

Original Article

**Problems and features of technique in the development of coordination abilities of players specializing in wheelchair basketball**

MISHYN MAKSYM<sup>1</sup>, KAMAIEV OLEG<sup>2</sup>, MULYK VIACHESLAV<sup>3</sup>, TARAN LARYSA<sup>4</sup>, GRASHCHENKOVA ZHANNA<sup>5</sup>, TARASEVICH OLENA<sup>6</sup>, HRADUSOV VLADYMYR<sup>7</sup>, MULYK KATERYNA<sup>8</sup>, POMESHCHIKOVA IRYNA<sup>9</sup>

1-9 – Kharkov state academy of physical culture, UKRAINE

Published online: July 31, 2018

(Accepted for publication June 15, 2018)

DOI:10.7752/jpes.2018.s2150

**Abstract:**

Influence of the experimental technique of improvement of coordination abilities on the level of preparedness of athletes with disorders of musculoskeletal system, specializing in wheelchair basketball, is considered in the article. Feature of a new technique became specially developed exercises with change of conditions of performance that considerably changed the range of amplitude of movements and gave the chance for optimum solution of difficult motive tasks. The specifics of dosing of training load considered the number of repetitions and pauses for players of various functional classes. The made pedagogical experiment allowed to establish the reliable statistical difference between results of tests, which were conducted by means of Student criterion, where at reliability of  $p=0.001$  and  $t_{bv}=4.44$ , in test 1 –  $t=8.50$ , test 2 –  $t=10.37$ , test 3 –  $t=11.11$ .

**Key words:** Wheelchair basketball, coordination abilities, training, athletes with musculoskeletal disorder.

**Introduction**

Sport for people with disabilities gained special popularity in the last decade. Their participation in training process and competitive activity, allows expanding borders of the opportunities significantly. In particular wheelchair basketball, which quickly develops, became one of the most popular and spectacular sports for the people, having violation of functions of the musculoskeletal system.

In the majority of the previous researches the main attention was paid to increase in ability of performance of shot hoop by basketball players on wheelchairs as the major factor of successful competitive activity (Schwark, Mackenzie, Springs, 2004; Goosey-Tolfrey, Butterworth, Morriss, 2002; Malone, Gervais, Steadward, 2002).

Specific competitive activity in wheelchair basketball demands performance of various movements of hands from athletes, and in particular the motor actions, which are connected with management of a basketball wheelchair. In this regard a number of experts investigated a problem of development of physical qualities of basketball players on wheelchairs (Vanlandewijck, Daly, Theisen, 1999; Rotstein et al., 1994; Molik, Kosmol, 2003) and at the same time need of accounting of functional classification of players in the course of physical training (Molik et al., 2010).

It is established by researches of Sileno da Silva Santos et al. (2014) that control of position of a trunk and direction of its deviation is very important for stabilization of the situation of the system “player-wheelchair” and manifestation of muscular force during game activity. The situation of stability of a trunk allows to transfer easier and more safely efforts on a body for performance of any motive task. At the same time muscular action amplifies and loads on joints decreases.

Practice shows that disability, which is connected with defeat of the musculoskeletal system, first of all leads to violations of coordination movements. As a number of authors (Pityn, 2004; Mishyn, 2017) specifies, stability of a vertical pose, maintaining balance, ability to coordinate and regulate the actions in space and in time, carrying out them freely without the excess tension and constraint, these are those properties which are necessary for a basketball player on a wheelchair for satisfaction of sports requirements.

**Materials and methods**

12 players of national team of Ukraine on wheelchair basketball aged from 24 till 40 years participated in the pedagogical experiment. 3 players (average age of 29 years) had a functional class from them, 2-2.5 – 3 players (average age of 36 years), 3-3.5 – 3 players (average age of 28 years) and 4 - 4.5 – 3 players (average age of 30 years). 1-1.5. The Master of Sports of Ukraine – 11 persons, the Candidate for the Master of Sports – 1 person are from them.

