



Application of the pulley tower training complex by highly qualified athletes who complete a sports career with injuries of the musculoskeletal system

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Postgraduate student **V.V. Savelyeva**¹

Dr. Hab., Professor **G.N. Ponomarev**¹

¹The Herzen State Pedagogical University of Russia, St. Petersburg

Corresponding author: valviksav@yandex.ru

Abstract

Objective of the study was to evaluate the effectiveness of the use of a complex of special physical exercises on the Pulley Tower multifunctional simulator for the prevention and correction of the musculoskeletal system and spine, for highly qualified athletes who completed their sports career with injuries to the musculoskeletal system.

Methods and structure of the study. The pedagogical experiment was conducted on the basis of the GYROTON-IC studios in Moscow, the Moscow region and St. Petersburg for 12 months. The experiment involved highly qualified athletes (Master of Sports, International Master of Sports, Honored Master of Sports of Russia) involved in gymnastic sports (artistic gymnastics, artistic acrobatics, rhythmic gymnastics, figure skating) and sports games (hockey, volleyball, tennis). Age - from 15 to 27 years, in the amount of 92 people.

Results and conclusions. As part of the experiment, it was revealed that the proposed set of exercises on the Pulley Tower multifunctional simulator slows down the deterioration of the musculoskeletal system and spine of athletes after the end of their sports career. Restores the motor symmetry of the musculoskeletal system and spine during rotational movements, tilts to the right - to the left.

Keywords: *highly qualified athlete, the stage of completion of a sports career, a multifunctional Pulley Tower simulator, a set of exercises.*

Introduction. The growth of sports achievements, reaching a new level of sportsmanship, as well as early sports specialization makes us think and turn to the problem of diseases of the musculoskeletal system in high-class athletes, in order to maintain their health and improve the quality of life, at the stage of completing a sports career. During a sports career, athletes use the body's ability to adapt to various loads to improve sports results (A.I. Shamardin, 2000; I.N. Solopov, A.I. Shamardin, 2003; Qian Wei, 2006; A.I. Shamardin, 2008), going beyond the capabilities of the body and functional systems. Sports training has a serious drawback: athletes of various sports, performing repeatedly a specific motor regimen, subject the same muscle groups, tendons, ligaments and joints to stress. Most often, training takes place against the background of fatigue, which additionally creates conditions for injuries and diseases of the musculoskeletal system [2].

Often the pain that appears in the back and limbs is not a reason to reduce the load, thereby provoking chronic diseases of the musculoskeletal system. At present, the problem of deterioration in the health status of athletes who have completed their sports career is becoming more and more urgent, when constant loads are sharply reduced or training sessions are stopped.

The state of the musculoskeletal system in athletes is determined mainly by three factors: qualification, sport and age. Therefore, at the stage of the completion of a sports career, it becomes important to prevent a readaptation deterioration in the state of the musculoskeletal system, the cause of which may be the cessation or a sharp decrease in loads; slow down the process of reducing the amplitude of movement, which can occur under the influence of specific morphofunctional changes associated with the process of deadaptation [2]; to slow down the regression of flex-



ibility, while maintaining, as far as possible, the optimal mobility of the main links of the musculoskeletal system [1]; to activate the non-dominant side of the athlete, thus smoothing out the functional dynamic asymmetry of the athlete that arose as a result of adaptive rearrangements [3].

Currently, there are few publications devoted to the problems of maintaining the musculoskeletal system of high-class athletes who have completed their sports career. Mostly studied diseases of the musculoskeletal system in the late post-sport period [4]. Studies show that sports veterans (40-60 years old), and these are the leading athletes in the team game sport - basketball, have back and ankle injuries - 67.2%, knee meniscus - 23.3%, Achilles tendon tear - 9.6%, osteochondrosis of the spine - 43.8%. There are 21% of post-traumatic, dystrophic and inflammatory diseases of the musculoskeletal system in high-class athletes who have received injuries during sports training.

Objective of the study was to evaluate the effectiveness of using a complex of special physical exercises on the Pulley Tower multifunctional simulator for the prevention and correction of the musculoskeletal system and spine, for highly qualified athletes who completed their sports career with injuries to the musculoskeletal system.

Methods and structure of the study. The pedagogical experiment was conducted on the basis of the GYROTONIC studios in Moscow, the Moscow region and St. Petersburg for 12 months. The experiment involved highly qualified athletes (Master of Sports, Master of Sports of International Class, Honored Master of Sports) involved in gymnastic sports (artistic gymnastics, artistic acrobatics, rhythmic gymnastics, figure skating) and sports games (hockey, volleyball, tennis). Age - from 15 to 27 years, in the amount of 92 people.

