outcomes of physical rehabilitation programmes.

In recent years, increasing attention has been devoted to nociplastic pain, which results from altered central processing of nociceptive input in the absence of ongoing tissue damage or progressive injury to the somatosensory nervous system. The principal pathophysiological mechanism underlying nociplastic pain is central sensitisation, a state of heightened excitability within the central nervous system that amplifies pain perception despite minimal or even absent peripheral nociceptive stimuli. The development of nociplastic pain is closely associated with psychological factors,

including anxiety, depressive symptoms, pain catastrophising, post-traumatic stress, and kinesiophobia. These factors interact synergistically and contribute to the persistence and chronification of pain.

In clinical practice, these pain mechanisms rarely occur in isolation. Most patients with spinal injuries, particularly those with combat-related trauma, present with a combination of nociceptive, neuropathic, and nociplastic pain components. Consequently, contemporary physical rehabilitation programmes are based on a comprehensive assessment of the biological, psychological, and social factors that shape the patient's pain experience rather than relying solely on pain intensity measured by the VAS. This biopsychosocial approach facilitates the early identification of risk factors for pain chronification, enables optimisation of physical therapy interventions, and improves patient adherence to rehabilitation programmes ⁸.

Over the past few decades, the understanding of chronic pain has undergone a profound transformation. While the traditional biomedical model regarded pain primarily as a direct consequence of structural tissue damage, contemporary research has convincingly demonstrated that pain intensity does not necessarily correlate with the extent of anatomical abnormalities. Many patients continue to experience persistent pain and marked functional limitations even after complete tissue healing or successful surgical intervention. These observations highlight the pivotal role of central pain processing mechanisms and psychological factors in maintaining persistent pain.

Consequently, the biopsychosocial model has become widely accepted in contemporary medicine. According to this model, pain results from the complex interaction of biological, psychological, and social factors. The biological component includes the nature and severity of tissue injury, inflammatory responses, neuroplastic changes, and the functional status of both the peripheral and central nervous systems. The psychological component encompasses individual pain perception, anxiety, depressive symptoms, pain catastrophising, self-efficacy, and fear of movement. The social component is influenced by family support, occupational demands, military experience, rehabilitation conditions, and motivation to resume an active lifestyle.

Among the psychological factors, kinesiophobia occupies a particularly important position. It is defined as an excessive fear of movement arising from the expectation of pain or reinjury. Unlike the protective caution that is appropriate during the acute stage of injury, kinesiophobia is disproportionate to the actual level of physical risk and often persists even after clinical stabilisation has been achieved. It alters patients' movement behaviour by promoting the avoidance of physical activity, which subsequently leads to muscle deconditioning, impaired motor control, reduced exercise tolerance, and persistent functional limitations ⁹.

This issue is particularly relevant among military personnel with combat-related spinal injuries. Combat-related stress, a heightened sense of responsibility, the expectation of returning to military duties, and fear of reinjury substantially amplify the

⁸ Chen Y., Zhong G., Zhong S., et al. Effect of kinesiophobia on postoperative rehabilitation outcomes in patients with cervical spondylotic myelopathy: a cross-sectional study. *J Orthop Surg Res*. 2024. Vol. 19, No. 1. P. 469. DOI: 10.1186/s13018-024-04819-4

⁹ Archer K.R., Phelps K.D., Seebach C.L., et al. Comparative study of short forms of the Tampa scale for kinesiophobia: Fear of movement in a surgical spine population. *Arch Phys Med Rehabil*. 2012. Vol. 93, No. 8. P. 1460–1462. DOI: 10.1016/j.apmr.2012.03.024

psychological dimension of pain. Under these circumstances, kinesiophobia becomes not merely a reaction to pain but an independent factor that contributes to pain chronification and reduces the effectiveness of physical rehabilitation programmes (Figure 2).

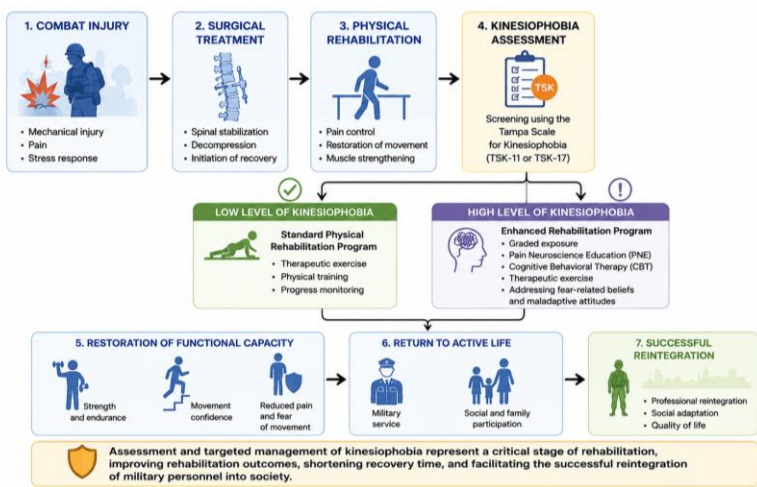


Fig. 2. The role of kinesiophobia in the reintegration of military personnel

For this reason, current clinical guidelines increasingly emphasise the importance of early identification of fear of movement, assessment of its severity using standardised questionnaires, and timely implementation of evidence-based psychological and physical interventions. The Fear-Avoidance Model provides the conceptual foundation for the contemporary understanding of the role of psychological factors in pain chronification. The origins of this model can be traced to the pioneering work of Gordon Waddell (1987), who was among the first to recognise that avoidance of physical activity due to fear of pain is not merely a consequence of injury but may itself become an independent contributor to persistent functional disability¹⁰.

The model was subsequently refined by Vlaeyen, Crombez, and Linton (2016), who integrated cognitive behavioural theory with contemporary concepts of pain neurophysiology. Their work established pain catastrophising as the central mechanism of the fear-avoidance process. Pain catastrophising shapes the perception of pain as a threat, promotes the development of kinesiophobia, reinforces avoidance behaviour, and contributes to the persistence of chronic pain long after tissue healing has occurred¹¹.

Recent evidence has further strengthened this concept. In a large-scale study involving 10,436 participants, Zhao et al. (2023) identified pain catastrophising as the central psychological construct within the Fear-Avoidance Model, linking fear-related

¹⁰ Waddell G. The Back Pain Revolution. Edinburgh: Churchill Livingstone, 1987. 71 p.
¹¹ Vlaeyen J.W.S., Crombez G., Linton S.J. The fear-avoidance model of pain. *Pain*. 2016. Vol. 157, No. 8. P. 1588–1589. DOI: 10.1097/j.pain.0000000000000574

cognitive and behavioural responses to persistent pain ¹². Likewise, Leung et al. (2024) demonstrated that reducing pain catastrophising represents one of the principal mechanisms through which non-pharmacological interventions improve outcomes in individuals with chronic pain ¹³.

