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Readaptation of functional capabilities of special unit servicemen with long-term hypodynamia caused by peripheral neuromuscular system damage

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Abstract

Purpose. To study the efficiency of readaptation of the functional capabilities of special unit servicemen with prolonged hypodynamia caused by neuromuscular system damage during long-term rehabilitation.

Material & Methods. A study was conducted on 30 special unit servicemen, aged 25±1.6 years, who required immediate readaptation of their functional capabilities caused by prolonged hypodynamia lasting 45±4.7 days. The study participants were divided into three groups (10 people in each). Members of the first group were instructed to follow standard physical therapy protocols during the initial 70-day phase of their long-term rehabilitation. Participants in the second and third groups followed experimental training models for readapting functional capabilities. The heart rate variability (HRV) method was used to assess the adaptive and compensatory responses of the special unit servicemen to stress stimuli throughout the study.

Results. All study participants showed high tension in heart rhythm regulation following the previous rehabilitation. In response to test loads, sympathetic regulation activity increased, and the central mechanism of sinus rhythm control was enhanced in special unit servicemen. The HRV indicators observed in the group of military personnel showed no changes after 70 days of following standard long-term rehabilitation protocols. In response to the test load, there was a shift in the vegetative balance towards sympathetic regulation due to the weakening of the high-frequency spectrum of the heart rhythm power. In members of the other two groups who followed experimental training models, an increase in vagal influence on the sinus node was observed. The results after the load showed a shift in autonomic balance toward parasympathetic regulation, indicating the activation of short-term adaptation processes. The most significant functional readaptation was observed in special unit servicemen who combined isolated exercises with high-intensity training under creatine phosphokinase energy supply conditions.

Conclusions. The results confirm the effectiveness of the proposed system for restoring the functional capabilities of special unit servicemen experiencing hypokinesia caused by peripheral neuromuscular system damage during long-term rehabilitation. The use of standard physical therapy protocols in long-term rehabilitation is ineffective for the readaptation of functional capabilities in special unit servicemen. The proposed mechanism, which maximally engages synergistic muscle groups while minimizing the load on injured agonists and avoiding additional stabilizer activity, enables selective muscle fatigue without disrupting adaptation. Ap-

plying this combined approach, integrating isolated exercises from power fitness and MMA, effectively enhances the readaptation of special unit servicemen during long-term rehabilitation.

Keywords: special unit servicemen, readaptation, long-term rehabilitation, hypokinesia, heart rhythm regulation.

Introduction

The ongoing pursuit of effective mechanisms to enhance the physical rehabilitation system for military personnel necessitates an in-depth, comprehensive study of this issue by scientists (Biggs et al., 2019; Conkright et al., 2020). One of the least explored, yet highly relevant areas, is the study of the readaptation of functional capabilities in special unit servicemen after prolonged hypodynamia. This issue is particularly pressing in long-term rehabilitation due to the varying degrees of damage to the peripheral components of the neuromuscular system. The practical application of this issue causes the development of an innovative method for restoring the body's adaptive reserves following the completion of rehabilitation phases (acute and post-acute) (Klymovych et al., 2020; Miyatsu et al., 2023; Uphill et al., 2025). The absence of an adequate level of exercise during prolonged hypodynamia in this rehabilitation results in pronounced hypokinesia (Chernozub et al., 2024; Potop et al., 2024). The prolonged impact of pronounced hypokinesia, particularly when exercise intensity does not match the resistance level, will lead to persistent compensatory reactions, followed by increased maladaptation (Collins et al., 2018; McFadden et al., 2024).

The effectiveness of implementing standard rehabilitation protocols for special unit servicemen, considering their previous high level of body resistance, is a highly debated issue (Gancitano et al., 2021; Vine et al., 2024). Thus, using most methods, tools, and rehabilitation training programs during the readaptation may be ineffective or worsen the situation (Salonen et al., 2019). This problem can be solved by developing an experimental methodology based on the physiological mechanisms of selective recruitment of agonist, synergist, and stabilizer muscles (Potop et al., 2023). The proposed mechanism is especially relevant when performing isolated exercises, considering the initial hypokinesia and the condition of the neuromuscular system (Olkhovyi et al., 2016). Load regimes, energy supply mechanisms, and the kinematic characteristics of the exercise technique are important factors in adjusting the stress stimulus during the readaptation of military personnel (Chernozub et al., 2023). Optimizing the integrated system for controlling the readaptation processes of special unit servicemen with hypokinesia is a vital component of long-term rehabilitation. The development of a system for the readaptation of functional capabilities in special unit servicemen following neuromuscular system damage remains one of the unresolved challenges in rehabilitation.

