Polyfunctionality of hydrogenic locomotion as motor substrates of applied swimming

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Abstract

Objective of the study was to develop and substantiate a technological and pedagogical model for improving the applied swimming skills of rescue technicians in the water area by replacing hydrogen locomotion.

Methods and structure of the study. At the first stage, technical elements preferred for replacement were identified. The integral expert assessment of the effectiveness of locomotor movements was calculated using the arithmetic mean method based on the use of qualimetry algorithms. At the second stage, the productivity of using replacement exercises with the participation of rescue technicians in the water area at the age of 32.5±0.5 years was assessed.

Results and conclusions. New possibilities for programming neuromuscular structures that ensure the functional implementation of hydrogenic locomotion in existing swimming combinations were achieved by generating a higher power regime for strokes; structural-kinetic coupling of rowing movements with the performance of the respiratory function during swimming; reducing hydrodynamic resistance forces; maintaining a stable body position in the water. The effectiveness of the replacement impact model is due to the structural and functional modification of the training of rescue service specialists in water areas, achieved through the use of transformative and integrating exercises.

Keywords: *hydrogen locomotion, rescue techniques, water-supported strokes, economization of equipment, replacement exercises.*

Introduction. The concept of hydrogenic locomotion is associated with the elementary movements of a person, ensuring his retention on the surface of the water in an active way, movement in the aquatic environment and the implementation of various professional functions in water-environmental conditions [1, 4]. As a rule, the formation of such actions occurs spontaneously under the influence of external circumstances that are not related to the purposeful pedagogical process of teaching sports methods of swimming. Failure to comply with pedagogical principles leads to unpredictability of learning outcomes [5].

Direct contact with the aquatic environment determines the water-environmental essence and genesis of the origin of hydrogenic locomotion. The structure of emerging technical actions, as a rule, manifests itself in individual motor reactions to the properties of water and is characterized by a high energy cost of movements [2, 3, 7].

The didactic process of teaching applied swimming, based on the replacement of hydrogenic locomotion, includes the study of systemic connections of the elements of the structure of technical swimming; selecting the locomotion to be converted based on locomotor weight coefficients; synthesis of operational accents of programming a technical element; integration of the transformed element into the structure of the technical swimming combination [6].

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were identified. The criterion indicator of the contribution of hydrogenic locomotion to swimming productivity is the value of locomotor weight, calculated as the arithmetic mean of the significance coefficients of individual kinematic characteristics. The integral expert assessment of the effectiveness of locomotor movements was calculated using the arithmetic mean method based on the use of qualimetry algorithms.

The diagnostic process of parametric assessment of locomotor weight included two stages of sequential diagnostic actions.

Stage I. Assessment of individual characteristics of locomotion: measurement of the values of quantitative indicators; selection within the optimal boundaries of quantitative indicators that are informative for assessing locomotor weight; calculation of significance coefficients of quantitative indicators; selection within the optimal boundaries of quality indicators that are informative for assessing locomotor weight; justification of scales for measuring quality indicators; calculation of coefficients of significance of qualitative indicators; translation of numerical values into points in accordance with the scales used.

Stage II. Final assessment of locomotor weight: choosing a method for combining points into an integral assessment of locomotor weight; calculation of the integral assessment of locomotor weight; studying the calculated values and justifying the decision to replace locomotion.

According to the data obtained, a didactic model for the replacement of ineffective elements has been developed, reflecting the multifunctional orientation of hydrogenic locomotion.

At the second stage of the study, the productivity of using replacement exercises of a transformative and integrating nature was assessed with the participation of two study groups of rescue technicians in the water area at the age of 32.5 ± 0.5 years - experimental (EG) and control (CG). The structure of the content of the study includes 20 lessons focused on the multifunctional development of hydrogen skills.

Based on the predicted result, the structure of the experimental model of training rescuers for actions in natural waters includes three levels of mastering the content functionality: mastering special technical exercises on land; transformation of irrational hydrogen locomotion into technical elements that effectively ensure the performance of supporting and locomotor functions; formation of specialized skills for rescuing human and material resources in conditions of hydrogen disasters. The accentuated phase of the load ensured the manifestation of connections between the development of rational stroke movements, the duration of flotation on the surface of the water, orientation