Contemporary interpretations of the Fear-Avoidance Model conceptualise persistent pain as a dynamic biopsychosocial process rather than a simple consequence of structural tissue injury. Within this framework, fear of movement is considered a modifiable therapeutic target rather than an inevitable consequence of pain. Early identification and appropriate management of kinesiophobia can interrupt the pathological cycle of pain, pain catastrophising, kinesiophobia, movement avoidance, functional disability, and pain chronification (**Figure 3**).

Consequently, contemporary physical rehabilitation programmes increasingly integrate PNE, cognitive behavioural interventions, and GET. These evidence-based approaches aim to reduce fear of movement, restore confidence in physical activity, improve functional capacity, and optimise rehabilitation outcomes.

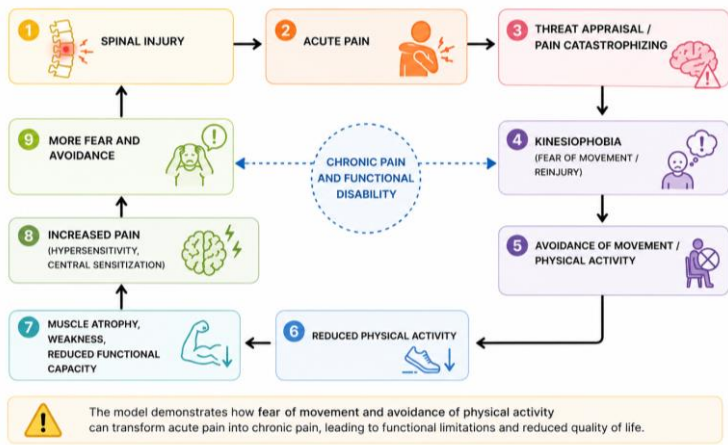


Fig. 3. The contemporary Fear-Avoidance Model as a mechanism of pain chronification and functional disability

2. Assessment of kinesiophobia and findings of the authors' own study

The evaluation of treatment outcomes in patients with spinal injuries has traditionally relied on the assessment of pain intensity using the VAS. Owing to its simplicity, high

¹² Zhao X., Boersma K., Gerdle B., et al. Fear network and pain extent: Interplays among psychological constructs related to the fear-avoidance model. *J Psychosom Res.* 2023. Vol. 167. P. 111176. DOI: 10.1016/j.jpsychores.2023.111176

¹³ Leung D.K.Y., Fong A.P.C., Wong F.H.C., et al. Nonpharmacological Interventions for Chronic Pain in Older Adults: A Systematic Review and Meta-Analysis. *Gerontologist.* 2024. Vol. 64, No. 6. P. gnac010. DOI: 10.1093/geront/gnac010

reproducibility, and ease of administration, the VAS has become one of the most widely used instruments in clinical practice. However, this scale reflects only the patient's subjective perception of pain at a specific point in time and provides no information about the psychological factors that influence behaviour throughout the rehabilitation process.

Contemporary evidence indicates that patients reporting similar pain intensity may demonstrate markedly different patterns of movement behaviour. For example, a patient with a VAS score of 4/10 may actively participate in a physical therapy programme and progressively increase functional loading, whereas another patient with a VAS score of 3/10 may completely avoid bending, lifting, or even walking because of fear of reinjury or pain exacerbation. Consequently, fear of movement, rather than pain intensity alone, often determines patient adherence to physical rehabilitation programmes, functional performance, and overall treatment outcomes ^{14, 15}.

These findings highlight the limitations of relying exclusively on pain intensity when evaluating rehabilitation outcomes. Contemporary physical therapy therefore places increasing emphasis on a comprehensive assessment that incorporates not only the clinical manifestations of pain but also the cognitive and behavioural factors that contribute to its persistence. Among these factors, kinesiophobia has emerged as one of the most clinically significant determinants of rehabilitation success. Its assessment requires the use of validated psychometric instruments capable of identifying fear of movement and quantifying its impact on functional recovery.

The Tampa Scale for Kinesiophobia as a contemporary tool for assessing fear of movement. The most widely used and validated instrument for assessing fear of movement is the Tampa Scale for Kinesiophobia (TSK), which is currently regarded as the international "gold standard" for diagnosing kinesiophobia in patients with chronic pain, musculoskeletal pathology, and post-surgical conditions. The scale was developed to quantify excessive fear of physical activity associated with the expectation of pain or reinjury and is now extensively used in both clinical practice and research settings.

The original version of the TSK consists of 17 items rated on a 4-point Likert scale ranging from 1 ("strongly disagree") to 4 ("strongly agree"). Total scores range from 17 to 68, with higher scores indicating more pronounced fear of movement. In most clinical studies, a cut-off score of 37 or above is considered indicative of clinically significant kinesiophobia, although some authors recommend adapting this threshold according to the clinical population and the purpose of the study.

The high reliability, validity, and sensitivity of the TSK have been confirmed in numerous studies involving patients with spinal pathology. Specifically, Archer et al. demonstrated that abbreviated versions of the scale (TSK-11 and TSK-13) have strong psychometric properties and can be effectively used in patients following spinal surgery.

Recent studies focused on patients with spinal injuries are of particular interest. In the study by Yao et al. (2024), the mean kinesiophobia score following surgical treatment of spinal fractures was 57.14 ± 3.12 points, indicating a high level of fear of movement. The authors also found a statistically significant negative correlation between TSK scores

¹⁴ Chimentì R.L., Pacha M.S., Glass N.A., et al. Elevated Kinesiophobia Is Associated With Reduced Recovery From Lower Extremity Musculoskeletal Injuries in Military and Civilian Cohorts. *Physical Therapy*. 2021. Vol. 102, No. 2. P. pzab262. DOI: 10.1093/ptj/pzab262

¹⁵ Pinto S.M., Cheung J.P.Y., Samartzis D., et al. Are Morphometric and Biomechanical Characteristics of Lumbar Multifidus Related to Pain Intensity or Disability in People With Chronic Low Back Pain After Considering Psychological Factors or Insomnia? *Front Psychiatry*. 2022. Vol. 13. P. 809891. DOI: 10.3389/fpsyt.2022.809891

and both rehabilitation self-efficacy and patient adherence to the rehabilitation programme. These findings suggest that higher levels of kinesiophobia are associated with reduced confidence in recovery, poorer compliance with prescribed exercises, and lower overall rehabilitation effectiveness.

Similar results were reported by Chen et al. (2024), who showed that elevated TSK scores were associated with poorer functional outcomes after surgical treatment of cervical spondylotic myelopathy, including increased Neck Disability Index (NDI) scores and reduced quality of life. Taken together, these findings confirm that kinesiophobia is not merely a psychological reaction to pain but an independent predictor of functional recovery.

The clinical utility of the TSK extends beyond the identification of patients with high levels of fear of movement; it also enables the individualisation of rehabilitation programmes. Test results allow clinicians to identify, at an early stage, those patients who may benefit from graded exposure, PNE, and cognitive behavioural interventions. In addition, repeated assessments using the TSK provide an objective means of monitoring the effectiveness of the psychological components of physical therapy and allow adjustments to the rehabilitation programme based on changes in the patient's scores.