Purpose of the Study. To explore the efficiency of readaptation of the functional capabilities of special unit servicemen after prolonged hypodynamia caused by neuromuscular system damage during long-term rehabilitation.

Materials and Methods

Participants

The study involved 30 special unit servicemen aged 25±1.6 years, who needed prompt readaptation of functional capabilities after prolonged hypodynamia (45±4,7 days). Previously, the examined servicemen who had neuromuscular system damage due to mine-explosive injuries used standard medical protocols during the acute and post-acute rehabilitation periods. Random sampling divided the study participants into three groups (10 people in each group). Using this sampling method is justified by the high level of resistance, which all examined military personnel had before injuries. The studies were conducted in 2024 based on the Research Center of Modern Kinesiology "KINEZUS" and its branches (Odesa and Mykolaiv, Ukraine). The ethics committee of Lesya Ukrainka Volyn National University approved the study design. After explaining the risks and benefits of the study, the participants signed an informed consent form prepared following the ethical standards of the Declaration of Helsinki.

Measurements

Heart rate variability (HRV)

A Polar V800 heart rate monitor (Polar Electro Oy, Kempele, Finland) was used to measure RR intervals. Heart rate and raw RR intervals were recorded using a sensor mounted on a chest strap (H10, Polar Electro Oy, Finland). The Polar Flow web service was used to download RR interval data to a computer. Kubios HRV Standard 3.5.0 software (University of Eastern Finland) calculated HRV parameters in the time and frequency domains. The most informative indicator for short-term analysis from the time domain was selected as the standard deviation of RR intervals (SDNN, ms). Fast Fourier transform was selected for spectral analysis in the frequency domain. During the

analysis of HRV power spectral characteristics, the following frequency ranges were identified: low-frequency (LF, %), very-low-frequency (VLF, %), and high-frequency (HF, %). The LF/HF ratio was determined as an indicator of autonomic balance. The RR interval signals were recorded in the subjects seated at rest, before (baseline) and after acute physical exertion. To standardize HRV studies with short recordings, an optimal recording duration was 5 minutes. The temperature was 22–24°C.

Research Design

The research was conducted in several stages during 2024.

In the first stage, the medical records of special unit servicemen were analyzed. These servicemen participated in the study after completing the acute and post-acute rehabilitation periods (60–75 days). The protocols were assessed for the effective implementation of standard physical rehabilitation programs during each rehabilitation period. The protocols of biochemical blood tests conducted in medical institutions during this period were also analyzed. The obtained results enabled an assessment of the adaptive body changes in the examined servicemen during the acute and post-acute rehabilitation periods. After analyzing the data provided by medical institution representatives and the research findings (Miyatsu et al., 2023; Uphill et al., 2025), the key issues in the rehabilitation system across different periods were identified. One of the ways to solve this problem is to develop a system for readapting the functional capabilities of special unit servicemen after prolonged hypodynamia. This system is important for military personnel experiencing hypokinesia due to damage to the peripheral parts of the neuromuscular system during long-term rehabilitation.

In the second stage, the heart rhythm regulation tension was determined using the spectral characteristics of HRV in the examined groups of servicemen at rest (before exercise). To assess the functional body capabilities at the beginning of the study, a test load was developed to evaluate the nature of adaptive and compensatory reactions to a stressful stimulus. During the test load, four isolated auxiliary exercises were employed to target muscle groups that act as synergists for those requiring readaptation. The intensity of the external stimulus, or resistance to external stimulus, was set at 65-70% of 1 RM. Exercises are performed with partial amplitude, moderate pace (2/2), and minimal involvement of muscle groups of body position stabilizers. The number of repetitions in these conditions should not exceed 8-10 until the active muscle groups of synergists are fully fatigued. The creatine phosphokinase energy supply mechanism and the onset of anaerobic glycolysis were used to conduct the training. Rest intervals between test exercises were within 50-60 seconds.

The characteristics of changes in spectral heart rate indicators during the performance of the developed test task were examined. A comparative analysis of the studied indicators at rest before and after exercise was carried out. Based on the study results, two experimental models of functional readaptation classes for special unit servicemen were created for long-term rehabilitation. Representatives of the first group were offered standard protocols in physical therapy during the first period (70 days) of long-term rehabilitation. The participants in the second group followed experimental class model 1 for functional readaptation. The servicemen in the third group were instructed to use experimental model 2 during the long-term rehabilitation.

In the third stage, we examined the impact of standard physical therapy protocols for long-term rehabilitation and the experimental class models on the functional readaptation of the participants. The control over the functional readaptation of the participants using the proposed class models was conducted in two stages: at the beginning and the end of the 70-day readaptation period. The dynamics of spectral HRV indicators in the participants of the examined groups at rest and in response to an acute test load were studied. The results were processed.