Table 1. *Empirical combinations of hydrogen locomotion of rescuers*

Description	Conditional name	Empirical variations in the combination of locomotion
Hand movements		
Simultaneous downward strokes with arms	P_1	
Simultaneous frequent hand strokes	P_2	
Simultaneous wide strokes with arms to the sides	P_3	P_1-H_1; P_1-H_2; P_1-H_4
Simultaneous hand strokes to the sides - downwards	P_4	P_2-H_1; P_2-H_2; P_2-H_4
Variable hand strokes without lifting out of the water	P_5	P_3-H_1; P_3-H_2; P_3-H_3; P_3- H_4
Alternating hand strokes, carrying them above the water, head in a position above the water	P_6	P_4-H_1; P_4-H_2; P_4-H_3; P_4-H_4
Alternating hand strokes, taking them out of the water, head in the water	P_7	P_5-H_4
Leg movements		P_6-H_4
Synchronized leg strokes with the outside of the foot	H_1	P_7-H_3; P_7-H_4
Synchronized foot strokes with sole	H_2	
Multidirectional leg stroke	H_3	
Alternating kicks in a vertical plane	H_4	

in natural waters while afloat, crossing water and wetlands by swimming and using the skills of diving while holding the breath.

The nature of adaptive reactions in mastering the hydrogen functionality of movements was assessed based on the results of performing verification tests of professional readiness.

The participants in the experiment, who made up the CG, were trained in swimming according to the training program for lifeguards in the water area.

Results of the study and discussion. Empirically, 18 combined combinations of hydrogenic locomotion were identified, representing an independent method of swimming. Locomotor movements were conventionally marked as follows: P – locomotion performed by the upper limbs; H – locomotion performed by the lower limbs with the designation of a serial number in the assignment sequence.

Table 1 presents the labeling of empirical combinations of hydrogen locomotion in the practice of applied swimming.

The directions for improving irrational technical actions were:

– synchronization of the breathing function with the swimmer's locomotor movements;

– technical economization of movements performed in order to create propulsive forces in conditions of dynamic swimming;

– reducing the overall hydrodynamic resistance, maintaining horizontal streamlining of the body in water;

– optimization of the coordination structure of the hydrogenic functional.

New possibilities for programming neuromuscular structures that ensure the functional implementation of hydrogenic locomotion in existing swimming combinations were achieved by generating a higher power regime for strokes; structural-kinetic coupling of rowing movements with the performance of the respiratory function during swimming; reducing the forces of frontal, wave and vortex resistance; maintaining a stable body position in the water.

The phenomenality of phase transitions to the optimization of hydrodynamic characteristics when using substituting means of transformative and integrating orientation indicates the resonant nature of structural and functional rearrangements that form a fundamentally new structure of locomotor movements in swimming and performing special rescue actions in water areas (Table 2).

When performing the exercise of staying afloat for a long time using water-supported strokes, the greatest intergroup differences were recorded. According to the data obtained, accentuated training in water-supported strokes stimulates reserve capabilities in the duration of staying afloat in uniform.

It is obvious that synchronizing rational breathing with locomotor movements in the swimming cycle increases the efficiency of managing the current and cumulative effects of technical economization of the work of body parts involved in the creation of propulsive forces of dynamic swimming. This is evidenced by the increase in the length of the distance in swimming with rescue equipment.

The concept of the optimization factor of the technical and functional structure of swimming methods has identified several vectors of transformation of the hydrogenic functional, ensuring the study, transformation, integration and coordination of elements of the rescuers' swimming technique. In the structure of the factor, the emphasis is placed on the specific extraordinary nature of the pedagogical impact on the irrational structures of hydrogenic locomotion of students. Structural and functional modulation of individual elements and their integration into a holistic stereotype of swimming techniques ensured the complexity of the application of swimming and diving skills with orientation on the water surface.

Conclusions. The pedagogical meaning of the method of replacing hydrogen locomotion is revealed in the systematic transformation of swimming movements without violating the existing dynamic stereotype of swimming.

Table 2. *Test results based on training results*

Index	EG	CG	t	p
Duration of staying afloat in uniform (min)	25,7±4,3	18,3±0,4	2,4	< 0,05
Swimming with rescue equipment to maximum distance (m)	185,7±3,8	177,5±3,6	2,7	< 0,05
Swimming underwater after jumping from a tower while holding your breath, (m)	13,7±0,7	8,4±0,5	3,7	< 0,05
Deviation in a complex exercise in swimming and diving 50 m in a given direction (m)	2,8±0,3	5,6±0,5	4,8	< 0,05

The effectiveness of the replacement impact model is due to the structural and functional modification of the training of rescue service specialists in water areas, achieved through the use of transformative and integrating exercises.

The representativeness of positive transformations in the hydrogenic locomotion of rescuers is expressed in the achievement of high levels of professional activity, an increase in the implementation efficiency of swimming techniques and the implementation of special techniques and actions in water environmental conditions.

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