Based on current evidence, it is recommended that the TSK be included in the standard assessment protocol for patients with spinal injuries upon admission to rehabilitation units, with repeat testing following the completion of the main rehabilitation course (approximately 12 weeks later). This approach will permit the evaluation of changes in kinesiophobia levels and the effectiveness of the rehabilitation interventions provided.

The comprehensive set of diagnostic tools for assessing pain, kinesiophobia, and psychophysiological factors in patients with spinal injuries is presented in **Table 1**.

Table 1

Diagnostic instruments for the comprehensive assessment of pain, kinesiophobia, and psychophysiological factors in patients with spinal injuries

Instrument	Parameter assessed	Primary purpose
VAS	Pain intensity	Assessment of pain severity
TSK-17	Fear of movement	Screening for kinesiophobia
PainDETECT	Neuropathic component	Differential diagnosis of pain
DN4	Neuropathic pain	Identification of neuropathic mechanism
PCS	Pain catastrophising	Assessment of cognitive risk factors
CSI	Central sensitisation	Detection of nociplastic component

Results of the authors' own research. The aim of this study was to evaluate changes in kinesiophobia (assessed using the Tampa Scale for Kinesiophobia, TSK), pain intensity (assessed using the Visual Analogue Scale, VAS), and functional status (assessed using the Oswestry Disability Index, ODI) in military personnel with neuropathic pain following spinal injuries during a 12-week physical rehabilitation programme incorporating elements of GET.

Materials and Methods. This study was designed as a prospective, longitudinal, interventional pilot study without a control group. A total of 278 patients participated in the study, including 223 male military personnel. The participants were 25 to 45 years of age.

The study was conducted in full compliance with international and national ethical principles governing medical research involving human participants, including the World

Medical Association Declaration of Helsinki (1964, as amended; latest revision, 2024), the Council for International Organizations of Medical Sciences (CIOMS) International Ethical Guidelines for Health-related Research Involving Humans, and the Belmont Report. Before enrolment, all participants received comprehensive information regarding the voluntary nature of participation, the confidentiality of personal data, the objectives, procedures, duration, and overall purpose of the study. Participation was entirely voluntary and was documented by written informed consent obtained from each participant before inclusion in the study. Participants were informed of their rights and responsibilities, including their right to withdraw from the study at any stage without providing a reason and without any adverse consequences.

Inclusion criteria comprised military personnel with combat-related spinal injuries and a confirmed neuropathic pain component (PainDETECT score >18), previous surgical stabilisation of the spine, absence of contraindications to physical activity, and provision of written informed consent.

Assessments were performed at three predefined time points: T1 (baseline), upon admission to the rehabilitation department; T2 (intermediate assessment), six weeks after the initiation of the rehabilitation programme; and T3 (final assessment), twelve weeks after baseline following completion of the primary rehabilitation programme.

At baseline (T1), 82.4% of participants demonstrated clinically significant kinesiophobia (TSK ≥ 37 points). The mean TSK score was 51.2 ± 6.8 points, indicating a very high level of fear of movement. Higher levels of kinesiophobia were significantly associated with greater neuropathic pain severity ($r = 0.54$; $p < 0.001$) and higher levels of pain catastrophising measured using the Pain Catastrophizing Scale (PCS) ($r = 0.61$; $p < 0.001$). Changes in the study outcomes during the rehabilitation programme are presented in **Table 2**.

Table 2

Changes in pain, kinesiophobia, and functional status in patients with spinal injuries (M $\pm$ SD)

Parameter	Time point T1 (n=278)	Time point T2 (n=265)*	Time point T3 (n=240)**	p (T1-T3)	Effect size (Cohen's d)
Visual Analogue Scale (VAS), points	6.8 $\pm$ 1.5	5.1 $\pm$ 1.8	4.2 $\pm$ 2.1	<0.001	1.42
Tampa Scale (TSK-17), points	51.2 $\pm$ 6.8	44.5 $\pm$ 8.2	38.9 $\pm$ 10.5	<0.001	1.35
Oswestry Disability Index (ODI), %	58.4 $\pm$ 12.3	46.7 $\pm$ 14.1	38.2 $\pm$ 16.4	<0.001	1.38
PainDETECT, points	22.1 $\pm$ 4.2	18.3 $\pm$ 5.5	15.4 $\pm$ 6.7	<0.001	1.15

Notes: * – 13 patients dropped out due to non-adherence to the rehabilitation protocol or personal reasons; ** – 25 patients dropped out due to low compliance and refusal to undergo repeated testing; p – statistical significance of the difference between T1 and T3 (paired-samples t-test).

Subgroup Analysis: Combat-Related and Non-Combat Spinal Injuries

To gain a more comprehensive understanding of the influence of injury characteristics on the progression of kinesiophobia, participants were stratified into two subgroups: Group A ($n = 187$), comprising military personnel with combat-related spinal injuries, and Group B ($n = 91$), comprising individuals with non-combat spinal injuries, including domestic and sports-related trauma.

The analysis revealed substantial differences between the two groups. First, the baseline level of kinesiophobia was significantly higher in Group A than in Group B (53.7 ± 5.9 vs 46.2 ± 6.3 points, $p < 0.01$). These findings suggest that combat experience represents an additional risk factor for the development of persistent kinesiophobia. For military personnel, fear of movement extends beyond concerns about pain or reinjury. It is closely associated with fear of losing the ability to return to military duties, a concern that substantially intensifies psychological distress, including symptoms of anxiety and depression. Previous studies have reported the prevalence of depression in this population to range from 30% to 40%.

Second, the pattern of recovery differed considerably between the two subgroups. In Group B (non-combat injuries), the mean TSK score decreased to 32.7 ± 8.1 points after 12 weeks of rehabilitation, falling below the threshold for clinically significant kinesiophobia (TSK < 37) in the majority of participants. In contrast, improvement was less pronounced in Group A (combat-related injuries). Although a statistically significant reduction in kinesiophobia was observed ($p < 0.05$), the mean TSK score remained 41.2 ± 9.4 points, which exceeded the accepted clinical threshold for kinesiophobia.

These findings indicate that even a contemporary rehabilitation programme incorporating GET may not be sufficient to eliminate fear of movement in military personnel with combat-related spinal injuries within a 12-week period. Fear of being unable to return to military service, together with the profound psychological consequences of combat trauma, appears to require more prolonged and integrated rehabilitation programmes that combine physical rehabilitation with structured psychological interventions. The changes in TSK scores according to injury type are presented in **Figure 4**.

Thus, TSK scores remained above the clinical cut-off value in patients with combat-related spinal injuries even after 12 weeks of rehabilitation, whereas participants with non-combat injuries achieved a sustained reduction in fear of movement to levels below the threshold for clinically significant kinesiophobia.

The present findings confirm that kinesiophobia represents a major barrier to functional recovery following spinal injury. Although the proposed GET programme demonstrated overall effectiveness, resulting in a 12.3-point reduction in the mean TSK score across the entire cohort, its effects were not uniform. Among patients with combat-related injuries, TSK scores remained within the range of clinically significant kinesiophobia even after three months of rehabilitation. These findings suggest that conventional GET protocols, which primarily focus on graded physical activity, may require further adaptation and reinforcement through structured psychological interventions for this patient population. In addition, the relatively high dropout rate (13.7%) indicates the challenges associated with maintaining patient motivation throughout the rehabilitation process, highlighting another important issue that should be addressed by multidisciplinary rehabilitation teams.

