

## THE SPATIOTEMPORAL PARAMETERS OF MOVEMENTS OF THE TOP TENNIS PLAYERS

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**Анотація.** Планування підготовки тенісистів високої кваліфікації необхідно проводити з урахуванням індивідуальних особливостей спортсменів, їхнього стилю гри. *Мета.* Оцінювання просторово-часових параметрів рухів висококваліфікованих спортсменів у сучасному тенісі. *Методи.* Теоретичний аналіз і узагальнення, педагогічне спостереження, педагогічне тестування, вивчення психофізіологічних параметрів елітних тенісистів, методи математичної статистики. *Результати.* Дослідження дозволило визначити модельні характеристики підготовленості тенісистів з оцінкою взаємозв'язку властивостей основних нервових процесів різної складності за сенсомоторними реакціями і виявити ймовірний зв'язок між латентними періодами простих та складних сенсомоторних реакцій, а також між латентними періодами зорово-моторної реакції вибору, функціональної рухливості і сили нервових процесів. Встановлено взаємозв'язки індивідуально-типологічних властивостей та сенсомоторних реакцій з психофізіологічними показниками тенісистів високої кваліфікації з урахуванням статевго диморфізму. Отримані дані дозволяють удосконалити систему контролю спортсменів з урахуванням їхніх індивідуальних особливостей і специфіки тактичного стилю змагальної діяльності; комплексно оцінити специфічні координаційні можливості і за допомогою цього скорегувати й індивідуалізувати тренувальний процес. Побудова модельних характеристик з урахуванням стилю змагальної діяльності й індивідуальних особливостей спортсменів дозволила виявити особливості їх підготовленості і визначити перспективи подальшого удосконалення.

**Ключові слова:** просторово-часові параметри, тенісисти високої кваліфікації, сенсомоторні реакції, статевий диморфізм.

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**Abstract.** Planning the preparation of highly skilled tennis players should be made with account for their individual characteristics and their way of playing. The objective is to evaluate the spatiotemporal parameters of highly skilled athlete motions in modern tennis. *Methods.* Theoretical analysis and generalization, pedagogical observation, pedagogical testing, study of psychophysiological parameters of elite tennis players, methods of mathematical statistics. *Results.* The study allowed to determine the model characteristics of tennis players' fitness with the evaluation of the relationship between the properties of the main nervous processes of different complexity according to sensorimotor responses and to reveal the probable association between the latent periods of simple and complex sensorimotor responses, as well as between the latent periods of visual and motor choice response, functional mobility and strength of nervous processes. The correlation of individual-typological properties and sensorimotor responses with psychophysiological indices of highly skilled tennis players with account for sexual dimorphism has been established. The findings allow to improve the system of control of athletes with account for their individual characteristics and specificity of competitive activity tactical style; comprehensively evaluate specific coordination capacities and thereby correct and individualize the training process. Designing model characteristics with account for the competitive activity style and individual peculiarities of athletes allowed to identify the features of their fitness and to determine the prospects for further improvement.

**Keywords:** spatiotemporal parameters, highly skilled tennis players, sensorimotor responses, sexual dimorphism.

**Introduction.** Modern tennis characterized by high speed, variety and unexpected change in attacking and defensive actions, the tension of tactical struggle and emotional stress. Increasing the level of special physical, technical, tactical and psychological preparedness of athletes requires the development of indicators of functional states, which require an individual approach to the study of psy-

chophysiological parameters of the athlete. In the competitive and training activities of athletes' physical abilities are manifested not in pure form, but in complex interaction [7, 8]. In specific situations, some coordination abilities play a leading role. Coordinating abilities that require the manifestation of motor reactions and spatial and temporal attitudes

are the basis of the competitive activity of top tennis players.

The strength and mobility of nerve processes, as highly genetically determined properties of the nervous system, is one of the essential factors that determines individual differences in psychophysiological features. The previous studies [1, 2, 5, 6] proved that certain mental functions of humans are dependent on the development of their properties of nerve processes.

According to the literature, individual-typological peculiarities of higher nervous activity are the natural basis for the psycho-physiological properties of the individual and, in addition to the special factors, significantly affect not only the dynamic structure of activity but also the final result of human work [3, 4].

**The purpose of the work** is to assess the spatio-temporal parameters of movements of the top male and female athletes in modern tennis.

#### Methods of research:

- Theoretical analysis and generalization.
- Pedagogical observation.
- Pedagogical testing.
- The study of psychophysiological parameters of the top tennis players.
- Methods of mathematical statistics.

**Results and discussions.** When evaluating competitive activities in tennis you must take into account the individual characteristics of athletes and the style of conducting competitive activities.