Statistical Analysis

The study results were statistically analyzed using the IBM SPSS*Statistics 26 software package (StatSoftInc., USA). The G-Power 3.1.96 program (Germany) was used to determine the minimum sample size for the study through statistical power calculation. Nonparametric statistical analysis methods were used to calculate the median (Me) and interquartile range (IQR). The Mann-Whitney U test was applied to compare the initial parameters among the three groups of examined servicemen. The Wilcoxon T-test was used to compare two dependent samples.

Results

Figure 1 illustrates the system designed to restore the functional abilities of special unit servicemen experiencing hypokinesia caused by peripheral neuromuscular damage during extended rehabilitation.

To develop a system for restoring servicemen's functional capabilities, the stages' characteristics and control methods were thoroughly analyzed. The study outlines the gradations of key informative markers used to evaluate both the short-term and long-term adaptation of participants to

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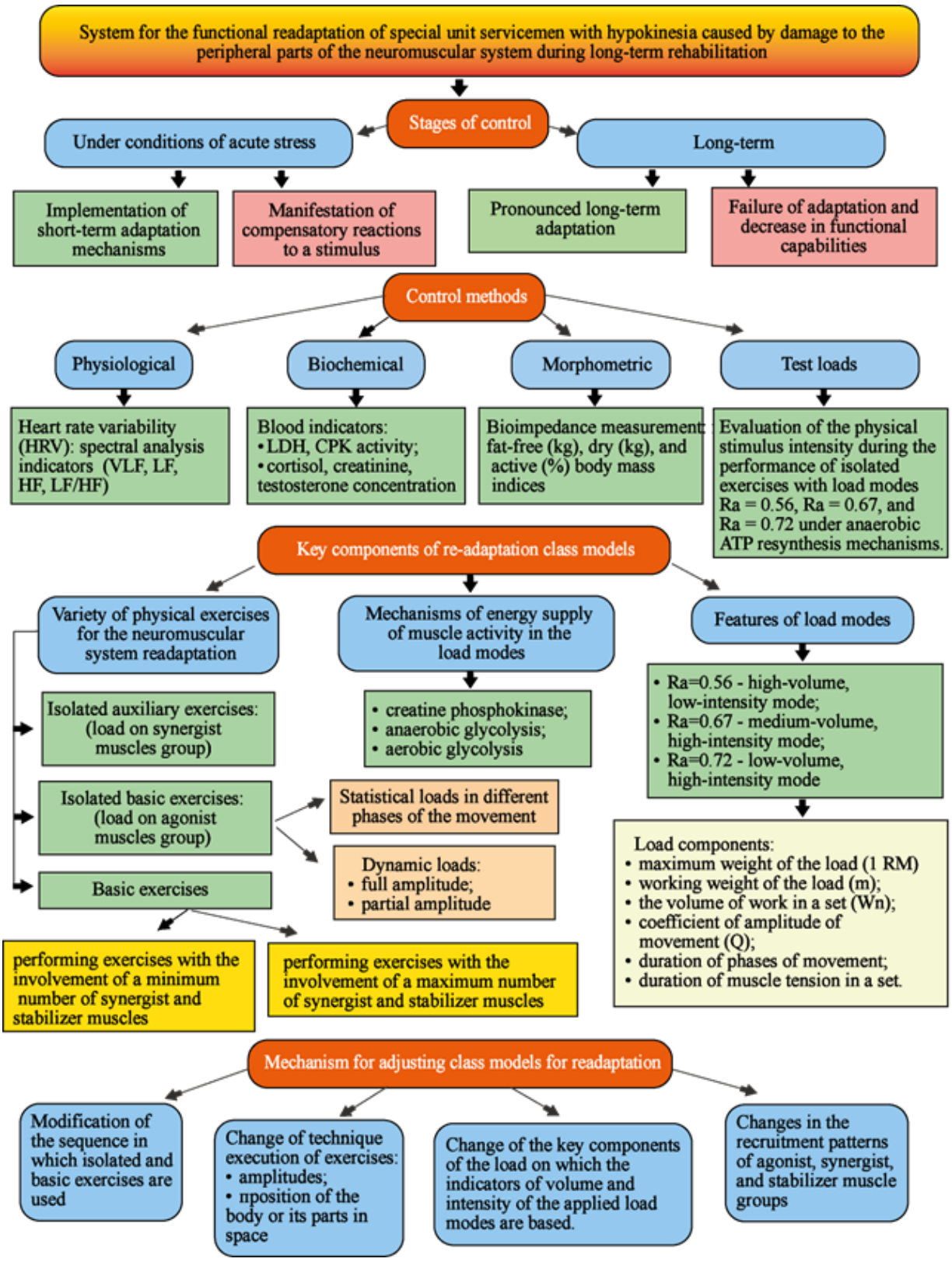