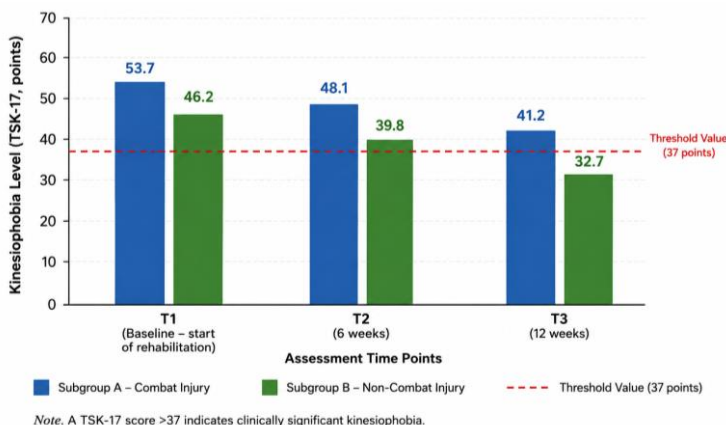


Fig. 4. Changes in kinesiophobia (TSK-17 scores) in patients with spinal injuries according to injury type (combat-related vs non-combat) during a 12-week physical rehabilitation programme

Note: The dashed horizontal line indicates the clinical cut-off value (TSK ≥ 37 points) corresponding to a clinically significant level of kinesiophobia.

3. Strategies for the Management of Kinesiophobia: Graded Exposure Therapy, Pain Neuroscience Education, and Future Directions

Graded Exposure Therapy: A Contemporary Approach to Overcoming Kinesiophobia. One of the most evidence-based interventions for the management of kinesiophobia is GET. Originally developed within the framework of cognitive behavioural therapy (CBT), GET has subsequently been adapted for use in physical rehabilitation programmes for patients with chronic pain and musculoskeletal disorders^{16, 17}. According to the systematic review by López-de-Uralde-Villanueva et al. (2016), graded exposure is more effective than graded activity in reducing pain catastrophising in the short term. More recent studies have further demonstrated that graded exposure, when integrated with psychologically informed physical therapy, significantly reduces fear of movement, pain intensity, disability, and depressive symptoms in individuals with chronic low back pain.

Unlike traditional rehabilitation approaches that encourage patients to avoid movements perceived as painful or potentially harmful, GET is based on the principle of gradual, structured, and safe exposure to feared movements. Patients progressively

¹⁶ López-de-Uralde-Villanueva I., Muñoz-García D., Gil-Martínez A., et al. A Systematic Review and Meta-Analysis on the Effectiveness of Graded Activity and Graded Exposure for Chronic Nonspecific Low Back Pain. *Pain Med.* 2016. Vol. 17, No. 1. P. 172–188. DOI: 10.1111/pme.12882

¹⁷ Kang J.W., Zhang Y.H., Yuk Y.S., et al. The effects of psychologically informed physical therapy on kinesiophobia, pain, disability, depression, and anxiety in patients with chronic low back pain: an intervention study focusing on graded exposure. *J Phys Ther Sci.* 2025. Vol. 37, No. 11. P. 556–560. DOI: 10.1589/jpts.37.556

perform activities that they perceive as threatening within a carefully supervised therapeutic environment. The primary objective of GET is not merely to reduce pain intensity, but to modify maladaptive beliefs about movement by replacing the perception that *"movement is dangerous"* with the understanding that *"movement is safe, controllable, and beneficial"*.

The theoretical foundation of GET is the contemporary interpretation of the Fear-Avoidance Model, which proposes that avoidance of physical activity is a key mechanism underlying the persistence of chronic pain. As patients repeatedly experience that previously feared movements can be performed safely without causing reinjury, they develop new adaptive behavioural patterns. This process leads to reduced anxiety and kinesiophobia while promoting improvements in functional capacity and participation in everyday activities.

Importantly, GET should not be interpreted as forcing patients to perform painful movements. Exposure is introduced only after a comprehensive clinical assessment, identification of an appropriate and safe level of physical loading, and establishment of a trusting therapeutic relationship between the physical therapist and the patient. Consequently, GET represents a multimodal rehabilitation approach that integrates therapeutic exercise, PNE, and cognitive behavioural strategies aimed at reducing fear of movement and restoring functional independence.

Evidence Supporting the Effectiveness of Graded Exposure Therapy. Over the past two decades, the effectiveness of GET has been consistently demonstrated in numerous randomised controlled trials, systematic reviews, and meta-analyses. The greatest therapeutic benefits have been reported in patients with chronic low back pain, individuals undergoing rehabilitation following spinal surgery, and other patient populations characterised by high levels of kinesiophobia.

Current evidence indicates that GET produces statistically significant reductions in TSK scores while improving functional independence, health-related quality of life, and adherence to physical rehabilitation programmes. Importantly, these improvements are achieved not only through progressive physical exercise but also through modification of maladaptive beliefs and cognitive responses related to pain and movement.

The study by Yao et al. (2024) demonstrated that a high level of kinesiophobia following surgical treatment of spinal fractures was directly associated with lower rehabilitation self-efficacy and poorer adherence to rehabilitation programmes. Similar findings were reported by Chen et al. (2024), who showed that reductions in fear of movement were accompanied by significant improvements in functional outcomes and health-related quality of life following surgery for cervical spondylotic myelopathy.

In addition, cognitive behavioural interventions have been shown to reduce pain intensity, shorten the duration of work disability, and decrease the risk of chronic pain development. These findings are particularly relevant for military personnel, in whom fear of reinjury is frequently compounded by the psychological consequences of combat exposure, including elevated stress and anxiety.

Taken together, the available evidence supports GET as a key component of multidisciplinary physical rehabilitation programmes for patients with spinal injuries. By addressing both the physical and psychological determinants of disability, GET contributes to improved functional recovery and facilitates successful long-term rehabilitation outcomes.

Implementation Algorithm for Graded Exposure Therapy in Physical Rehabilitation Programmes for Patients with Spinal Injuries. The practical implementation of GET involves the gradual restoration of safe movement based on the individual level of kinesiophobia and the patient's functional capacity.

Step 1. Developing an Individualised Fear Hierarchy. Following the initial clinical assessment and evaluation of kinesiophobia using the TSK, the physical therapist collaborates with the patient to identify movements or functional activities that provoke fear. These activities are then ranked from the least threatening (for example, ankle movements, isometric contraction of the lower-limb muscles, or rolling in bed) to the most anxiety-provoking tasks, such as forward bending, lifting objects from the floor, squatting, or carrying loads.

Step 2. Establishing a Sense of Safety. The initial phase of rehabilitation focuses on exercises performed under conditions of minimal axial loading of the spine. Aquatic therapy represents one of the most effective interventions because the buoyancy of water reduces spinal loading, facilitates movement, and promotes positive movement experiences in a safe environment. When aquatic therapy is unavailable, comparable objectives may be achieved through exercises performed in the supine position or with the use of body-weight support systems.