Definition of change of level of coordination abilities was carried out by means of the block of control tests. The purpose of tests – is to obtain data with the subsequent their analysis for definition of changes of level

of coordination abilities at basketball players on wheelchairs after application of the experimental technique. The contents of tests consisted in overcoming a certain distance with continuous change of the direction of the movement.

1. The test "8" – the start is carried out from the middle line, to the right of the central circle, with movement to the opposite side of a circle of a free throw which detour is carried out on the left side, having made a circle detour, the athlete moves to the opposite side of the central circle, with his detour on the right side and continues movement to the opposite side of a circle of a free throw and carries out his detour at the left after which detour the athlete carries out acceleration to the place of start where there is the finish.

2. The test "Zigzag" – about 1 basketball is located in the center of circles of the line of a free throw and central circle, and on 1 ball is located on the sideline corresponding to the place of start and the finish at distance of 10 m from front lines. The start is made from a corner of front and side lines. The athlete carries out movements to the center of the line of a free throw and having executed a ball detour on the left side, does acceleration to a ball which is on a sideline, having made a ball detour on the right side, the athlete does acceleration, towards a basketball which is in the middle of the central circle, having made a ball detour on the left side, the athlete does acceleration to a ball on a sideline, having made a ball detour on the right side, the athlete does acceleration towards a ball which was in the center of the line of a free throw, having made a ball detour on the left side, the athlete does acceleration to a corner of the opposite front line from the place of start and a sideline where carries out the finish.

3. The test "T" – 5 basketballs are established in the form of a letter "T", 3 balls are located on the center between which distance of 3,3 m, and central - at distance of 5 m from the line of start-finish, and 2 balls are at distance of 10 m from the line of start finish between which distance made also 10 m. The athlete begins the movement with the place of start and in turn goes round balls which are on the center. Having reached the third ball, the athlete carries out acceleration to a distant ball and, having executed a ball detour, does acceleration to an opposite ball after which detour does movement to the central balls, having reached which carries out a consecutive detour, in the direction to the line of the finish (Williams, 2014).

The experimental technique of development of coordination abilities was applied during year preparation within one-cyclic planning. Two educational-training camps, lasting 21 day, were held at each stage of preparation in which the advanced technique was applied. It provided holding two trainings in day where a preparatory part of training included special sets of exercises. Duration of performance of complex was made 30-45 minutes. The main content of exercises had aerobic and aerobic-anaerobic orientation at 1 and 2 educational-training camps which were held at the all-preparatory stage. The large volume of work was executed in the zone of intensity 120-140 bpm. Exercises of anaerobic orientation were widely applied; intensity of performance increased to 160-180 bpm, and high amount of means was supported due to application of performance of well mastered exercises with balls at 3 and 4 educational-training camps which were held at the special-preparatory stage. Two problems were solved at 5 and 6 educational-training camps which were held at the competitive stage. The first – the maximum realization of coordination opportunities which occurred at the expense of high total load where intensity of load was provided with application of exercises anaerobic-glycolytic and anaerobic-alactate orientation and broad application of exercises with a ball. The second problem, providing optimum conditions for course of adaptation processes, was solved at the 6th educational-training camp. Intensity and volume of load were reduced for the solution of this task. The applied exercises were directed to maintenance and strengthening of the available level of coordination abilities.

Quantity and duration of performance of exercises considered a functional class of players and depended on complexity of exercise, rate of performance, starting position, amplitude of movement, interval and nature of rest between exercises. The analysis of the obtained data in control tests was carried out by means of the program of mathematical statistics Microsoft Office of Excel 2007. The significance value was carried out by means of t criterion of Student. We went from the level of probability  $p=0.001$  at assessment of a standard error of average size, which provides necessary accuracy in pedagogical researches.

## Results

The leading experts of the theory of sport note (Kostyukevich, 2014; Platonov, 2017) that the level of coordination abilities influences key components of preparedness of athletes. Improvement of coordination abilities has to take place with emphasis on mastering muscle sense, visual perception, feeling of space and other specific qualities which are shown in specialized motive reactions, such as feeling of distance, feeling of the rival, moment to start actions and so forth. Thus, increase in level of coordination abilities has to be directed to improvement of quality of specific movements and improvement of reliability of management by them.