Fig. 1. System for the functional readaptation of special unit servicemen with hypokinesia caused by damage to the peripheral parts of the neuromuscular system during long-term rehabilitation.

a stressful stimulus. A scientifically substantiated integral mechanism for combining physiological, biochemical, and morphometric control methods is proposed. The mechanism will allow for determining the dynamics of functional capabilities during readaptation. The developed test tasks enable the design of an appropriate stressful stimulus based on the individual functional capabilities and the condition of the examined person's neuromuscular system. The effective development

Table 1. Experimental class models for functional readaptation proposed for special unit servicemen during long-term rehabilitation

Class model 1	Class model 2
Features of physical exercises	
Mainly basic power fitness exercises are used with the simultaneous involvement of agonist, synergist, and stabilizer muscle groups: – free-weight exercises: the load correction is carried out by altering the body position and shifting the center of gravity, which affects the number of muscle groups engaged simultaneously; – exercises with dumbbells: load correction is achieved by modifying the technique (movement amplitude, pace), the duration of muscle activity, and the number of stabilizer muscle groups involved, which results from changes in the position of body parts in space; – exercises involving resistance from another person: load correction is achieved by increasing the partner's muscle efforts, altering the biomechanics of movements, and reducing the activation of stabilizer muscle groups.	Isolated exercises (auxiliary and basic) are used to consistently involve mainly synergist, stabilizer, and partially agonist muscle groups: – a combined set of special isolated exercises (exercises involving resistance from another person, machine exercises) of power fitness and MMA for readaptation of affected muscle groups; – an algorithm for using auxiliary isolated exercises (with resistance from another person) for premature fatigue of stabilizer muscles and partly synergists; – a set of isolated machine exercises designed to load agonist muscles following prior fatigue of synergist muscles; – isolated exercises (with resistance from another person) resembling technical elements of MMA, aimed at loading agonist muscles after prior fatigue of synergist muscles.
Features of load modes	
A high-volume, low-intensity training load regime (R_a=0.56) is used; in some cases, a medium-volume, low-intensity regime (R_a=0.67) is used.	A low-volume, high-intensity training load regime is used (R_a=0.72).
Mechanisms of energy supply for muscle activity	
Under the specified training load conditions, anaerobic glycolysis mechanisms were activated. Muscle glycogen is the main energy source for ATP resynthesis.	Under this training load regime, the creatine phosphokinase energy supply mechanism is used. Creatine phosphate is the main energy source for ATP resynthesis.
Periodization of loads	
Load parameters vary within 55-68% of 1 RM. The number of repetitions in a set is within 7-8 to 10-12 in most cases. The total number of exercises in a set is 8-10. The set duration is about 60-70 minutes. Rest intervals between a series of sets are 48 hours. The main assessment criterion is quantitative indicators within the specified limits of 1 RM.	Load parameters vary within 70-75% of 1 RM. The number of repetitions in a set is within 5-6 until the working muscle groups fatigue. The total number of exercises in a set is 8-10. The set duration is about 35-40 minutes. Rest intervals between a series of sets are 24 hours. The main evaluation criterion is the magnitude of the stimulus (% of 1 RM).

and adjustment of a stressful stimulus rely on the use of various load mode combinations along with different energy supply mechanisms for muscular activity.

An important aspect of long-term rehabilitation is the selection of key components while developing re-adaptation exercise models. We proposed a non-standard variation of exercise model components compared to conventional physical therapy protocols due to hypokinesia caused by peripheral neuromuscular damage in servicemen. One component is a peculiar variety of using isolated (subtractive and basic), basic strength exercises, and special exercises for this category of military men. Creating individualized exercise combinations and a prioritized engagement algorithm directly influences the pace of re-adaptation processes. This algorithm is based on neuromuscular damage and the involvement of synergists, agonists, or stabilizer muscle groups. An important structural component in this process is a clear understanding of the necessity to apply an appropriate load regime based on the conditions and the body's adaptive reserves. Considering the ability to effectively apply load regimes of varying volumes and intensities under both anaerobic and aerobic energy supply mechanisms is essential.

Developing an optimal mechanism for adjusting class models to restore the functional capabilities of servicemen with prolonged hypodynamia requires processing much physiological and biochemical data collected during rehabilitation. The effectiveness of the correction process relies on the timely adjustment of the variability in using isolated or basic exercises to prioritize the activation of the relevant muscle groups. Modifying the kinematic characteristics of performing technique and load parameters effectively impacts the en-

ergy supply system.