Step 3. Movement Stabilisation and Motor Control. Once the initial fear response has diminished, rehabilitation progresses to exercises targeting activation of the deep trunk muscles and spinal stabilisers in supine, sitting, and standing positions. The incorporation of biofeedback techniques is recommended, as these provide patients with real-time information regarding movement quality, enhance motor control, and increase confidence in their physical abilities.

Step 4. Graded Exposure. Under the direct supervision of a physical therapist, patients gradually perform movements selected from their individual fear hierarchy. The intensity and complexity of each activity are increased only after the previous level has been completed successfully without a significant increase in fear or anxiety. Throughout this stage, particular attention is paid to breathing control, body awareness, and the development of realistic perceptions regarding physical capabilities and movement safety.

Step 5. Cognitive Restructuring and Pain Neuroscience Education. Physical exercise is complemented by structured education concerning contemporary concepts of pain neurophysiology. The physical therapist explains that the occurrence of mild or moderate pain during movement does not necessarily indicate tissue damage or reinjury but may instead reflect central sensitisation or increased nervous system sensitivity. This educational component, commonly referred to as PNE, helps reduce pain catastrophising, strengthens patients' confidence in the rehabilitation process, and contributes to improved long-term clinical outcomes.

The proposed implementation algorithm can be readily integrated into standard physical rehabilitation programmes for patients with both combat-related and non-combat spinal injuries without requiring expensive equipment. Its principal advantages include individualisation of treatment, emphasis on patient-centred functional goals, and compatibility with other contemporary physical therapy interventions (**Figure 5**).

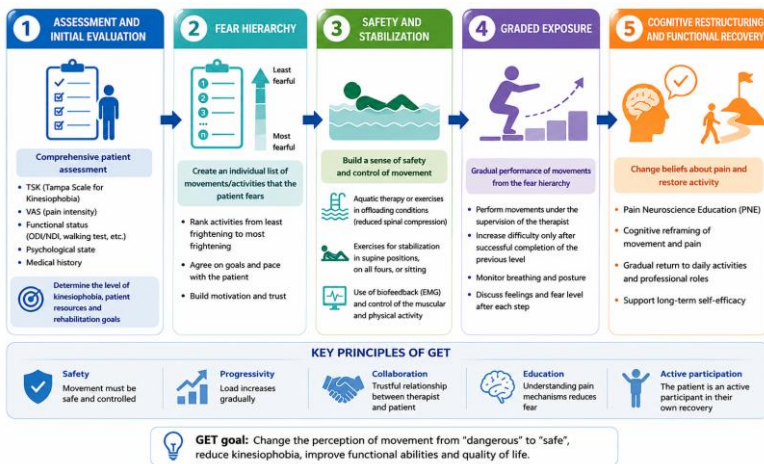


Fig. 5. Proposed algorithm for implementing Graded Exposure Therapy in physical rehabilitation programmes for patients with spinal injuries

Current Status of the Problem in Ukraine. The development of the physical rehabilitation system in Ukraine over recent years has been characterised by the active implementation of evidence-based medicine, multidisciplinary rehabilitation, and international standards of rehabilitation care. These processes have accelerated considerably during the full-scale war because of the substantial increase in the number of patients with combat-related musculoskeletal and nervous system injuries requiring long-term comprehensive rehabilitation.

According to the current regulatory framework of the Ministry of Health of Ukraine^{18,19,20}, physical rehabilitation is based on an individualised approach, comprehensive functional assessment, and coordinated work within a multidisciplinary rehabilitation team²¹. At the same time, analysis of current clinical practice indicates that physical rehabilitation programmes continue to focus primarily on restoring muscle strength,

¹⁸ Закон України «Про реабілітацію у сфері охорони здоров'я»: від 03.12.2020 № 1053-IX. *Відомості Верховної Ради України*. 2021. № 8. Ст. 59. URL: <https://www.rada.gov.ua/>

¹⁹ Постанова Кабінету Міністрів України «Питання організації реабілітації у сфері охорони здоров'я»: від 03.11.2021 № 1268. *Офіційний вісник України*. 2021. № 96. Ст. 6272. URL: <https://zakon.rada.gov.ua/laws/show/1268-2021-%D0%BF#Text>

²⁰ Постанова Кабінету Міністрів України «Деякі питання організації реабілітації у сфері охорони здоров'я»: від 16.12.2022 № 1462. *Офіційний вісник України*. 2023. № 3. Ст. 168. URL: <https://zakon.rada.gov.ua/laws/show/1462-2022-%D0%BF#Text>

²¹ Наказ Міністерства охорони здоров'я України «Про затвердження переліків закладів охорони здоров'я, лікарських посад, посад фармацевтів, посад фахівців з фармацевтичної освіти, посад професіоналів у галузі охорони здоров'я, посад фахівців у галузі охорони здоров'я та посад професіоналів з вищою неметодичною освітою у закладах охорони здоров'я»: від 25.03.2019 № 668. Зареєстровано в Міністерстві юстиції України 22.04.2019 за № 428/33399. URL: <https://zakon.rada.gov.ua/laws/show/z0892-02/ed20221115#Text>

range of motion, coordination, tolerance to physical activity, and reducing pain intensity. The VAS remains the most commonly used outcome measure, whereas psychological factors influencing movement behaviour are not routinely or systematically assessed.

Despite the rapid development of the physical therapy profession in Ukraine, the assessment and management of kinesiophobia have not yet been fully incorporated into standard rehabilitation protocols. In most clinical settings, psycho-emotional disturbances are regarded primarily as the responsibility of clinical psychologists or psychotherapists, while physical therapists focus mainly on functional exercise interventions. Although this division of professional responsibilities is appropriate for the management of psychiatric disorders, it does not fully reflect the contemporary biopsychosocial understanding of chronic pain. According to this concept, fear of movement develops and is reinforced during physical activity itself and should therefore be addressed as an integral component of physical rehabilitation programmes rather than as a separate psychological intervention.

At the same time, substantial progress has been achieved in leading rehabilitation centres across Ukraine. Specialised institutions operating under the Ministry of Health of Ukraine, the Ministry of Internal Affairs of Ukraine, the Ministry of Defence of Ukraine, as well as modern rehabilitation centres for veterans, have actively adopted multidisciplinary models of care involving physical therapists, occupational therapists, physicians specialising in Physical and Rehabilitation Medicine (PRM), psychologists, speech and language therapists, and social workers. This provides favourable conditions for integrating contemporary psychophysiological approaches into physical rehabilitation programmes.

Nevertheless, an analysis of available clinical protocols and practical recommendations indicates the absence of a unified algorithm for the assessment of kinesiophobia, routine implementation of the TSK, and systematic integration of GET into everyday physical therapy practice. Consequently, adaptation of internationally recognised evidence-based approaches to the Ukrainian healthcare system remains an important priority for further improving the effectiveness of physical rehabilitation programmes for patients with spinal injuries.