The participants were divided into two groups (experimental (EG) and control (CG), 46 people each. The experimental group performed a set of exercises on the Pulley Tower multifunctional simulator (Fig. 1) three times a week for 45 minutes. using a goniometer consisting of two branches connected to a scale graduated from 0 to 180°. When assessing mobility, the amplitude of active movement was measured. The average value in the exercises of each group was determined.

To measure the volume of the upper limb in the initial position, the arms hang freely along the body. Suggested movements: forward flexion, abduction, posterior flexion of the forearm. Flexion (raising the

arm forward) in the shoulder joint occurred in the sagittal plane, and a goniometer was installed in the same plane to the outer surface of the shoulder. Abduction in the shoulder joint was performed without movement of the scapula. Extension was carried out in the sagittal plane. The goniometer screw was installed in the middle of the head of the humerus. The back flexion of the forearm was carried out with the shoulder pressed against the body, the angle of flexion of the forearm was measured.

To measure the volume of active movement of the hip joint, the starting positions were: supine position, prone position, lying on the side. Movements were carried out: flexion of the leg, extension of the leg and abduction of the leg.

To measure the mobility, flexibility and symmetry of movements between the left and right sides of the spine, the starting positions were: standing against a wall and sitting on a bench. Movements were carried out: forward and backward tilts, tilts to the right and left, rotational movement to the right and left.

When tilting forward and backward, the subject stood sideways to the wall, on which a vertical line had previously been drawn. The angle between the vertical line and the inclination forward and backward was measured. When tilting to the side, the subject stood with his back to the vertical line, and the angle between the vertical line and the tilt to the right and left was also measured. When performing a rotational movement to the right and left, the subject sat on the bench, fixing it between the legs, the measurement was carried out from above, the angle between the initial position and rotation to the right and left was measured.

To determine the flexibility of the hamstrings, the "sit and reach" test (D.R. Hopkins, W.W. Hoeger, 1986), a modified version of the test, was used to eliminate the influence of insufficient mobility of the shoulder girdle and proportional differences between the length of the arms and legs [4]. The subject sat with his back to the wall, legs together, extended forward, feet unbent. A box with a sliding measuring scale is installed at the feet. For each subject, a zero point was established on the segment of the distance of the fingers to the box, based on proportional differences in the length of the limbs. Tilt forward.

Based on a comprehensive assessment of the state of the musculoskeletal system and spine, athletes who completed their sports careers were given the necessary recommendations for further training, doing exercises at home, and the training load was adjusted depending on the individual adaptive capabilities of the body.



A set of special physical exercises on a multifunctional simulator is aimed at muscle relaxation, restoring muscle balance, maintaining the level of physical condition, improving posture and symmetry, getting rid of muscle cramps, and reducing pain after injuries. The sets of exercises were divided into three blocks. The first block included exercises for the spine, the second block of exercises was aimed at the shoulder girdle and the third block contained exercises for the pelvic girdle.

1. *Exercises for the spine.* It is performed sitting on the bench of the Pulley Tower training complex. Options for the position of the hands: each hand on the "handle", both hands on the same "handle", sitting with his back to the "handles", sitting sideways to the "handles". The position of the hands changes the effect on the muscles of the back and the position of the spine. – I.P. sitting legs apart, hands on the "han-

dles" in front of you, back straight. Hold hands on the "handles" of the simulator. Inhale and slowly push the handles forward in a circle. Fix the stretch and return back. The movement is performed with straight arms, with maximum extension of the spinal column forward.

2. *Exercises for the shoulder girdle.* It is performed while sitting on the bench of the Pulley Tower training complex, leaning on a special backrest. The upper loops are dressed on brushes. Weight - 5 kg. Variants of execution: alternately with the left and right hand, simultaneously with two hands, in different directions with both hands, with a look up, down, with bent elbows, with straight arms. Movement options: up, down, circular movements in front of you with one hand, two hands together, alternately, circular movements above your head. I.P. sitting legs apart, back straight, arms extended in front of you, perform circular movements with your hands.