Table 1 presents experimental models of classes for functional readaptation offered to servicemen of special units with prolonged hypodynamia caused by damage to the neuromuscular system.

Each experimental class model for functional readaptation is based on key components. These components include a series of physical exercises, load regimes, mechanisms of muscle activity energy supply, and load periodization.

A comparative analysis of the sets of physical exercises used in the presented models reveals a notable difference. Model 1 contains mainly basic power fitness free-weight exercises, exercises with dumbbells, and exercises involving resistance from another person. The key feature of implementing such exercises is the simultaneous activation of muscle groups of agonists, synergists, and stabilizers. This strategy enables the execution of the exercise even with only a 30% recovery of the agonists after prior rehabilitation periods, thanks to the increased activity of the synergists and stabilizers (Potop et al., 2023). However, prolonged use of only basic exercises in rehabilitation will lead to hypertrophy of mainly synergist and stabilizer muscle groups (Chernozub et al., 2023). These changes will only complicate the readaptation of damaged agonist muscle groups by reducing their activity during loads. Model 2 offers the option of using isolated exercises to sequentially engage primarily synergist, stabilizer, and partially agonist muscle groups, which may address this issue. Specifically, implementing a combined set of special isolated strength fitness exercises and MMA is crucial for the readaptation of damaged muscle groups in special unit servicemen.

The effectiveness of applying the developed exercise sets for each experimental class model relies on the balance between the combination of load modes and energy supply mechanisms. Under the conditions of using basic exercises, it was suggested to apply a high-volume, low-intensity load mode within anaerobic glycolysis conditions. This combination was chosen due to the low level of adaptation reserves in the study participants and their limited resistance to stress stimuli. It was assumed that performing isolated exercises with a low-volume, high-intensity load mode, under the creatine phosphokinase energy supply mechanism, would positively impact the readaptation processes. Considering the specific features of the developed training class models for the readaptation of servicemen's functional capabilities, classic power fitness options for load periodization were proposed.

Figures 2 and 3 visually display changes in the spectral indicators of heart rate in the participants of the examined groups using the proposed training models for readapting functional capabilities. The 70-day study was conducted during the long-term rehabilitation of special unit servicemen following prolonged physical hypodynamia caused by damage to the neuromuscular system.

An analysis of the results shown in Figure 2 indicates that the initial spectral indicators (LF and HF) of the participants did not reveal any intergroup differences. This suggests that the servicemen in the examined groups had an identical initial heart rhythm regulation tension at rest. However, in response to the test load, a reduction in the influence of autonomic regulation was observed in participants across all three groups, with HF decreasing by an average of 7.8%. At the same time, a decrease in sympathetic tone was also observed in examined group 2, with LF decreasing by 9.9% in response to the stressful stimulus. In the servicemen of group 1, an increase in the low-frequency spectrum of the heart rhythm power (LF +3.1%) was detected after the test load.

The results obtained after 70 days of using the proposed class models for readapting functional capabilities during long-term rehabilitation revealed the following findings. In a resting state, the heart rhythm regulation tension in group 1 remained unchanged after using standard training protocols in rehabilitation. At the same time, an increase in the activation of the parasympathetic branch of the autonomic nervous system was observed in servicemen of groups 2 (HF +9.4%) and 3 (HF +23.3%). A decrease in sympathetic tone was observed after an extended period of using the experimental models, with representatives of group 2 showing a reduction of LF by 4.1% and group 3 – by 15.7%. This finding indicates an increase in vagal influence on the sinus node during the readaptation of functional capabilities, particularly among group 3.

The results of the spectral indices LF and HF obtained at the end of the study, in response to the test load, showed opposing changes. Servicemen in group 1 increased their sympathetic tone (LF +4.7%) in response to the test load, while the influence of autonomic regulation decreased (HF -7.6%). Representatives of the other two groups showed different changes in the studied HRV indices in response to the stressful stimulus. An increase in parasympathetic activity was observed in the participants of groups 2 (HF +13.7%) and 3 (HF +10.2%). A decrease in sympathetic tone after exercise was noted in representatives of groups 2 (LF -11.5%) and 3 (LF -14.2%).