Prospects for the Implementation of Contemporary Approaches to the Management of Kinesiophobia. Current international guidelines indicate that successful rehabilitation of patients with spinal injuries cannot be achieved without addressing the psychological factors that influence movement behaviour and adherence to treatment. Consequently, one of the most promising directions for the further development of the Ukrainian rehabilitation system is the integration of standardised kinesiophobia screening and cognitive behavioural strategies into routine physical therapy practice.

A key priority is the incorporation of the TSK into the standard assessment protocol for patients with spinal injuries at the time of admission to physical rehabilitation programmes. Administration of the questionnaire both at the beginning and upon completion of rehabilitation would facilitate early identification of patients at high risk of developing chronic pain, enable monitoring of psychological adaptation throughout rehabilitation, and provide an objective measure of treatment outcomes.

Another important priority is the development of educational programmes and continuing professional development courses for physical therapists focusing on the application of GET, PNE, and fundamental cognitive behavioural techniques within the

professional scope of physical therapy practice. Similar educational models have already been successfully implemented in leading rehabilitation centres in the United States, Canada, Australia, and several Western European countries, particularly in programmes designed for military veterans recovering from combat-related injuries.

An additional opportunity for improving rehabilitation practice lies in the integration of cognitive behavioural principles into conventional therapeutic exercise programmes. Within this model, the physical therapist not only instructs patients in the correct performance of therapeutic exercises but also helps them reinterpret fear of movement, explains contemporary concepts of pain neurophysiology, promotes positive movement experiences, and gradually restores confidence in their physical capabilities. Consequently, the rehabilitation process evolves from a programme focused solely on exercise performance into a comprehensive biopsychosocial intervention aimed at restoring functional independence and facilitating successful reintegration into everyday life.

Importantly, these approaches do not require substantial financial investment or expensive specialised equipment. Nevertheless, they have the potential to significantly improve the effectiveness of physical rehabilitation programmes, shorten recovery time, and reduce the risk of chronic pain development. In the future, these principles may provide the foundation for the development of national clinical guidelines on the assessment and management of kinesiophobia in patients with spinal injuries.

A comparison of the traditional functional approach and the contemporary biopsychosocial approach to the physical rehabilitation of patients with spinal injuries is presented in **Table 3**.

Table 3

Comparative Characteristics of the Traditional Functional Approach and the Contemporary Biopsychosocial Approach to Physical Rehabilitation Programmes for Patients with Spinal Injuries

Criterion	Traditional Functional Approach	Contemporary Biopsychosocial Approach (GET + TSK)
Primary target of rehabilitation	Structural impairments, muscles, and joints	Biological, psychological, and behavioural mechanisms of recovery
Initial assessment	Pain (VAS), range of motion, muscle strength	VAS + TSK + functional outcome measures + psychological screening
Primary outcome measure	Pain reduction	Reduction in kinesiophobia, improvement in functional performance, and enhancement of quality of life
Main intervention	Therapeutic exercises and motor function training	Graded Exposure Therapy (GET), Pain Neuroscience Education (PNE), cognitive-behavioural strategies, and therapeutic exercises
Approach to pain	Pain is often considered a limitation to exercise	Moderate, controlled pain does not necessarily indicate tissue damage and may represent part of the adaptive recovery process

Role of the physical therapist	Exercise instructor	Clinical practitioner integrating physical training, patient education, and behavioural support
Role of the patient	Following prescribed recommendations	Active participation in overcoming fear of movement and restoring functional independence
Expected outcome	Restoration of physical function	Functional recovery, improved self-efficacy, reduced kinesiophobia, and successful reintegration

Discussion. The present findings confirm that kinesiophobia is a common and clinically significant phenomenon among patients with spinal injuries, particularly following combat-related trauma. The baseline mean TSK score (51.2 ± 6.8) is consistent with the findings of Yao et al. (2024), who reported a mean score of 57.1 ± 3.1 following surgical treatment of spinal fractures. The significant correlation observed between kinesiophobia and pain catastrophising ($r = 0.61$, $p < 0.001$) supports the pivotal role of cognitive factors in the development of fear of movement and is consistent with the Fear-Avoidance Model proposed by Vlaeyen and Linton. Similar findings were reported by Sharif-Nia et al. (2024), who, in a cohort of 400 postoperative patients, confirmed the excellent psychometric properties of the TSK and its association with functional outcomes²².

Particular attention should be given to the differences in recovery trajectories between the study subgroups. Patients with non-combat-related spinal injuries achieved a reduction in TSK scores below the clinical threshold (32.7 ± 8.1), whereas service members with combat-related injuries continued to demonstrate clinically elevated levels of kinesiophobia (41.2 ± 9.4). These findings are consistent with previous evidence indicating that combat-related stress and post-traumatic psychological reactions intensify the psychological consequences of spinal trauma. Our results suggest that a standard GET programme alone may be insufficient for military personnel with combat experience and should be complemented by additional psychological interventions. In this population, fear of being unable to return to military service appears to become a stronger determinant of persistent kinesiophobia than fear of pain itself.

The dropout rate of 13.7% is also noteworthy. This observation is consistent with the findings of Chen et al. (2024), who reported substantial difficulties in maintaining rehabilitation adherence among patients with high levels of kinesiophobia. Possible explanations include reduced motivation, psychological distress, and unrealistic expectations regarding the pace of recovery. Moreover, the relatively high dropout rate may indicate that patients with the greatest fear of movement experience the greatest difficulty adhering to physical rehabilitation programmes, thereby presenting an additional challenge for multidisciplinary rehabilitation teams. Chen L. et al. (2025), in a study involving 489 patients after lumbar fusion surgery, reported a kinesiophobia prevalence of 45.2% and identified sex, educational level, pain intensity, and self-efficacy

²² Sharif-Nia H., Froelicher, E.S., Hosseinzadeh, E., et al. Psychometric and network analysis of kinesiophobia in Iranian surgical patients. *Scientific Reports*. 2024. Vol. 14. P. 27181. DOI: 10.1038/s41598-024-78407-1

as significant predictors²³. These findings further support the need to consider psychological risk factors when designing individualised physical rehabilitation programmes.

The observed improvements in the Oswestry Disability Index (from 58.4% to 38.2%) and PainDETECT scores (from 22.1 to 15.4) indicate that integrating GET with PNE contributes not only to reducing fear of movement but also to meaningful improvements in functional recovery. These findings are in agreement with the study by Pawelczyk et al. (2023), which demonstrated the effectiveness of cognitive behavioural interventions in patients with spinal disorders. Recent evidence further supports combining GET with Pain Neuroscience Education. Delgado-Gil et al. (2025), in a randomised clinical trial involving 55 patients, demonstrated that adding PNE to multimodal physiotherapy resulted in significantly greater improvements in pain, physical function, pain catastrophising, and kinesiophobia ($F = 7.62$; $p = 0.008$)²⁴. Likewise, Rodríguez-Domínguez et al. (2025), in a pilot randomised controlled trial involving 31 women, found that combining PNE with resistance exercise was more effective than conventional exercise alone in reducing pain and symptoms of central sensitisation²⁵. Furthermore, Savvoulidou et al. (2025) are currently evaluating a communication-focused PNE programme in a randomised controlled trial, highlighting the potential value of integrating communication strategies into physical therapy practice²⁶.