Creation of the experimental technique of improvement of coordination abilities was based on regularities of development of a human body and synthesis of practical activities of coaches. Works of leading experts in the field of sport became a methodological basis of development of the technique (Platonov, 2015; Mulik, Kamayev, 2017) and, in particular, basketball (Kozina, 2009, 2011). Development of the technique was based on the data concerning creation of long-term training of athletes in sports, preparation individualization in sports, feature of training of athletes with disability including athletes with violation of the musculoskeletal system, use of technical and ergogenic means in training of athletes.

The pedagogical experiment was made for the analysis of change of level of coordination abilities of athletes with violation of the musculoskeletal system, specializing in wheelchair basketball. The test, which consisted of 3 tests which results are given in table 1, was conducted before the pedagogical experiment and after its termination. Improvement of result fluctuates ranging from 3.1 till 17.7% in the test “8” after application of the technique, which is directed to increase in level of coordination abilities of the athletes, specializing in wheelchair basketball. And the gain more than 10% is observed at 5 athletes. The percent of gain makes 6-10% at 5 athletes, and 2 players have 3-5%, and the result improved for 9.2% on average (table 1, figure 1).

Table 1. Results of the test and their gain after realization of the consecutive pedagogical experiment (s), (n=12)

No. Test	Testing terms	Athletes												$\bar{X}$ (s)
		1	2	3	4	5	6	7	8	9	10	11	12	
		Result (s)												
1	Before the experiment (s)	18.1	17.4	18.6	17.3	16.8	17.2	16.4	16.3	16.5	15.3	16.4	16.1	16.87
	After the experiment (s)	16.4	16.1	16.3	14.7	15.3	15.4	15.0	15.5	16.0	13.9	15.7	15.1	15.45
	Improvement of result (%)	10.4	8.1	14.1	17.7	9.8	11.7	9.3	5.2	3.1	10.1	4.5	6.6	9.2
2	Before the experiment (s)	19.9	17.8	19.5	17.6	17.9	17.8	16.7	17.1	18.6	15.9	17.2	17.7	17.81
	After the experiment (s)	17.3	16.7	18.3	14.5	16.1	15.2	15.4	15.7	16.5	14.4	15.9	16.1	16.01
	Improvement of result (%)	15.0	6.6	6.6	21.4	11.2	17.1	8.4	8.9	12.7	10.4	8.2	9.9	11.3
3	Before the experiment (s)	25.9	25.73	27.03	24.65	25.81	23.62	23.72	24.44	25.49	23.39	24.92	24.22	24.91
	After the experiment (s)	24.5	24.17	24.74	22.47	23.63	22.5	22.65	23.51	24.46	21.27	23.83	22.77	23.38
	Improvement of result (%)	5.7	6.5	9.3	9.7	9.2	5.0	4.7	4.0	4.2	10.0	4.6	6.4	6.5

Note: 1 – the test “8”, 2 – the test “zigzag”, 3 – the test “T”.