Analysis of the results presented in Figure 3 shows that initial vegetative balance in representatives of all groups shifted towards sympathetic regulation. The obtained results indicate high tension in heart rate regulation at rest, which may

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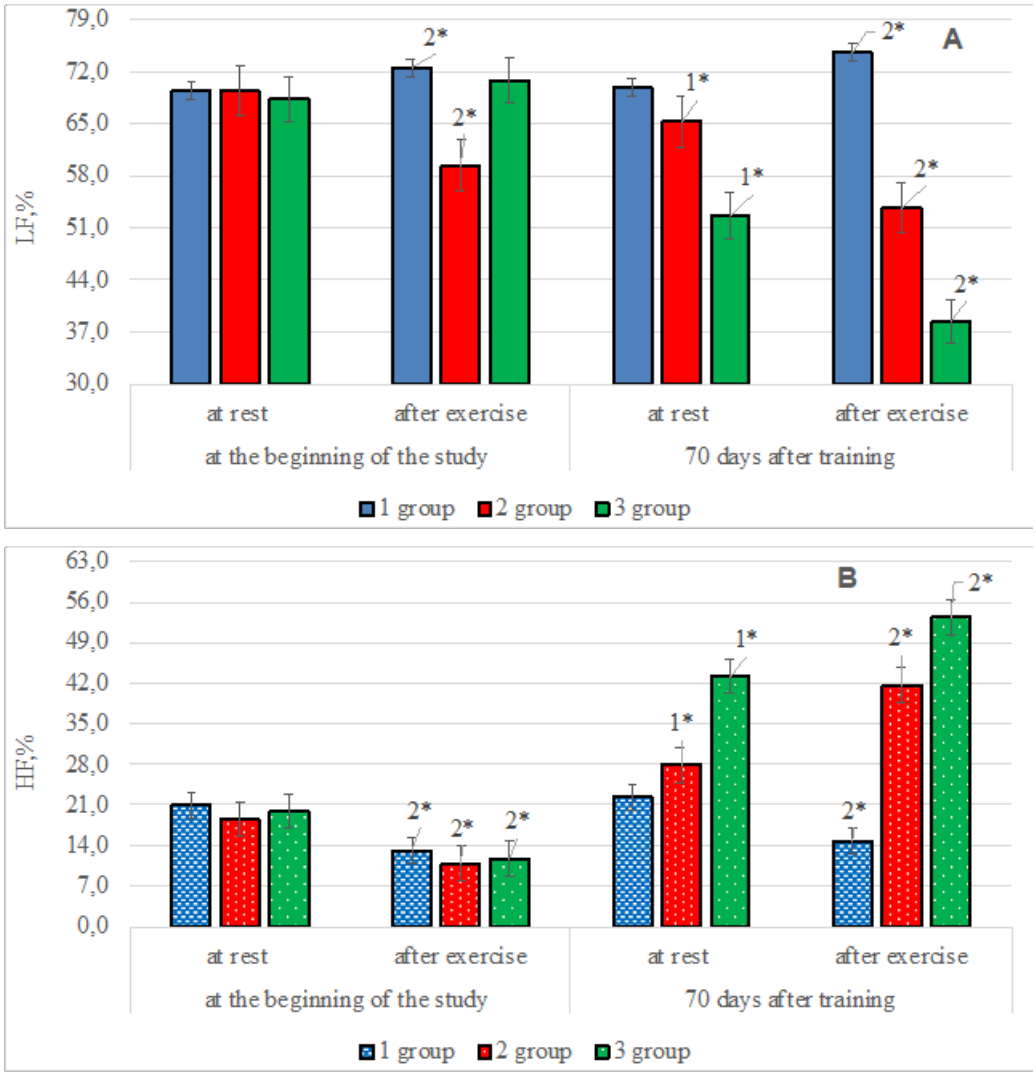

Fig. 2. Results of changes in spectral heart rate indices LF (A) and HF (B) of the examined servicemen during long-term rehabilitation in response to test loads, n=30.

Note: 1 – p<0.05 compared to the indices at the beginning of the study in a state of rest; 2* – p<0.05 compared to the indices before the load.*

be a consequence of prolonged hypodynamia. In response to the test load, an increase in the LF/HF index parameters was observed among participants in all groups, indicating the activation of the humoral and sympathetic regulatory mechanisms (Korobeinikova et al., 2024). Group 2 servicemen showed the greatest increase in the central circuit of sinus rhythm regulation (VLF +17.6%) to a stressful stimulus.

After using the proposed models of re-adaptation exercises there was a varied change in the indicators of vegetative balance and the activity of the central circuit. The initial (at rest) parameters of the HRV indicators in group 1 servicemen did not change after 70 days of using standard rehabilitation protocols. The vegetative balance (LF/HF) decreased in servicemen of group 2 (-37.7%) and 3 (-64.5%). These changes indicate a balance between the mechanisms of vagal and sympathetic tone during the re-adaptation of functional capabilities, particularly in representatives of group 3. After using the proposed class models during rehabilitation, group 1 servicemen had the highest level of tension in heart rhythm regulation.

