MYORELAXATION IN THE MECHANISM OF SPECIAL PHYSICAL WORKING CAPACITY OF SPORTSMEN

Y.P. Denisenko— the branch of Povolzhskaya State Academy of Physical Culture, Sports and Tourism, Naberezhnye Chelny

Y.V. Vysochin, L.G. Yatsenko - St.-Petersburg State Technological University of Vegetative Polymers, St.-Petersburg

Y.V. Gordeev - St.-Petersburg State University, St.-Petersburg, Russia

E-mail: yprof@yandex.ru

Keywords: extreme conditions, the functional protection system, the speed of the muscles relaxation, central nervous system, relaxation.

Annotation. Nowadays there are different ways of a special physical working capacity improvement which are based on the increase of the training and competitive loads. They are effective enough for the main aim achievement but none of them provides health safety of sportmen. Moreover with the increase of the volume and intensity of the loads, which are great, there is increase in sports traumatism and sickness rate. That is why it is important to search for the new ways of these two problems solution: the problem of the highest level of a special physical working capacity (SPWC) achievement and the problem of the athletes’ health saving and improvement. We combined these two problems into one – the problem of a person’s motional activity effectiveness increase. That is why physiologically reasonable methods and principles of a special relaxation training, directed at effectiveness increase of the athletes training process on all levels of sports skills development, are necessary.

Research methods. To study the mechanisms of regulation and coordination of the voluntary movements, to control the contractile and relaxation characteristics of the skeletal muscles and the functional state of the central nervous system and nervous – muscular system (NMS) we used the method of computer polymyography, created by Y.V. Vysochin, which was used in training of the sportmen from picked team of Russia and Saint - Petersburg.

Results. 600 sportmen of different qualifications took part in the experiment. As a result of our multiyear research works we substantiated the main ways and principles of special relaxation training, directed at effectiveness increase of the athletes training process on all levels of sports skills development.

Conclusion. The search for a new complex system of a special physical and functional training is necessary, the use of which since childhood will provide universal development and perfection (training) of the inhibition – relaxation processes, defense mechanisms improvement and formation of more rational relaxation type of a long term adaptation and individual organism development.

The tendencies of recent years in professional activity are connected with the constant loads increase almost in all kinds of person’s professional activity. As a result there is violation of regulatory mechanisms which decreases the level of physical working capacity and can lead to negative vegetative shift in health state [3,6,12]. At the same time urgent becomes the problem of sportmen effective training provision in extreme conditions of activity and the functional conditions creation for health saving. One of the ways to solve this problem is the use of effective, modern and physiologically substantiated technologies with the simultaneous use of the rational system of functional state complex diagnostics and correction. This kind of approach allows to broaden the range of compensation abilities
of an organism on the base of the maximum volume and intensity of professional and psychological – emotional loads. The provision of a maximum adaptation to muscular loads can become one of the conditions of the health saving level and the quality of professional mastery improvement [6,10,11, 13].

This problem becomes urgent in modern conditions of a person’s professional activity and is discussed in several research works connected with the idea of the loads criticality in sport and in other spheres of professional activity [7, 13].

Along with traditional approaches there is a great experience in application of other non-traditional means in different kinds of sport (medium altitude mountains, pressure chambers, hypoxic and hyperthermic effects, special breathing exercises, the methods of biological feedback, the methods of active self-regulation and relaxation and others) in the system of sports training.

At the same time, it is necessary to notice that recently among non-traditional means of influence on a person’s functional state great attention is paid to the methods of myorelaxation, which are famous for safety of influence, effectiveness and low financial expenses. According to some authors relaxation is seen as the alternative or addition to the functional state correction [1, 14, 16]. That is why it is often presented as the method of emotional stress prevention, correction and elimination. As the researchers mention, it is one of the most effective methods which help to achieve necessary changes in an organism functional state.

In physiology relaxation is presented as an active process of muscular tonus and psychoemotional stress decrease [8, 14, 17]. Undoubtedly these are not all changes which characterize relaxation processes. The relaxation of the respiratory muscles changes considerably the state of the respiratory system. During relaxation there is a trophotrop state, the level of apprehension and psychological and physiological reactions to stress decrease. Moreover relaxation is accompanied by a considerable decrease of an afferent and efferent impulse and this, according to the data of electroencephalogram, causes the attention concentration and a state of consciousness with an active cortical activity [6, 9, 15, 18]. As a result we can say that practical application of relaxation methods, directed at prevention, correction and elimination of negative psychoemotional states, can provide the increase of the adaptive abilities of an organism.

The methods of relaxation were used in correction of some pathologic states, in case of hypertensive disease, in order to get rid of sharp and chronic pain including the sphere of sports activity [2, 4, 16].

