# Preserving the functional asymmetry of the muscular system in young hockey players through compensatory exercises

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PhD, Associate Professor **A.O. Mironov**[1]
Dr. Hab., Associate Professor **E.A. Spiridonov**[1]
PhD **S.A. Khutin**[1]
Dr. Hab., Associate Professor **O.E. Ponimasov**[1,2]
[1]The Russian Presidential Academy of National Economy and Public Administration, Moscow
[2]The Herzen State Pedagogical University of Russia, St. Petersburg

Corresponding author: miron1964@yandex.ru

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**Abstract**

**Objective of the study** was to assessment of the interplay between the integration of remedial exercises into training and the outcomes of specific assessments for young hockey players.

**Methods and structure of the study.** The participants in the research were young hockey players aged between 13 and 14. The hockey players underwent a series of training and evaluation throughout the course of a single season. The players engaged in a 45-minute twice-weekly training regimen that included exercises designed to strengthen the core muscles, enhance flexibility, and improve joint mobility.

**Results and conclusions.** Corrective exercises can mitigate the adverse consequences of unilateral exercises and decrease the likelihood of overexertion for the athlete. The process of corrective exercises is based on the comprehensive improvement of joint flexibility and mobility, as well as the ability to move in different directions while skating and using a stick and puck.

***Keywords:*** *junior hockey players, functional symmetry, compensatory exercises.*

**Introduction.** The informative characteristics that determine the manifestation of physical qualities and the processes of adaptation to training loads include anthropometric and morphological parameters of athletes. Control of anthropometric dynamics based on systematic monitoring of physical development allows recommending the most preferable sport to beginning athletes and helps to predict sports results [1]. The systemic accentuated impact of physical exercises on individual aspects of physical potential can have a destructive effect on the functional and coordination indicators of young athletes [4, 5].

Repeated exercises performed by young hockey players unilaterally overload the musculoskeletal system, most negatively affecting the muscles of the shoulder girdle, hip, lumbar spine, and deep back muscles. Due to a decrease in elasticity and active tone of muscles that provide spatial stability and dynamic balance, muscle imbalance occurs, which entails a decrease in sports results [3]. Presumably, one of the most effective methods of comprehensive training of muscle groups are compensatory exercises that have a harmonizing effect on the physical development and balanced functioning of the kinematic links of the musculoskeletal system of young hockey players.

Objective of the study was to assessment of the interplay between the integration of remedial exercises into training and the outcomes of specific assessments for young hockey players.

**Methods and structure of the study.** The study participants were players of the youth hockey team aged 13-14 years (height – 159,8 ± 5,3 cm; weight – 50,4 ± 4,2 kg). The study participants were divided into an experimental (12 athletes) and a control group (11 athletes). Before the study, the group participants

had a homogeneous level of fitness. The homogeneity of the initial level of fitness of the athletes was statistically confirmed by preliminary testing. The control group of hockey players trained according to the standard of training of athletes approved by regulatory documents. The longitudinal study was carried out at the State Budgetary Institution of Additional Education «Moscow Hockey Academy». The study analyzed the dynamics of anthropometric indicators of young hockey players of the Sports School «White Bears». For the actual analysis of game technical and tactical indicators, systematic collection of game data was carried out in accordance with the theory and practice of sports selection and early orientation in sports [2]. Monitoring the dynamics of game techniques indicators, along with measuring the results of mastering special training tools for hockey players in the EG and CG, was carried out to maintain the versatile physical fitness of athletes, the proportionality of which was determined by the effectiveness of the implementation of hockey playing techniques.

Hockey players underwent a training and testing cycle during one game season. Compensatory exercises were performed by players for 45 minutes twice in a weekly training cycle. Pedagogical impact was provided by exercises to strengthen the muscles of the trunk, improve flexibility and mobility in the joints in order to increase the maximum amplitude of movements. Repeated testing was carried out in the final phase of the annual cycle. The effectiveness of the training work was assessed using the t-test for dependent samples at the significance level.

System requirements for the coordination of actions of young hockey players when performing compensatory exercises consisted of performing game actions in one and the other direction with a large amplitude of skating and movements, under the left and right hand of stick and puck control. The training effect of compensatory exercises was assessed by the number of speed-strength and coordination-oriented game techniques performed by young hockey players with rational use of body parts with different ranges of motion.