At the end of the study, group 1 servicemen shifted the autonomic balance towards sympathetic regulation in response to the test load. Representatives of this group also showed an increase in the central circuit of sinus rhythm regulation (VLF +2.9%) in response to the stimulus. In servicemen of the other two groups, a shift in the autonomic balance towards parasympathetic regulation was observed in response to the test load. The most pronounced implementation of short-term adaptation and an increase in the level of resistance to loads was recorded in servicemen of group 3.

Discussion

The results presented in this study highlight

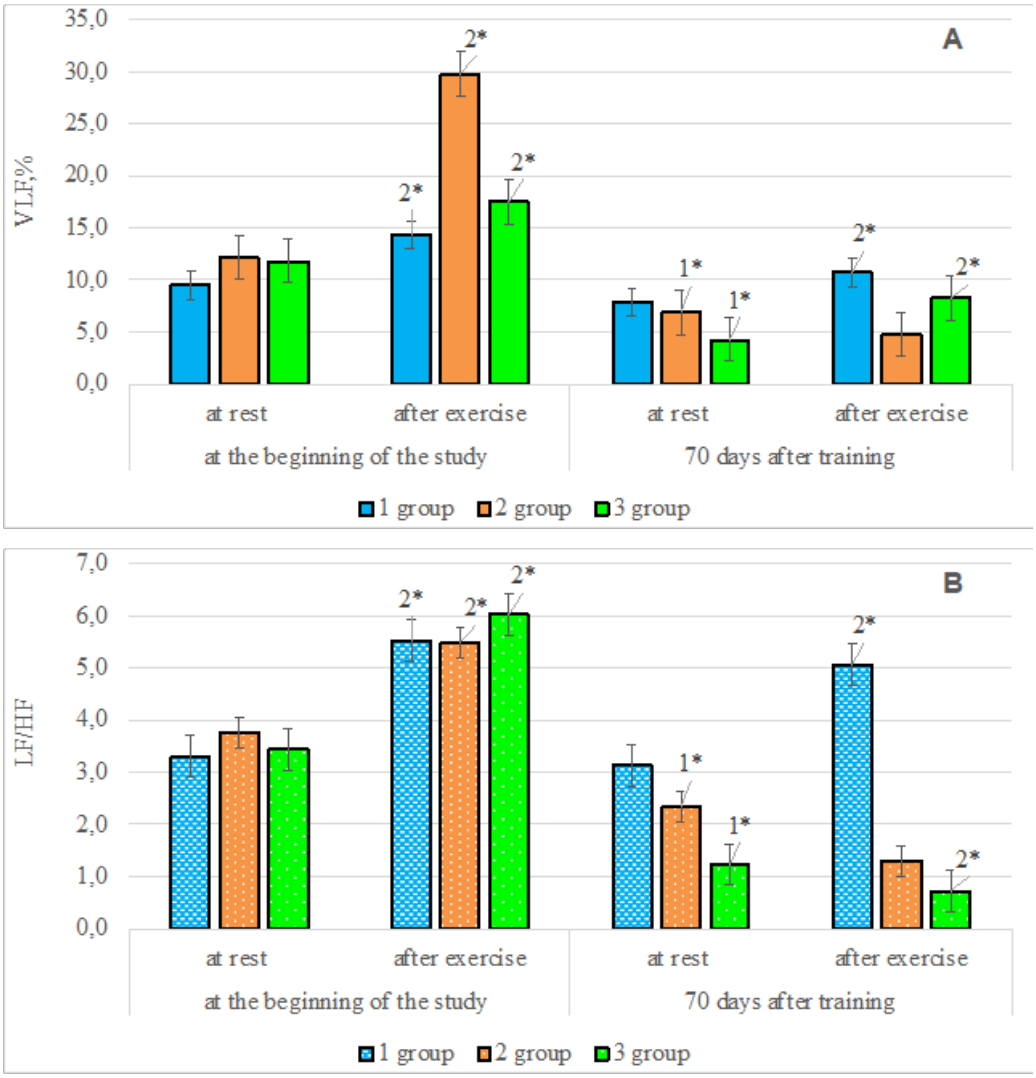

Fig. 3. Results of changes in spectral heart rate indices VLF (A) and LF/HF (B) of the examined servicemen during long-term rehabilitation in response to test loads, n=30.