The obtained results on revealing certain parameters of spatial-temporal characteristics of tennis movements and analysis of competitive activity of leading tennis players of Ukraine and the world allowed to modify three types of models of tactical style of competitive activity of athletes-tennis players. In the research group of athletes, after determining the leading indicators, tennis players were distributed according to tactical styles of competitive activities: A – universal, B – active, C – protective (for men fig. 1 and women fig. 2).

For players of the universal style of competitive activity in tennis, there are advantages in the indi-

cators of switching attention, speed of information processing, accuracy of cross and direct filing. Athletes of the attacking style are characterized by the speed of complex visual-motor reaction, the accuracy of the reaction to the moving object, the speed of mental processes, the variation in the choice of technical and tactical actions and the accuracy of their performance, especially the filing in different directions.

Players of protective style are characterized by high values of indicators that characterize the mobility of nervous processes and change of attention. However, the players do not perform very well and steadily, in comparison bumps and volley.

Construction of modeling characteristics, taking into account the style of competitive activity and individual characteristics of athletes, allowed to reveal the peculiarities of the readiness of tennis players and to determine the prospects for their further improvement.

The study of sensorimotor reactions and properties of the main nervous processes in athletes enabled us to determine the sexual characteristics of neurodynamic functions.

The statistical analysis of the results for the non-parametric U - Mann-Whitney criterion showed that in general, the men were significantly different from women according to the following indicators: the latent period of simple visual-motor reaction and the latent period of complex visual and motor reaction, the choice of two of the three stimulus ( $p < 0.05$ ).

Determining the latent period of the reaction of choice in tennis is of great importance. The duration of this indicator determines the qualitative qualities of the athlete, which is very important in high-speed sports. Thus, the average value of the latent period of the reaction of choice 2-3 for men was  $\bar{x} = 411,26$  ms, standard deviation -  $S = 43.84$  ms, for women, respectively, 451.18 ms and 51.84 ms.

Thus, as a result of the study, differences in time characteristics of the various complexity of the visual - motor reactions in athletes of high qualification, which are associated with the detection of sexual dimorphism, have been revealed.

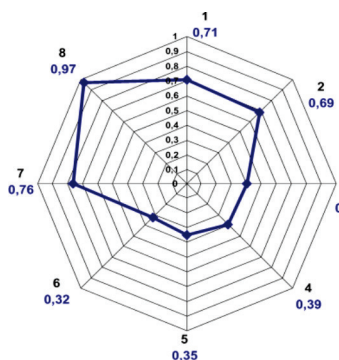


Fig. 1. Interconnection of a sports result with the assessment of tennis players: 1 – technique of execution of feeds and strikes; 2 – differentiation of muscular effort; 3 – working memory; 4 – complex visual-motor reaction; 5 – speed of information processing in the visual analyzer; 6 – functional mobility of nerve processes; 7 – switching attention; 8 – the final comprehensive assessment

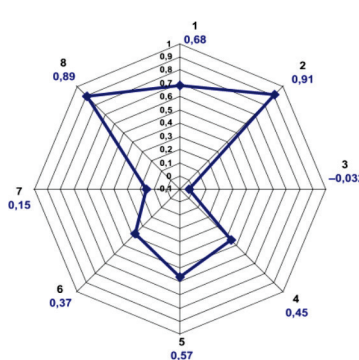


Fig. 2. Interconnection of a sports result with the assessment of female tennis players:

1 – technique of execution of feeds and strikes; 2 – differentiation of muscular effort; 3 – working memory; 4 – complex visual-motor reaction; 5 – speed of information processing in the visual analyzer; 6 – functional mobility of nerve processes; 7 – switching attention; 8 – the final comprehensive assessment

The data obtained by us coincide with the results of the majority of authors who investigated the relationship of individual-typological properties of higher nervous activity with psychophysiological indicators and came to the conclusion that athletes, in their physical, psychological and functional readiness, differ in essential individual characteristics, which largely determine the effectiveness competitive activities [2-6].

**Conclusions.** Construction of modeling characteristics, taking into account the style of competitive activity and individual characteristics of athletes, allowed to reveal the peculiarities of the readiness of tennis players and to determine the prospects for their further improvement.

Study of the relationships of properties of the main nervous processes with different complexity

by sensorimotor reactions at athletes has revealed the probable relationship between the latent periods of simple and complex sensorimotor reactions, as well as between latent periods of the visual-motor reaction of the choice of two of the three stimuli, functional mobility, and force of nervous processes.

With the help of correlation analysis, interconnections of individual-typological properties and sensorimotor reactions with psychophysiological indices of top tennis players of different sexes were established.

**Prospects for further development** are in the study of the sport preparation of top tennis players, to individualize the training process.

**Conflict of interest.** The authors state that there is no conflict of interest.

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