Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XVI, ISSUE 2 Supplement, 2016, Romania
The journal is indexed in: Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengace Learning, Cabell's Directories

Science, Movement and Health, Vol. XVI, ISSUE 2 Supplement, 2016
September 2016, 16 (2, Supplement): 364-369
Original article

SWIMMING NEUROMUSCULAR CONTROL

a
CIOROIU Silviu Gabriel[1], NECHITA Florentina[2]

Abstract*

Aim. Swimming is a sport that can be practiced by all people regardless of age or sex and contributing to the improvement of cardiovascular diseases, rheumatic, orthopedic and neurological disorders.

Improve neuromuscular control should be an important objective in this sport, because with increasing its quality occur optimization of other parameters. Muscular effort to execute movement is reduced significantly and therefore during practice exercises you can perform more complex and with greater amplitude.

Conclusions: Entering simulator training provides conditions for sports swimmer can receive real-time information strictly necessary to check and continue reorganization of the movement. By analyzing the information received on this path is correct not only the form of movement, but also the length of the drive, there is an increase of strength, speed and power.

Keywords: swimming, neuromuscular control, reflex arc, muscle contraction.

Introduction

Swimming is one of the most practiced sports since no restrictions typical of most sports. Swimming is open to all age groups can practice regardless of physical condition, requiring no special equipment or "co-teammates" and can be practiced by pregnant women without risk. Swimming is one of the healthiest sports, due to special conditions involved: horizontal body position, support both mobile and braking factor consisting of water, requiring more intense high pressure breathing movements (fig.1).

Aquatic therapy means using water as a therapeutic and has its origins many centuries ago. It was used both to treat various diseases and as a means of restoring post effort (and here it's primarily sports effort), but also as a means of recreation.

Execution of movements in water is relieved because, under the principle of Archimedes, a body immersed in a liquid "lose" part of its weight (2). Thus, the muscular effort to execute movement is greatly reduced, therefore during restoration or recovery can run more complex exercises and with greater amplitude.

The biggest advantage of swimming is that muscles and joints work without having to bear any weight. Thus, over two thirds of the entire muscle surface develops without joints to suffer. Moreover, ligaments reinforce and develop their flexibility. Develop strong muscles and ligaments proper body posture means a greatly improved appearance (Cioroiu, 2014).

Muscles are an important component of the body, accounting for approximately 40-45% of total body weight. They are a highly specialized tissue, achieving movement whose primary function. The human body contains more than 650 muscles (fig.2).

All muscle cells to contract by converting chemical energy into mechanical energy used to achieve movement. An important role has motor plate, which is "synapse" between the terminations axonal membrane of the muscle fiber and motor neurons (fig.3). Characteristic chemical mediator motor plate is acetylcholine. In sarcolemma acetylcholine receptors exist that will contribute to membrane depolarization and onset of action potential.

The action potential diffuses through the membrane by T tubules Ca 2+ channels and activates the RE. In the presence of Ca2 + ions is initiated muscle contraction (Botnar, 2015).

[1] Department of Physical Education and Special Motricity University of Brasov, ROMANIA
[2] Faculty of Physical Education and Sports Mountains, Transilvania University, Brasov, ROMANIA
E-mail address: florentina.nechita@unitbv.ro
Received 24.03.2016 / Accepted 07.04.2016
* the abstract was published in the 16th I.S.C. "Perspectives in Physical Education and Sport" - Ovidius University of Constanta, May 20-21, 2016, Romania

Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XVI, ISSUE 2 Supplement, 2016, Romania
The journal is indexed in: Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST, DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengace Learning, Cabell's Directories

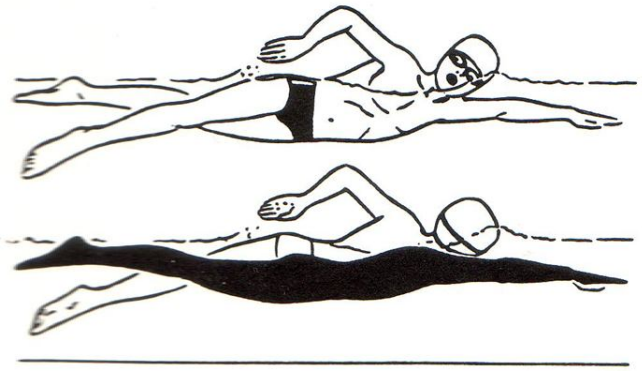

Fig. 1. Style crawl, (1).