The state of relaxation is also used in meditation methods. Meditation and the relaxation exercises have a wide range of application, very often they are used in transcendental medicine [8, 9, 10, 14].

All mentioned above effects of the relaxation methods application have a great meaning in sports activity. It is necessary to mention other methods of relaxation which also influence athletes’ functional state, they are: biological feedback, functional music, aromatherapy [1, 5, 12, 15].

Myorelaxation, the speed of skeletal muscles relaxation, is also an important factor characterizing the functional state of nervous - muscular system and the functional abilities of an organism as the contractile characteristic of the muscles.

Muscles relaxation function in sport and labor activity is very important. This problem was studied in some research works where it was proved the positive influence of special exercises, which improve the function of skeletal muscles relaxation, on central nervous system, on visceral organs and systems activity, on formation of the rational types of blood circulation, on movement co-ordination, speed, endurance, technical mastery, increase of a special physical working capacity (SPWC) and sports results [1, 6, 9, 18, 19].

Some research works prove the importance of the muscles relaxation function in the sports results improvement in different kinds of sport and even in ballet and choreography.

The most important, in our opinion, are the research works which prove the leading role of the inhibitory systems of central nervous system and the speed of voluntary relaxation of skeletal muscles in activity of an entire organism: in the mechanisms of express and durable adaptation to big physical, hypoxic and hyperthermic loads; in the mechanisms of a special physical working
capacity; in the mechanisms of overexertion, trauma and disease of locomotor apparatus and also in the mechanisms of rhythm disorder and athletes’ heart overexertion; in the mechanisms of heart adaptation and different types of blood circulation formation; in the mechanisms of muscles blood supply and energy supply of muscular work; in the mechanisms of resistance to physical overloads, overexertion, trauma and diseases prevention and also in the mechanisms of organism protection from extreme effects and athletes’ rehabilitation [4, 5, 7, 16].

It should be noted that all most effective methods of psychoregulation, self-regulation and autotraining, which are used in a special psychological training of the athletes and in new health-improving technologies, are based on relaxation [8, 14, 15].

Nowadays different ways of a special physical working capacity (SPWC) increase are known and they are mainly based on the increase of the training and competitive loads volume. They are effective enough for the main aim achievement but none of them provides health safety of sportsmen. Moreover with the increase of the volume and intensity of the loads, which are great, there is increase in sports traumatism and sickness rate. Different ways of health improvement are known in most of which the main health-improving role play moderate physical loads of low intensity. But this kind of approach doesn’t provide the progress of a special physical working capacity and sports results. That is why it is important to search for the new ways of these two problems solution: the problem of the highest level of a special physical working capacity (SPWC) achievement and the problem of the athletes’ health saving and improvement. We combined these two problems into one – the problem of a person’s motional activity effectiveness increase.

**Research methods.** To study the mechanisms of regulation and coordination of the voluntary movements, to control the contractile and relaxation characteristics of the skeletal muscles and the functional state of the central nervous system and nervous – muscular system (NMS) we used the method of computer polymyography, created by Y.V.Vysochin, which was used in training of the sportsmen from picked team of Russia and Saint - Petersburg. The method showed its high informativeness and reliability [4,7,8].

The method is based on the synchronous graphic registration of bioelectric activity (electromyograms), cross solidity (tonusgrams) and strength (dynamograms) of different groups of the muscles under study with their voluntary tension and relaxation in isometric regime. The isometric regime of muscles work during testing is preferable, on the one hand, because of its low power intensity, easy modeling [11], on the other hand, as the most widely –spread in sports and labor activity.

**The research results.** Carried out by us experiments, in which 600 sportsmen of different qualifications and specializations took part, showed direct reliable dependence of special physical working capacity and sports results from the speed of voluntary relaxation (SVR) of skeletal muscles [12]. In most kinds of sport (in 17 from 20) the importance of SVR in the progress of sports results, especially at the stage of highest sportsmanship, was sufficiently higher than the importance of contractile muscles characteristics. In such kinds of sport like boxing, hockey, football, speed skating, decathlon and swimming SPWC is not only the leading one but the only from polymyographic parameters which define the qualification improvement. All this doesn’t mean that the contractile characteristics of the muscles are not important in the mechanisms of working capacity. On the contrary, they are very important as the muscles contraction provides the fulfillment of physical work. But the duration of this work, physical endurance, and SPWC mainly depend on relaxation characteristics of the muscles.

That is why our data should be studied as the evidence of the fact, that the level of the muscles contractile characteristics, obtained, for example, by the candidate masters of sport and the first rate sportsmen in the process of long-term sports training, is enough to achieve high rate of sportsmanship which is limited by the level of special physical working capacity of the muscles.

