Myorelaxation in Increase of Efficiency of Training Process of Athletes

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Abstract At the present time a number of various ways of sportspersons' special physical capability based mainly on training and competitive loadings ramp up. They are effective enough to reach the main goal, but none of them provides sportspersons' health safety. Moreover, with the increase in volume and intensity of the loadings, which in sport have almost reached their limits, the sport traumatism and morbidity rate grow progressively. Proceeding from this, there was an evident necessity for the search of conceptually new ways for a simultaneous solution of these two the most complex and, in the opinion of many research workers, almost incompatible problems - the problem of achieving the highest levels of special physical working capacity, and the problem of sportspersons' health maintenance and improving - associated by us into one general problem of human motor activity efficiency enhancement. Therefore it is necessary to physiologically substantiated the basic methods and principles of special relaxation training, directed on increase of efficiency of process of training of sportsmen at all stages of the development of athletic skills. Under the efficiency of the motor activity, we understand achieve the highest levels of the special physical performance while maintaining sports longevity and health of athletes.

Keywords Extreme Conditions, Protection Functional System, Muscle Relaxation Rate, Physical Efficiency, Central Nervous System, Relaxation

1. Introduction

Professional tendencies of the last years are connected with steady growth of loadings in practically all kinds of human professional activities. The consequence of this is often the disturbance in the work of regulatory mechanisms, that essentially decreases the level of physical capability and can result in various unfavorable vegetative shifts in health state[3, 6, 12], the problem of providing effective training of sportspersons in extreme conditions of life activity and creating functional preconditions for health saving being more and more topical. One of the ways to solve this problem is attracting modern effective and physiologically substantiated technologies with the simultaneous use of the functional state correction and complex diagnostics rational system. Such an approach allows widening the diapason of compensatory abilities of the body against the maximal volume and intensity of professional and psycho-emotional loadings. The provision of optimal adaptation to muscular loadings can appear one of the conditions for the health level maintenance and professional mastery quality increase[6, 10, 11, 13].

Certainly, the given problem acquires a special meaning in modern conditions of the human professional activity. It finds its reflection in a series of works connected with the idea of loading criticism both in sport and other areas of professional activity[7, 13].

Together with traditional approaches a great experience of using a whole range of non-traditional means (baro-chamber, hypoxic and hyper-pyretic effects, special breathing exercises, methods of biological feedback, methods of active self-adjustment and relaxation, etc.) within the system of sport training has been accumulated. Together with that it is necessary to note that among the non-traditional means of effect on the functional state of the human body a careful attention has lately been paid to myorelaxation methods, which such features as action safety, relative easiness of effect achieving and not high financial expenditures are typical of. Relaxation, on some authors' opinion, is considered as an alternative or compliment to the functional state correction[1, 14, 16]. That is why it is often presented as a means of prophylaxis, correction and emotional stresses elimination. Thereat, as many note[16 and others], it is the leading one in the series of methods allowing achieving necessary changes in the body's functional state.

In physiology an active process of muscular tone and psycho-emotional tension decrease[8, 14, 17] are meant by relaxation. At relaxation there appears a trophotropic state, the level of anxiety, psychological and physiological response to stress effects decreases. Besides, relaxation is
attended by a considerable reduction of afferent and efferent
impulsation. As a consequence we can speak on the fact that
the introduction of relaxation methods aimed at the
prophylaxis, correction and negative psycho-emotional states
elimination into practice can promote adaptive capabilities of
the body[6, 9, 15].

The relaxation methods have also found their application
in the correction of a range of pathological states,
hypertensive disease treatment, acute and chronic painful
states taking down inclusive of sport activity[2, 4, 16]. The
state of relaxation lies in the foundation of meditative
methods. Meditation and relaxation exercises have a wide
diapason of application, most often they are used in
transcendental medicine[8, 9, 10, 14].

The value of muscles relaxation function in human sport
and labour activities is difficult to overestimate. In a series of
works[1, 6, 9, 18, 19] a healthy influence of special exercises
enhancing the function of skeletal muscles relaxation on the
central nervous system, visceral organs' and systems' activi-
ties, rational blood circulation types formation, motion
coordination, tempo, stamina, technical skills, special
physical working capacity and sport results growth were
proved.

The investigations proving the leading role of inhibitory
systems of the central nervous system and skeletal muscles'
arbitrary relaxation rate in the most important manifestations
of life activity of the whole body: in the mechanisms of
timed and long-term adaptation to more physical, hypoxic
and hyper-pyretic loadings; in the mechanisms of heart
adaptation and various blood circulation types formation; in
the mechanisms of muscles blood supply and muscular
activity energy supply; in the mechanisms of physical
overwork stability improving, prevention of risks, traumas
and diseases, and also in the body's mechanisms of defence
from extreme conditions or factors and sportspersons
rehabilitation[4, 5, 7, 16], are especially meaningful, in our
opinion.