**Results of the study and discussion.** Testing at the end of the experiment made it possible to identify the effectiveness of the young hockey players' performance of technical and tactical techniques (see table).

The training factor causing adaptive reactions was the compensatory transformation of the functionality of training effects during a diverse physical load on various parts of the body involved in performing game techniques. According to the dispersion measure of the distributed random variable, the percentage performance was expressed by the median (50%) on the percentile scale. This parameter indicates the placement of players within the reference group. The studied indicators classified above the average team game profile can be considered indicators of a high level of preparedness of an individual player.

The transition to a higher speed and amplitude mode of operation of the biomechanical links of the body proves that as a result of the use of compensatory exercises for the purpose of additional stimulation of the working muscle groups and structural components of the joints, a new neurophysiological state of young hockey players is formed, which is manifested in an increase in the effectiveness of game techniques: throwing the puck - by 14,8%, passes to the forward - by 14,7%, dribbling with dribbling of the opponent - by 12,4%, shots on goal - by 16,5%, puck tackling - by 16,6%, power techniques of the game - by 15,1%. The predicted increase in overall flexibility and local mobility in the main joints of the body, postural dynamic balance and strength capabilities of the trunk muscles expanded the possibilities of using the tech-

*Efficiency of young hockey players' performance of technical and tactical techniques of the game, $\bar{x}\pm m$*

| Indicator | Number of effective techniques | | |
|---|---|---|---|
| | EG | CG | t |
| Throwing the puck in | 5,9±0,2 | 1,6±0,2 | 1,5 |
| Dribbling the opponent | 16,8±0,5 | 11,6±0,5 | 4,2 |
| Passing to the forward | 11,8±0,5 | 6,1±0,6 | 0,8 |
| Shots on goal | 3,8±0,5 | 1,9±0,6 | 0,5 |
| Taking the puck away | 13,9±0,4 | 1,7±0,3 | 2,1 |
| Power plays | 17,8±0,5 | 8,1±0,4 | 1,9 |

nique of holding the stick with both hands in amplitude skating by hockey players of the experimental group when performing game techniques that require an integrated manifestation of technical coordination and mobility in the joints. Although mastering basic game techniques lays the foundation for stick and puck handling and skating techniques, due to the low variability of actions it creates prerequisites for unilateral overstrain of individual body parts and, as a consequence, contributes to the development of functional asymmetry. Subsequent attempts to master the requirements of modern hockey do not have significant success due to the dominance of the established unilateral stereotype of movements. The consistent implementation of the tasks of training mesocycles also provided for the selective selection of the structure of compensatory exercises based on the principle of complex impact on the development of game abilities, both in defense and in attack.

Activation of the functional capabilities of young hockey players was achieved due to the accumulation of a multifaceted compensatory effect with the systematic use of compensatory exercises. The resonant nature of the adaptive reactions of the athletes of the experimental group in mastering the complex coordination of a hockey player is based on the integral focus of training tools that take into account the positional location of the player when performing game actions and his ability to play on multidirectional trajectories of movement. In response to the impact of a multifaceted physical load, multidirectional adaptive reactions of the body occur, contributing to the selectively accentuated development of the skills of young hockey players in accordance with the specifics of the game, which requires a coordinated manifestation of coordination abilities and mobility in the joints. In changing conditions of the game environment, a decrease in the elasticity and active tone of the muscles that ensure spatial stability and dynamic balance is compensated for by performing work with a change in the usual limbs, a change in the direction of movement, the sides of the site, the vector of attack of the opponent's goal. The ability to change the usual tempo and rhythm, formed through the development of compensatory exercises, ensured the variability of the implementation of the functional and coordination components of the hockey players' athletic skills.

**Conclusions.** Compensatory exercises help to smooth out the negative side effects of unilateral exercises performed by hockey players, as well as reduce the risk of overloading the athlete's body. Evaluation of the effectiveness of individual and group game techniques is the basis for designing exercises that include compensatory, stabilizing and strengthening options for special exercises. The mechanism of action of compensatory exercises is based on the comprehensive development of flexibility and mobility in the joints, skating and handling of the stick and puck in various directions and for any hand.

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