Several limitations of the present study should be acknowledged. First, the absence of a control group precludes definitive conclusions regarding whether the observed improvements resulted specifically from the GET programme rather than from the natural course of recovery or other concurrent interventions. Second, although the sample included 278 participants, the relatively modest sample size together with the 13.7% dropout rate may limit the generalisability of the findings. Third, the 12-week follow-up period does not allow assessment of the long-term sustainability of treatment effects. Future research should therefore include large-scale randomised controlled trials with extended follow-up periods and appropriate control groups to establish the long-term effectiveness of GET for military personnel with spinal injuries.

²³ Rodríguez-Domínguez Á.J., Rebollo-Salas M., Chillón-Martínez R., et al. Pain Neuroscience Education and Resistance Training in Women With Fibromyalgia: A Randomized Control Pilot Study. *Pain Res Manag*. 2025. Vol. 2025. P. 7550108. DOI: 10.1155/prm/7550108

²⁴ Delgado-Gil J.A., Prado-Robles E., Muñoz-Alcaraz M.N., et al. Effectiveness of Adding a Pain Neuroscience Education Program to a Multimodal Physiotherapy Intervention in Patients with Chronic Shoulder Pain: A Randomized Clinical Trial. *Brain Sci*. 2025. Vol. 15, No. 2. P. 125. DOI: 10.3390/brainsci15020125

²⁵ Chen L., Cai Z., Ye L., et al. Current status and influencing factors of kinesiophobia in patients with lumbar disc herniation after lumbar fusion surgery. *Beijing Da Xue Xue Bao Yi Xue Ban*. 2025. Vol. 57, No. 2. P. 317–322. DOI: 10.19723/j.issn.1671-167X.2025.02.015

²⁶ Savvoulidou K. Effectiveness of Communication-Focused Pain Neuroscience Education in Chronic Musculoskeletal Pain. *ClinicalTrials.gov*. 2025. NCT07001449. URL: <https://clinicaltrials.gov/study/NCT07001449>

CONCLUSIONS

Kinesiophobia is a key psychophysiological factor determining the effectiveness of physical rehabilitation in patients with spinal injuries, particularly following combat-related trauma. The authors' own study confirmed a high baseline level of fear of movement (Tampa Scale for Kinesiophobia 51.2 ± 6.8 points) and its strong correlation with pain catastrophizing ($r = 0.61$; $p < 0.001$), which substantiates the need for systematic screening of kinesiophobia using standardised instruments, particularly the Tampa Scale for Kinesiophobia.

Patients with combat-related injuries demonstrate a significantly higher baseline level of kinesiophobia (53.7 ± 5.9 points) compared to those with non-combat injuries (46.2 ± 6.3 points; $p < 0.01$), and the recovery trajectory in military personnel is less pronounced – after 12 weeks, the Tampa Scale for Kinesiophobia score remained above the clinical cut-off (41.2 ± 9.4 points vs 32.7 ± 8.1 points in the non-combat injury group). This suggests that fear of losing the opportunity to return to military service constitutes an additional factor that exacerbates kinesiophobia and necessitates more prolonged psychotherapeutic support.

The most effective method for overcoming kinesiophobia is Graded Exposure Therapy, which combines gradual exposure, pain neuroscience education, and cognitive-behavioural strategies. A promising direction for the development of physical rehabilitation in Ukraine is the integration of the biopsychosocial model into clinical practice, the inclusion of the Tampa Scale for Kinesiophobia in standard assessment protocols, and the incorporation of Graded Exposure Therapy and Pain Neuroscience Education into the training of physical therapists. These measures will contribute to improving rehabilitation outcomes and facilitating the successful reintegration of military personnel following spinal injuries.

SUMMARY

The article addresses the problem of kinesiophobia as a key psychophysiological factor that impedes effective physical rehabilitation of military personnel with neuropathic pain following spinal injuries. The necessity of integrating the diagnosis of fear of movement and modern strategies for its correction into physical therapy standards is substantiated. The results of a prospective longitudinal study involving 278 patients (223 servicemen) with combat and non-combat spinal injuries are presented. A high baseline level of kinesiophobia (TSK 51.2 ± 6.8 points) and its strong correlation with pain catastrophizing ($r = 0.61$; $p < 0.001$) were established. It has been proven that patients with combat injuries have a significantly higher level of fear of movement compared to non-combat injuries, and the recovery dynamics in military personnel are less pronounced. The effectiveness of Graded Exposure Therapy as an evidence-based method for overcoming kinesiophobia is substantiated. Promising directions for implementing the biopsychosocial approach, standardized screening of kinesiophobia using the Tampa Scale for Kinesiophobia, and pain neuroscience education in the training of physical therapists in Ukraine are identified.

References

1. Verbunt J.A., Smeets R.J.E.M. Graded Exposure: Een cognitief gedragsmatige aanpak van chronische pijn. Houten: Bohn Stafleu van Loghum, 2016. 183 c. DOI: 10.1007/978-90-368-1106-4
2. Yao Y., Tian J., Dai X., et al. Postoperative kinesiophobia level in patients with spinal fracture and its correlations with rehabilitation self-efficacy and rehabilitation compliance. *Journal of Clinical Medicine in Practice*. 2024. Vol. 28, No. 21. P. 127–131. DOI: 10.7619/jcmp.2024061
3. Kiliachenkova K.Ye., Fursenko A.O., Shevchenko A.S. et al. Qigong in physical therapy for patients with chronic low back pain: a narrative review. *International Medical Herald*. 2026. Vol. 1, No. 5. P. 17–27. DOI: 10.64108/imh.2026.1.5.17
4. Leontieva F.S., Fedotova I.F., Morozenko D.V., et al. Stress and spinal overload: clinical and pathogenetic mechanisms and associated biochemical markers. *Actual Problems of Modern Medicine: Bulletin of Ukrainian Medical Stomatological Academy*. 2026. Vol. 26, No. 2. P. 290–295. DOI: 10.31718/2077-1096.26.2.290
5. Pawelczyk A., Lusa W., Radek M. Do patients in neurosurgical wards benefit from psychotherapy? A brief discussion on the application of cognitive-behavioural therapy in patients treated for spinal conditions. *Psychiatria i Psychologia Kliniczna*. 2023. No. 4. P. 338–345. DOI: 10.15557/PiPK.2023.0042
6. Ovdii M. Cognitive behavioural therapy as an important component of a multidisciplinary rehabilitation programme for patients with chronic lower back pain. *Mental Health*. 2026. Vol. 1. P. 147–154. DOI: 10.32782/3041-2005/2026-1.24
7. Danylchenko S.I., Tkachuk A.V., Yesselbayeva A.K., et al. The Role of Innovative Physical Rehabilitation Tools in the Recovery of Amputee Veterans. *Clin Prof Med*. 2026. Vol. 1, No. 47. P. 149–159. DOI: 10.31612/2616-4868.1.2026.18
8. Chen Y., Zhong G., Zhong S., et al. Effect of kinesiophobia on postoperative rehabilitation outcomes in patients with cervical spondylotic myelopathy: a cross-sectional study. *J Orthop Surg Res*. 2024. Vol. 19, No. 1. P. 469. DOI: 10.1186/s13018-024-04819-4
9. Archer K.R., Phelps K.D., Seebach C.L., et al. Comparative study of short forms of the Tampa scale for kinesiophobia: Fear of movement in a surgical spine population. *Arch Phys Med Rehabil*. 2012. Vol. 93, No. 8. P. 1460–1462. DOI: 10.1016/j.apmr.2012.03.024
10. Waddell G. The Back Pain Revolution. Edinburgh: Churchill Livingstone, 1987. 71 p.
11. Vlaeyen J.W.S., Crombez G., Linton S.J. The fear-avoidance model of pain. *Pain*. 2016. Vol. 157, No. 8. P. 1588–1589. DOI: 10.1097/j.pain.0000000000000574
12. Zhao X., Boersma K., Gerdle B., et al. Fear network and pain extent: Interplays among psychological constructs related to the fear-avoidance model. *J Psychosom Res*. 2023. Vol. 167. P. 111176. DOI: 10.1016/j.jpsychores.2023.111176