It should also be noted that all the most effective methods
of psycho-regulation, self-adjustment and auto-training used
in special psychological preparation of sportspersons and the
latest health-improving technologies[8, 14, 15] are based on
relaxation.

2. Methods

To study the mechanisms of regulation and coordination
of arbitrary movements control the contractile and some
relaxation characteristics of skeletal muscle, functional state
of the central nervous system (CNS) and neuromuscular
(NMS) systems we used the method of computer
polymyography, designed by Yu.V. Vysocin, which is used
for preparation of sportsmen of national teams of Russia and
St.-Petersburg. Marked indicates its high informativeness
and reliability[5, 6].

Polymyography is based on synchronous graphic
recording of the bioelectric activities and strengths (in the
form of the elektryogram and the dynamogram, respectively) of the quadriceps muscles of both thighs during
their maximally rapid and strong contraction and relaxation
in the isometric mode. When deciphering polymyograms, we
estimated the rates of the motor reactions of contraction and
relaxation; the rate of development and the strength of
excitatory and inhibitory processes in the CNS; the
inhibition-excitation balance in the CNS; the relative rate of
voluntary muscle contraction, or the so-called explosive
characteristics of muscles; the relative maximum voluntary
muscle strength; the rate of voluntary muscle relaxation; and
the general functional states of the muscles, CNS and NMS.
In addition, we used the ratio between the relative maximum
voluntary muscle strength and the rate of voluntary muscle
relaxation to calculate the classification index of the type of
long-term adaptation or individual development.

3. Results and Discussion

In a series of experiments was attended by about 600
sportsmen of different skills. Summarizing the results of our
longstanding research we can substantiate the main ways and
principles of special relaxation training, aimed on higher
effectiveness of training process of sportsmen at all stages of
development of sport skills. Under effectiveness of motional
activity we understand achievement of the highest levels of
special exercise performance (SEP) at condition of total
preservation and improvement of sportsmen's health.

Nowadays there are known different means of sportsmen's
SEP improvement, based basically on increasing of training
and emulative loads. They are quite effective for achieving
the main target, but none of them provides preservation of
sportsmen's health. Moreover, when the amount and
intensity of exercise stress increase, sport traumatism and
morbidity increase progressively. As well as the amount and
intensity of exercise stress in sport almost reached their
limits already. There are well known different means of
health improvement; most of them consider moderate
physical activity of low intensity to have the leading
health-improving role. However this approach does not
contribute to progress in special exercise performance and
sport results. That is why it was obviously necessary to find
fundamentally new ways to solve these two very
complicated problems at the same time - how to achieve the
highest levels of special exercise performance and how to
preserve and improve sportmen's health. In opinion of many
investigators, these problems are almost incompatible. We
have combined these problems into one common problem -
to make man's motional activity more effective. In several
sets of experiments, in which sportsmen of different levels of
proficiency and different specialization took part, we have
found direct significant dependence between SEP and, of
course, sport results and velocity of voluntary relaxation
(VVR) of skeletal muscles[12]. In most kinds of sport (in 17
from 20) meaning of SEP in the progress of sport results,
especially at the stage of higher sport mastery was
considerably higher than the meaning of contractile properties of muscles. In such kinds of sport as box, hockey, football, skating, decathlon and swimming SEP was not only leading, but also the only one of all polygraphy parameters, which defines qualification growth. In some kinds of sport (football, skating, decathlon, swimming), for example, maximum muscles force of the sportsmen of high level of proficiency was slightly (not authentic) lower, than at the sportsmen of lower level of proficiency. This fact in no way means that contractile properties of muscles do not play any role in efficiency mechanisms. On the contrary, they are very important because muscles contraction provide physical action. And duration of this work, i.e. exercise tolerance and, correspondingly, special exercise performance considerably depend on relaxation characteristics of muscles. That is why our data should be considered only as a proof of the fact that the level of development of muscles contractile properties, acquired, for example, by candidates to master of sports and the level of development of muscles contractile properties, our data should be considered only as a proof of the fact that depend on relaxation characteristics of muscles. That is why correspondingly, special exercise performance considerably depend on relaxation characteristics of muscles. That is why our data should be considered only as a proof of the fact that the level of development of muscles contractile properties, acquired, for example, by candidates to master of sports and 1-grade sportsmen in the process of long-term sport training, is already sufficient for achieving the top of sport skills; and achievement of this top is limited mainly by the level of muscles VVR.