Mentioned above facts, in our opinion, are very important for understanding the role of myorelaxation in increase of
special physical working capacity in all kinds of sport as in all of them require speed, speed endurance or coordination, or the cooperation of these qualities which directly depend on special physical working capacity of the muscles. However, the most important role in understanding and interpretation of physiological mechanisms of special physical working capacity and resistance to physical loads, especially in extreme conditions, plays nonspecific inhibitory – relaxation functional system of urgent adaptation and protection (IRFSP) of the organism from extreme effects and its activity (capacity) influence on formation of three types of a long term adaptation (relaxational, hypertrophical and transitional). The experiments proved the advantage of a long term adaptation relaxation type; this type of adaptation develops in sportsmen with high special physical working capacity of the muscles and with the high activity of IRFSP and this provides a high level of physical working capacity and at the same time, a person’s health saving in extreme conditions. We also stated that hyperexcitability of central nervous system is the main factor which limits the opportunities of IRFSP [8, 11]. The relaxation type of the individual development is more advantageous in all meanings. The people of the relaxation type have equilibrium of excitatory and inhibitory processes of central nervous system, a high speed of muscles relaxation, great regulation and coordination of the movements, good reaction to moving objects and this provides minimization of sport, everyday and street traumatisms. They have dominant the most efficient eukinetic type of blood circulation, high profitability and effectiveness of heart activity, minimal level of energy expenditures, low level of metabolites of energy metabolism, adrenalin and stressor hormones, but higher level of noradrenaline and anabolic hormones at rest and in case of testing loads, high speed of renewal processes and resynthesis of energy resources, high physical working capacity and endurance. They have high level of stress resistance, immunological resistance, 2-3 times rarely than the people of the hypertrophic type undergo overexertion and diseases. The sportsmen of the relaxation type in comparison with the sportsmen of the hypertrophic type have longer sports life, easier overcome physical and psychological loads, 8-10 times rarely undergo different kinds of overexertion, trauma and diseases and achieve the highest sport results [5, 8, 11].

With the increase of the speed of muscles relaxation and formation of the relaxation type of long-term adaptation decreases sports traumatism of the athletes from 100% (in case of special physical working capacity less than 4,01/second) to 0 % (in case of special physical working capacity more than 9,01/seconds) and their health becomes stronger. Our long-term research works testified to the fact that even in the most dangerous kinds of sport traumas can be almost fully avoided (excluding traumas in case of evident rules violation) by means of correct organization of the training process directed at balance normalization of nervous processes, increase of special physical working capacity of the muscles and formation of the relaxation type of long-term adaptation.

In further series of experiments took part 320 pupils and qualified sportsmen (age range from 6 to 32 years old). As an adaptogenetic factor veloergometric physical load of maximum intensity was used. Even at the age range of 6-11 years old a very high speed of voluntary relaxation of the muscles (SPWC) was registered. Then it gradually decreased and to 14 years became minimal (decrease to 22,3%). After 14 SPWC of the muscles again started to grow till 29 years old, and that level of SPWC which was in early age (6-11 years old), was achieved only to 20-25 years old. The same was the age dynamics of the inhibitory – relaxation functional system of protection (IRFSP) power. At the age of 6-8 the children had a high level of the inhibitory – relaxation functional system of protection (IRFSP) power. Then it decreased (to12,6%) becoming minimal to the age of 13-15. After 14-15 the inhibitory – relaxation functional system of protection (IRFSP) power increased and to the age of 23-25 became maximum and then decreased a little to the age of 29. The same character of dynamics of these parameters had women, but their decrease at the age of 13-15 was less sharp [4, 7].

**Conclusion.** Mentioned above factors, in our opinion, vividly prove the importance of myorelaxation in the increase of SPWC in all kinds of sports activity as all of them have high demands to speed, speed endurance, coordination or all these qualities which are in close connection with SPWC of the muscles.
Also should be noted highly reliable correlation connections of SPWC with all main components of movements coordination and with sport results in high coordinate kinds of sport. Important are the data about great influence of SPWC on the degree of contractile characteristics of the muscles realization. This influence in case of low SPWC is in the fact that during the quick movements fulfillment the muscles meet considerable resistance from their slow relaxing antagonists and that is why can’t fully realize their contractile characteristics, especially speed. As a result, there is high energy waste and decrease of the maximum speed and movements tempo, appears so—called “speed barrier” and decreases the level of special physical working capacity.

In the end we should notice that a search for a new complex system of a special physical and functional training is necessary, the use of which since childhood will provide universal development and perfection (training) of the inhibition – relaxation processes, defense mechanisms improvement and formation of more rational relaxation type of a long term adaptation and individual organism development.

Bibliography

18. Tkhorevkyi, V.I. Blood supply of skeletal muscles in case of statitical and dynamic work: abstract
from the thesis of the doctor of medical sciences / V.I. Tkhorevkyi. – Moscow, 1967. – 24 p.