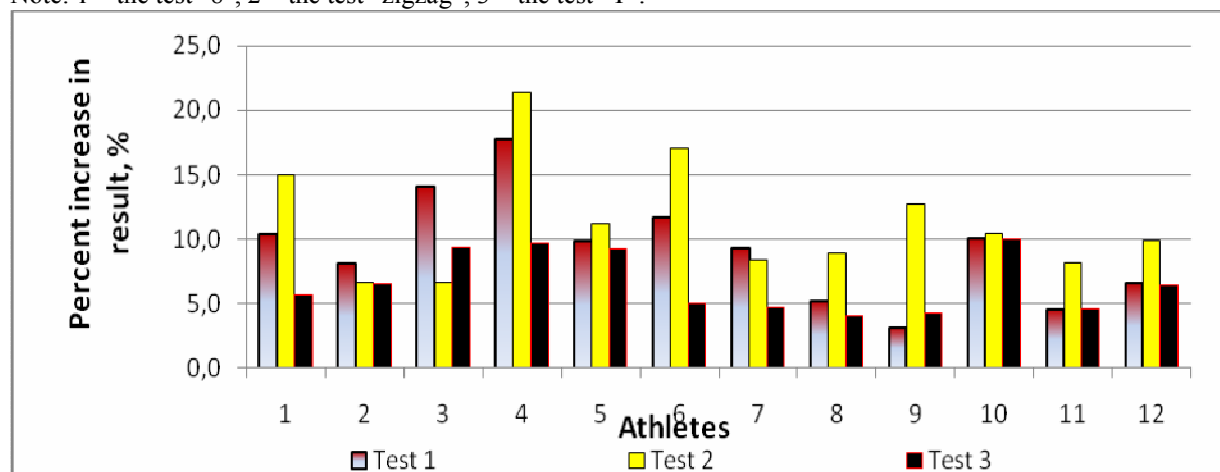


Figure 1. Result of gain percent in tests after application of the pedagogical experiment (%)

Note: 1 – the test “8”, 2 – the test “zigzag”, 3 – the test “T”.

In the test “zigzag” the result improved by 6.6% at 2 athletes, the gain of result is in limits of 8.2-9.9% at 4 players, 6 basketball players improved result from 10.4 to 21.4%, and on average – 11.3%.

Improvement of result in the test “T” makes 4-5% at 5 players and 7 athletes have 5.7-10%. At the same time the average value improved by 6.5%.

Significant improvements of results in all 3 tests are observed at 10 athletes whose gain in the sum makes from 20% till 48.8%. This indicator is ranging from 17.2 till 18.0% at other 2 players.

Assessment of statistical reliability of differences between the received results in each test was carried out on t criterion of Student for pair selections. The comparative analysis of average values in all three tests before and after the experiment revealed statistically reliable improvement of results at athletes. So, the average result improved from 16.87s till 15.45 in the test “8” that made 9.2% ( $t=7.82$ ;  $p<0.001$ ), improvement made 11.3% ( $t=9.54$ ;  $p<0.001$ ) in the test “zigzag”, and in the third test “T” by 6.5% ( $t=10.22$ ;  $p<0.001$ ) at  $t_{bv}=4.44$  (table 2).

Table 2. Group average results of the test of athletes before and after the pedagogical experiment (n = 12)

No. Test	Testing terms	$\bar{X} \pm m$	t	p
1	Before the experiment (s)	16.87±0.24	8.50	<0.001
	After the experiment (s)	15.45±0.19		
2	Before the experiment (s)	17.81±0.30	10.37	<0.001
	After the experiment (s)	16.01±0.30		
3	Before the experiment (s)	24.91±0.29	11.11	<0.001
	After the experiment (s)	23.38±0.28		

Note: 1 – the test “8”, 2 – the test “zigzag”, 3 – the test “T”.

Rather high reliable difference between indicators in tests proves that the offered technique promotes increase in level of coordination abilities of athletes with violation of the musculoskeletal system, specializing in wheelchair basketball.

### **Discussion**

Wheelchair basketball is sport with complex coordination structure of the movements providing communication between management of a sports wheelchair with other technical actions on the platform. Formation of technical-tactical preparedness of athletes is based on the basis of development of coordination abilities (Florin, 2017). The degree of importance of coordination abilities is defined by rhythmic, dynamic structure and maintenance of kinematic characteristics of motor activity of athletes (Antonov et al., 2017). The problem of development of coordination abilities is relevant for all sports and especially for people with disabilities (Sobko, 2015). So, I.P. Pomeshchikova, etc. (Pomeshchikova et al., 2016) specify that now the question of improvement of stable equilibrium at persons with violations of the musculoskeletal system and its preservation in various game situations is particularly acute that provides them relative freedom of movement and rational rhythm of motor actions in the conditions of competitions.