The above-mentioned facts, in our opinion, are quite important for understanding of the role of myorelaxation in increase of SEP in all kinds of sport activities, because in each of them there are very high requirements in velocity, velocity tolerance or coordination, or different combination of these qualities, which directly depend on muscles VVR.

However the most important role in understanding and interpretation of physiological mechanisms of SEP and tolerance to physical activity, especially in extreme conditions, is played by common nonspecific inhibitory-relaxation functional protective system (IRFPS) of organism against extreme impacts and influence of its activity (capacity) on forming of three different types of long-term adaptation. Experimentally big advantages of relaxation type of long-term adaptation were proved; this type of adaptation develops at sportsmen with high VVR of muscles and highly active IRFPS, and it provides achievement of the highest levels of exercise performance and preservation of health in extreme conditions at the same time. We also ascertained that heightened excitability of CNS is the main factors limiting the capacity of IRFPS[8, 12].

The relaxation type of individual development is the most profitable in all intents. For relaxation type persons the CNC exciting and inhibitory processes' balance, high rate of muscles' relaxation, excellent regulation and movement coordination, perfect reaction to moving objects, that guarantees the sport, everyday and street traumatism minimization, are specific. The most economical - eukinetic muscles' relaxation, excellent regulation and movement coordination, perfect reaction to moving objects, that guarantees the sport, everyday and street traumatism minimization, are specific. The most economical - eukinetic circulation type prevails in them, the cardiac performance high economical efficiency, the minimal level of energy consumption, a decreased concentration of energy exchange metabolites in blood, a high rate of reparative processes and resynthesis of energy resources, excellent physical performance and stamina prevail in them. They excel with an increased stress tolerance, twice or trice as seldom they are subject to overwork and diseases, as compared to the hypertrophic type persons. Relaxation type sportsmen, as contrasted with hypertrophic type ones, enjoy considerably greater sport longevity, stand physical and psychological stresses far easier, are subject to various overworks, traumas and diseases 8-10 times as seldom and achieve the highest sport results[5, 8, 11].

With the increase VVR and the formation of relaxation type of long-term adaptation the sport traumatism decreases progressively from 95-100% (at the VVR less than 4,01/sec) to 5-0% (at the VVR more than 9,01/sec) and, therefore, their health improves the same progressively. Our multiyear investigations testified that even in the most traumatic kinds of sport, one can almost fully make away with injuries (except for the traumas emerging at gross violation of game rules by the rival) due to the correct organization of the work-out session aimed at the CNC nervous processes' balance normalization, muscles' VVR increase and long-term relaxation type formation.

In the next series of experiments 320 schoolchildren and qualified sportsmen (aged from 6 to 32) took part. As an adaptogenic factor a veloergometric exercise of maximal intensity was used.

At the age of 6-11 already a very high muscles' VVR was registered. Then it gradually decreased and by 14 years old became minimal, having deteriorated by 22, 3%. After 14 the muscles' VVR started gradually increasing again up to the age of 29, and the early age (6-11) VVR level was achieved only by 20-25. The age-dependent dynamics of the IRFPS was analogous. Then it progressively decreased (by 12, 6%) achieving its minimal values by 13-15 years old. After 14-15 years old the IRFPS capacity increased and by 23-25 years old took its peak level, and by 29 years old decreased a little. The same character of these parameters' dynamics was observed in women as well, only their decrease at the age of 13-15 was less vividly expressed[4, 7].

4. Conclusions

The above-mentioned facts, in our opinion, are quite important for understanding of the role of myorelaxation in increase of SEP in all kinds of sport activities, because in each of them there are very high requirements in velocity, velocity tolerance or coordination, or different combination of these qualities, which directly depend on muscles VVR.

It should also be said here about the VVR highly authentic correlation relationships with all the principal components of motion coordination and sport results in various sports. The data for a significant influence of the VVR on the contractile muscles' properties realization degree also deserve attention. The enumerated facts, from our point of view, are meaningful enough to understand that important role, which is played by myorelaxation in the special physical capacity growth in all kinds of sport activity and sports persons' health maintenance.

In the conclusion we will note that it is necessary development of a brand new complex system of special
physical and functional training, the use of which from the early child age will provide the all-round development and perfection (training) of inhibitory-relaxation processes, one's own defence mechanisms and formation of the best rational types of long-term adaptation and individual development for an organism.

REFERENCES