Table 1. Assessment of changes in the musculoskeletal system and spine (degrees)

The results of changes in the mobility of the musculoskeletal system							Symmetry / asymmetry			
Movement name EG KG			Initial data		After 12 months		Initial data		After 12 months	
			EG	KG	EG, degree	KG, degree	EG	KG		
Shoulder joint, degrees	Bending the arm forward	Right	136,42	139,2	134,9	125,1	9,8	15,2	6,9	18,8
		Left	126,6	124,03	128,0	106,3				
	Retracting the hand to the side	Right	131	133,42	131,0	121,3	12,4	12,4	7,8	13,2
		Left	118,6	121	123,2	108,1				
	Flexion of the arm behind the back	Right	160	156,6	149,8	143,6	13,4	12,9	3,3	12,1
		Left	146,6	143,7	146,5	131,5				
Hip joint, degrees	Bending the leg lying on the back	Right	146,5	147,9	145,7	143,2	4,1	6,9	3,6	7,4
		Left	142,4	141	142,1	135,8				
	Leg extension lying on the stomach	Right	28,46	28,7	26,7	25,3	7,1	7,5	4,5	8,2
		Left	21,41	21,2	22,2	17,1				
	Side leg abduction	Right	47,26	47,7	44,6	42,8	9,4	9,1	4,3	9,6
		Left	37,9	38,6	40,3	33,2				
Spine, degrees	Standing bends	Forward	168	168,8	164,0	162,7	×	×	×	×
		Back	42,23	41,97	40,3	37,2				
		Right	46,34	46,14	44,8	42,1				
		Left	38	38,21	39,3	33,7				
	Bench rotation	Right	37,3	37,51	35,3	34,2	6,0	6,4	1,1	7,1
		Left	31,3	31,1	34,2	27,1				
Hamstring, cm	Sit down and reach out	Feet together	21	21,21	23	15	×	×	×	×



3. *Exercises for the pelvic girdle.* They are performed lying on the bench of the Pulley Tower training complex, the upper loops are put on the feet, weight 15 kg. Foot movement options: unbend, bend. Leg position options: legs together, legs apart to the sides, alternately lifting the legs up, knees straight, knees bent. I.P. lying down, legs raised up 45°, knees straight, feet unbent: exercise “bike”, “frog”, “scissors”.

Results of the study and their discussion. Table 1 shows the results of changes in the mobility of the musculoskeletal system of highly qualified athletes who have completed their sports career. The results are calculated as a percentage of the baseline. The baseline values were obtained from the report card of the last competitions in General Physical Training and Special Physical Training of athletes. For 12 months, the dynamics of changes in the functional state of the musculoskeletal system and spine in athletes of the experimental and control groups was monitored. As part of the experiment, it was revealed that the proposed set of exercises on the Pulley Tower multifunctional simulator slows down the deterioration of the musculoskeletal system and spine of athletes after the end of their sports career. Restores the motor symmetry of the musculoskeletal system and spine during rotational movements, tilts to the right - to the left.

Conclusion. The use of a complex of special physical exercises on the Pulley Tower multifunctional simulator is an effective and important tool for correcting the state of the musculoskeletal system of athletes who have completed their sports career by gradually slowing down the process of reducing the amplitude of movement and maintaining optimal mobility of the main links of the musculoskeletal system.



Figure 1. Multifunctional training complex Pulley Tower

References

1. Grishina T.S. Pedagogicheskoye fizkulturno-sportivnoye sovershenstvovaniye [Pedagogical physical culture and sports improvement]. Teaching aid. Voronezh: VGIFK publ., 2019. 239 p. [Electronic resource]. Available at: <https://e.lanbook.com/book/140332> (date of access: 02.19.2022).
2. Platonov V.N. eorii adaptatsii i funktsionalnykh sistem v razvitii v sisteme znaniy v oblasti podgotovki sportsmenov-2017 [Theories of adaptation and functional systems in development in the system of knowledge in the field of training athletes-2017] [Electronic resource]. Available at: <https://www.researchgate.net/publication/320234321> (date of access: 10.02.2022).
3. Fedotova I.V. Osnovy metodologii postprofesionalnoy adaptatsii sportsmenov [Fundamentals of the methodology of post-professional adaptation of athletes]. Teaching aid. Volgograd: VGAFK publ., 2016. 145 p. [Electronic resource]. Available at: <https://e.lanbook.com/book/158095> (date of access: 02.19.2022)
4. Hopkins D.R., Hoeger W.W. The modified sit and reach test. In Hoeger W.W. (Ed.), Lifetime physical fitness and wellness: A personalized program, 1986. pp. 47-48. Englewood, CO: Morton.