13. Leung D.K.Y., Fong A.P.C., Wong F.H.C., et al. Nonpharmacological Interventions for Chronic Pain in Older Adults: A Systematic Review and Meta-Analysis. *Gerontologist*. 2024. Vol. 64, No. 6. P. gnae010. DOI: 10.1093/geront/gnae010
14. Chimenti R.L., Pacha M.S., Glass N.A., et al. Elevated Kinesiophobia Is Associated With Reduced Recovery From Lower Extremity Musculoskeletal Injuries in Military and Civilian Cohorts. *Physical Therapy*. 2021. Vol. 102, No. 2. P. pzab262. DOI: 10.1093/ptj/pzab262
15. Pinto S.M., Cheung J.P.Y., Samartzis D., et al. Are Morphometric and Biomechanical Characteristics of Lumbar Multifidus Related to Pain Intensity or Disability in People With Chronic Low Back Pain After Considering Psychological Factors or Insomnia? *Front Psychiatry*. 2022. Vol. 13. P. 809891. DOI: 10.3389/fpsy.2022.809891
16. López-de-Uralde-Villanueva I., Muñoz-García D., Gil-Martínez A., et al. A Systematic Review and Meta-Analysis on the Effectiveness of Graded Activity and Graded Exposure for Chronic Nonspecific Low Back Pain. *Pain Med*. 2016. Vol. 17, No. 1. P. 172–188. DOI: 10.1111/pme.12882
17. Kang J.W., Zhang Y.H., Yuk Y.S., et al. The effects of psychologically informed physical therapy on kinesiophobia, pain, disability, depression, and anxiety in patients with chronic low back pain: an intervention study focusing on graded exposure. *J Phys Ther Sci*. 2025. Vol. 37, No. 11. P. 556–560. DOI: 10.1589/jpts.37.556
18. Закон України «Про реабілітацію у сфері охорони здоров'я» : від 03.12.2020 № 1053-IX. *Відомості Верховної Ради України*. 2021. № 8. Ст. 59. URL: <https://www.rada.gov.ua/>
19. Постанова Кабінету Міністрів України «Питання організації реабілітації у сфері охорони здоров'я» : від 03.11.2021 № 1268. *Офіційний вісник України*. 2021. № 96. Ст. 6272. URL: <https://zakon.rada.gov.ua/laws/show/1268-2021-%D0%BF#Text>
20. Постанова Кабінету Міністрів України «Деякі питання організації реабілітації у сфері охорони здоров'я» : від 16.12.2022 № 1462. *Офіційний вісник України*. 2023. № 3. Ст. 168. URL: <https://zakon.rada.gov.ua/laws/show/1462-2022-%D0%BF#Text>
21. Наказ Міністерства охорони здоров'я України «Про затвердження переліків закладів охорони здоров'я, лікарських посад, посад фармацевтів, посад фахівців з фармацевтичною освітою, посад професіоналів у галузі охорони здоров'я, посад фахівців у галузі охорони здоров'я та посад професіоналів з вищою неметичною освітою у закладах охорони здоров'я» : від 25.03.2019 № 668. Зареєстровано в Міністерстві юстиції України 22.04.2019 за № 428/33399. URL: <https://zakon.rada.gov.ua/laws/show/z0892-02/ed20221115#Text>
22. Sharif-Nia H., Froelicher, E.S., Hosseinzadeh, E., et al. Psychometric and network analysis of kinesiophobia in Iranian surgical patients. *Scientific Reports*. 2024. Vol. 14. P. 27181. DOI: 10.1038/s41598-024-78407-1
23. Rodríguez-Domínguez Á.J., Rebollo-Salas M., Chillón-Martínez R., et al. Pain Neuroscience Education and Resistance Training in Women With Fibromyalgia: A Randomized Control Pilot Study. *Pain Res Manag*. 2025. Vol. 2025. P. 7550108. DOI: 10.1155/prm/7550108

24. Delgado-Gil J.A., Prado-Robles E., Muñoz-Alcaraz M.N., et al. Effectiveness of Adding a Pain Neuroscience Education Program to a Multimodal Physiotherapy Intervention in Patients with Chronic Shoulder Pain: A Randomized Clinical Trial. *Brain Sci.* 2025. Vol. 15, No. 2. P. 125. DOI: 10.3390/brainsci15020125

25. Chen L., Cai Z., Ye L., et al. Current status and influencing factors of kinesiophobia in patients with lumbar disc herniation after lumbar fusion surgery. *Beijing Da Xue Xue Bao Yi Xue Ban.* 2025. Vol. 57, No. 2. P. 317–322. DOI: 10.19723/j.issn.1671-167X.2025.02.015

26. Savvoulidou K. Effectiveness of Communication-Focused Pain Neuroscience Education in Chronic Musculoskeletal Pain. *ClinicalTrials.gov.* 2025. NCT07001449. URL: <https://clinicaltrials.gov/study/NCT07001449>

Information about the authors:

Fedotova Inga Fridonivna,

Doctor of Medical Sciences, Senior Researcher,
Deputy Director for Scientific Work

Sytenko Institute of Spine and Joint Pathology National Academy of Medical
Sciences of Ukraine
80, Hryhoriia Skovorody str, Kharkiv, 61024, Ukraine

Danylchenko Svitlana Ivanivna,

Candidate of Medical Sciences,

Associate Professor at the Department of Physical Therapy and Occupational
Therapy of Medical Faculty

Kherson State University
14, Shevchenko str. Ivano-Frankivsk, 76018, Ukraine

Morozenko Dmytro Volodymyrovych,

Doctor of Veterinary Sciences, Senior Researcher,

Sytenko Institute of Spine and Joint Pathology National Academy of Medical
Sciences of Ukraine

80, Hryhoriia Skovorody str, Kharkiv, 61024, Ukraine