When developing the program of trainings of basketball players, according to authors (Kozina et al., 2017), it is important to select the exercises, which are directed at the development of ability to maintain steady balance of a body, to keep balance in unstable poses and to keep balance in various game situations and collisions. Scientific provisions of the theory of development of sportswear, formation of movement skills and increase in level of opportunities of functional systems were applied in the course of development of the experimental technique. The basic principle of selection of exercises consisted in complex reproduction of special motor actions of competitive activity. Ways of performance of exercises, which in game sports demand instant and rational performance of special game actions, were complicated and expanded for this purpose. In this regard, we developed special exercises with change of the conditions of their performance requiring change of range of amplitude of movements and optimal solution of difficult motive tasks. The distinctive feature of this technique is that the developed new exercises are connected on groups, in which continuity of exercises and gradual complication of conditions of their performance is observed. Many exercises are directed to improvement of spatial orientation of players, to increase in requirements to visual and to motive analyzers that allows accelerating process of improvement of their functions significantly. Thus, the advanced technique allows considering key components of competitive activity and functional class of players in wheelchair basketball.

However, despite positive changes of level of preparedness, there is a new pedagogical problem – exact use of individual opportunities of athletes with violation of the musculoskeletal system in the range of the indicators characteristic of this or that classification group. The special relevance and importance is gained by search of effective pedagogical means and methods of correction of motive violations for the players, having different functional classes in this connection when developing the technique, the number of repetitions and pause of rest for players of various functional classes for ensuring efficiency of processes of adaptation of an organism of athletes to physical activities were considered. The subsequent researches are planned for development of new methodical techniques which will include methods of individual corrections of movements and compensation of violations of functions, by creation of new motive programs where development of motor actions is connected taking into account the level of the remained athletic ability and extent of violations of the musculoskeletal system and to be based on the general regularities and features of formation of motor actions of athletes with disability.

### **Conclusions**

Modern wheelchair basketball is characterized by complex coordination structure of the movements that on the one hand demands to pay special attention to development of coordination abilities at creation of process of preparation, and on the other hand, defines one of the main problems of improvement of this component of preparation, in connection with various level of the kept athletic ability of the athletes playing in one team.

The important feature of increase in level of coordination abilities is creation of the system “wheelchair-athlete”, for providing a stable relation between management of a basketball wheelchair and other technical-tactical actions on the platform.

It is very important to develop ability to maintain balance of a body at athletes who have violation of functions of the musculoskeletal system and specialize in wheelchair basketball as the ability to balance in static and dynamic provisions of a wheelchair is one of necessary conditions for development and improvement of the technique of a game, development physical and functionality. Use of the advanced technique of development of coordination abilities of basketball players on wheelchairs, including exercises with sharp change of the direction of the movement, starting accelerations from different starting positions, movement on an arch of various radius and on "eight", raising of a wheelchair on the right and left wheel and another allowed to improve results of testing on: the test 1 – 9.2%, the test 2 – 11.3%, the test 3 – 6.5%. The efficiency of the advanced technique, on the basis of development of new methodical techniques taking into account the remained athletic ability and extent of violations of the musculoskeletal system of players, was confirmed on the basis of the made

pedagogical experiment which allowed to establish the reliable statistical difference between results of tests: in the test 1 –  $t=8.50$ , in the test 2 – to  $t=10.37$ , in the test 3 –  $t=11.11$ , at reliability of  $p=0.001$  and  $t_{bv}=4.44$ .

#### Acknowledgements

The research is executed according to the scientific subject of the chair of Olympic and professional sport of Kharkov state academy of physical culture "Improvement of training process of sportsmen with limited physical capacities in different types of sport" (the state registration number is 0116U008944).