Note: 1 – p<0.05 compared to the indices at the beginning of the study at rest; 2* – p<0.05 compared to the indices before the load.*

one possible solution to the problem of readaptation for servicemen who sustained neuromuscular system damage due to mine-explosive injuries. We examined the mechanisms of readaptation of functional capabilities during long-term rehabilitation, with the primary challenge being the development of hypokinesia resulting from prolonged hypodynamia (Chernozub et al., 2024; Uphill et al., 2025). A system for the readaptation of functional capabilities in special unit servicemen with hypokinesia, caused by damage to the peripheral parts of the neuromuscular system during long-term rehabilitation, was developed. A key issue in the research was determining the optimal class models for readaptation, considering the high previous level of resistance to loads in special unit servicemen. There is a lack of scientific studies evaluating the effectiveness of standard physical therapy protocols during the long-term rehabilitation of this category of servicemen (Collins et al., 2018; McFadden et al., 2024). Most scientists (Gancitano et al., 2021; Vine et al., 2024) in physical rehabilitation primarily focus on studying issues related to enhancing recovery processes during the acute period. At the same time, ongoing debates among scientists persist regarding the effectiveness of most physical rehabilitation protocols and the existing mechanisms for their adjustment (McFadden et al., 2024). The key issue is identifying informative indicators in rehabilitation to assess the effectiveness of readaptation of functional capabilities, particularly in special unit servicemen (Collins et al., 2018, Olkhovyi et al., 2020).

The results indicate that using standard physical therapy protocols during the long-term rehabilitation of military personnel is ineffective in the readaptation of functional capabilities. Despite their high resistance level, special unit servicemen lack the repeated restoration of adaptive re-

serves. However, using experimental class models during this rehabilitation helps balance the vagal and sympathetic tone mechanisms. The level of resistance to loads increased, indicating the effectiveness of readaptation of functional capabilities following prolonged hypodynamia (Chernozub et al., 2023). The results introduce a new approach for implementing the readaptation system for special unit servicemen, focusing primarily on functional capabilities during long-term rehabilitation. The identified data will improve the control system for restoring adaptive reserves in this contingent during long-term rehabilitation using the HRV method.

All study participants exhibited high tension in heart rhythm regulation following the previous rehabilitation periods. In response to the test loads, sympathetic regulation activity increased, and the central mechanism of sinus rhythm regulation was strengthened in special unit servicemen. These changes suggest the manifestation of compensatory reactions and low body resistance to stressful stimuli (Potop et al., 2024). This indicates low body adaptive reserves in special unit servicemen, negatively impacting the effectiveness of using functional capabilities under necessary conditions (Biggs et al., 2019; Conkright et al., 2020). The issue arises from the fact that, in developing training protocols, physical therapy specialists primarily focus on creating combinations of physical exercises (Gancitano et al., 2021; Korobeinikova et al., 2024). However, this category of researchers tends to overlook the optimization of load regimes in combination with energy supply mechanisms, depending on the level of adaptive reserves.

The HRV indicators studied in the group of servicemen after 70 days of using standard protocols during long-term rehabilitation showed no change. In response to the test load, the vegetative balance shifted towards sympathetic regulation, indicated by the weakening of the high-frequency spectrum of heart rhythm power. These HRV changes during long-term rehabilitation lack readaptation of functional capabilities in special unit servicemen (Vine et al., 2024). The vagal influence on the sinus node was enhanced in the other two groups that used experimental training models. The results after the test load show a shift in the vegetative balance towards parasympathetic regulation, indicating the activation of short-term adaptation processes (Chernozub et al., 2024). The most pronounced readaptation of functional capabilities was observed in the group of servicemen who used isolated exercises combined with high-intensity loads under creatine phosphokinase energy supply. Sequential engaging muscle groups of synergists, stabilizers, and partial agonists in isolated exercises enables selective muscle fatigue without disrupting adaptation (Uphill et al., 2025). These actions focus on maximizing the involvement of synergist muscle groups with minimal load on damaged agonists, without engaging stabilizers. The long-term implementation of such a mechanism in readaptation will enhance adaptive reserves and promote selective hypertrophy of damaged muscle groups (Potop et al., 2023). Combining isolated strength exercises with special MMA exercises is crucial during the long-term rehabilitation of special unit servicemen.

Conclusions

The results confirm the efficiency of the proposed system for restoring the functional capabilities of special unit servicemen experiencing hypokinesia caused by peripheral neuromuscular system damage during long-term rehabilitation. The use of standard physical therapy protocols during long-term rehabilitation of servicemen of this category is ineffective in the readaptation of functional capabilities. The study showed that combining isolated exercises with high-intensity loads under creatine phosphokinase energy supply was effective. The proposed mechanism, which maximizes the involvement of synergist muscle groups with minimal load on damaged agonists and no additional activity of stabilizers, enabled selective muscle fatigue without disrupting adaptation. Implementing this combined mechanism of isolated fitness and MMA exercises effectively influences the readaptation processes of special forces servicemen during long-term rehabilitation. The results obtained will help address the challenge of finding an effective rehabilitation mechanism for servicemen who sustained neuromuscular system damage from mine and explosive injuries.

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