#### Reference

- Antonov Sergiy, Briskin Yuriy, Perederiy Alina, Pityn Maryan, Khimenes Khrystyna, Zadorozhna Olha, Semeryak Zoryana, Svystelnyk Irina (2017). Improving technical preparedness of archers using directional development of their coordination skills on stage using the specialized basic training. *Journal of Physical Education and Sport*, 17(1), 262–68.
- Florin Cojanu (2017). Methodological contributions on the education of specific coordination for basketball children to 10-12 years. *Journal of Physical Education and Sport*, 17 Supplement issue 5, 2235-2238.
- Goosey-Tolfrey V., Butterworth D., Morriss C. (2002). Free Throw Shooting Technique of Male Wheelchair Basketball Players. *Adapted Physical Activity Quarterly*, 19(2), 238-250.
- Irina Sobko (2015). An innovative method of managing the training process of qualified basketball players with hearing impairment. *Journal of Physical Education and Sport*, 15(4), 640-645.
- Kostyukevich V.M. (2014). The theory and technique of sports preparation (on the example of team game sports): manual, 616.
- Kozina Z. L. (2009). Individualization of training of sportsmen in game sports: monograph, 396.
- Kozina Z., Iermakov S., Crețu M., Kadutskaya L., Sobyenin F. (2017). Physiological and subjective indicators of reaction to physical load of female basketball players with different game roles. *Journal of Physical Education and Sport*, 1, 1428-1432. doi:10.7752/jpes.2017.01056
- Kozina Z. L. (2011). The system of individualization of training of sportsmen in game sports: monograph, 532.
- Malone L.A., Gervais P.L & Steadward R.D. (2002). Shooting mechanics related to player classification and free throw success in wheelchair basketball. *Journal of rehabilitation, Research & Development*, 39(6), 701
- Mishyn M.V. (2017). The analysis of technique of possession of basketball wheelchair by players of different functional classes in competitive activity. *Scientific journal of M.P. Dragomanov National pedagogical university. Serie No. 15. "Scientifically-pedagogical problems of physical culture / Physical culture and sport"*, 1(82) 17, 39-43.
- Molik B., Kosmol A. (2003). Physical ability and playing skills criteria for classifying basketball wheelchair players. *Wychowanie fizyczne i sport*, 3(46), 256-261.
- Molik B., Laskin J., Kosmol A., Skučas K., Bida U. (2010). Relationship between functional classification levels and anaerobic performance of wheelchair basketball athletes. *Research Quarterly for Exercise and Sport*, 81(1), 69-73, ISSN 0270–1367.
- Mulyk V.V., Kamaev O.I. (2017). The theory of systemacity and system approach in professional activity of the coach: educational-methodical manual, 88.
- Pityn M.P. (2004). Functionality of performance of technical-tactical actions in wheelchair basketball. *Improving and sports work with disabled people*, 41-44.
- Platonov V.N. (2015). The system of training of athletes in the Olympic sport. General theory and its practical applications: textbook [for coaches], Book 1, 680.
- Platonov V.N. (2015). The system of training of athletes in the Olympic sport. General theory and its practical applications: textbook [for coaches], Book 2, 752.
- Platonov V.N. (2017). Motive qualities and physical training of sportsmen, 656.
- Pomeshchikova I.P., Shevchenko O.O., Yermakova T.S., Paievskiy V.V., Perevoznik V.I., Koval M.V., Pashchenko N.O., Moiseienko O.K. (2016). Influence of exercises and games with ball on coordination abilities of students with disorders of muscular skeletal apparatus. *Journal of Physical Education and Sport*, 16(1), 146-155.
- Rotstein A., Sagiv M., Ben-Sira D., Werber G., Hutzler J. & Annenburg H. (1994). Aerobic capacity and anaerobic threshold of wheelchair basketball players. *Paraplegia*, 32, 196-201.
- Santos, Sileno da Silva et al (2014). Analysis of velocity and direction of trunk movement in wheelchair basketball athletes. *MedicalExpress*, 1(2), 77-80. doi:10.5935/MedicalExpress.2014.02.04.
- Schwark B.N. Mackenzie S.J. & Sprigings E.J. (2004). Optimizing the Release Conditions for a Free Throw in Wheelchair Basketball. *Journal of Applied Biomechanics*, 20, 153-166.
- Vanlandewijck Y.C., Daly D.J., Theisen D.M. (1999). Field test evaluation of aerobic, anaerobic, and wheelchair basketball skill performances. *International Journal of Sports Medicine*, 20(8), 548-554.
- Williams E.J. (2014). Wheelchair basketball and agility. A dissertation. 80 p.