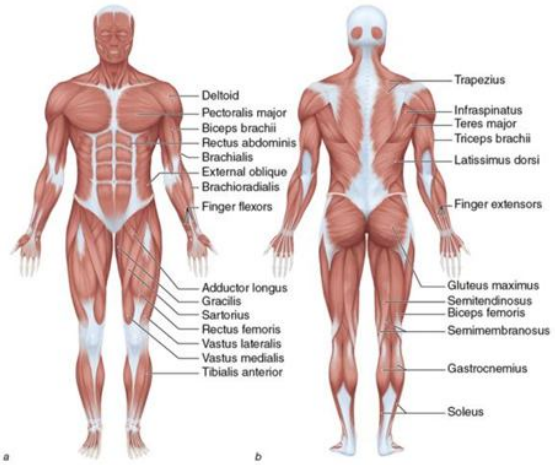

Fig.2 Selection human body muscle groups, (3).

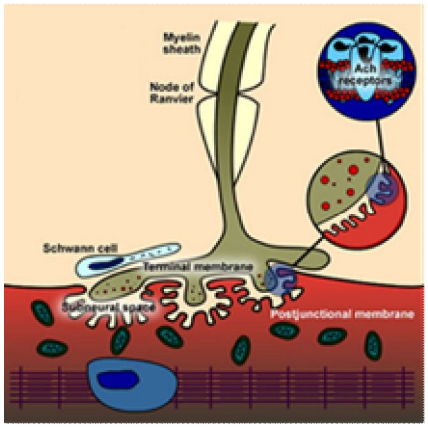

Fig.3 Motor plate, (Botnar, 2015)

Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XVI, ISSUE 2 Supplement, 2016, Romania
The journal is indexed in: Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST,
DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengace Learning, Cabell's Directories

Muscle contraction

"Contraction mechanism has been successively subject to numerous assumptions. The most widely accepted explanation is given by the so-called theory of the sliding mechanism, which issued an initial form of H.E. Huxley in 1964, was subsequently completed with detail. In issuing his theory, Huxley went from a few electron optical observations performed at varying degrees of muscle contraction. Thus, it has been observed that between the thick myosin filaments and actin thin bridges formed during transverse shrinkage, in which the sides of the projections that change their position myosin and attached to the actin. Such cross-bridges that do not occur in actin and myosin areas do not overlap. Sarcomere shortening would be achieved by sliding gradually towards actin filament inside the disc dark. Determining this slip force is applied repetitively to place the cross-bridge interaction between actin. Moving traction and separation is achieved by successive small scale which, combiners, would determine the overall movement" (Harduveli, 2015).

The onset of muscle contraction and to achieve the final relaxation there are the following successive stages:

a) Initiation of the action potential which is realized in normal muscle at the motor plate.

b) Excitation-contraction coupling which includes all phenomena that initiated the action potential sarcolemma sharp increases in the concentration of free Ca2 + from sarcoplasmic necessary training and dragging the cross deck.

c) Conduct cyclic sliding actin filaments. Movement of the head cross a bridge along the monofilament is very low compared with that required a complete swipes actin. It concluded that while shortening the sarcomere, cross bridges undergo a cyclical process of attachment-detachment from actin active areas. It is thus gradually traction inside dark disc. The degree of shortening the sarcomere would depend on the number of cycles (during which the concentration of free Ca2 + remains high) and developed force would be conditional upon the number of bridges cross it locks into every moment of contraction (2și4).

d) Muscle relaxation. " In 1950, noting the relaxing effect of the extracts in vitro muscle, Marsh hypothesized the existence of a relaxing factor. Much later it demonstrated that this relaxing factor is actually a particular fraction containing fragments of RS. Muscle relaxation is associated with Ca2 + uptake in sarcoplasmic free. Reducing the concentration of these ions Ca2 + causes the separation of the troponin C. The whole system thus returns to the rest state with the active troponin I and myosin ATPase by blocking active sites on actin filament. Event at rest it is possible to keep a minim number of bridging the attached actin" (4).

The muscle contraction energog

"The required energy is provided by the contraction of muscle glycogenolysis. The path then carried degradation of glycogen and glucose ranges after muscle oxygenation conditions: anaerobic path generation provides only 2 molecules of ATP, while aerobic conditions increase to 38 the number of ATP molecules as a primary source of energy for muscle contraction snapshots" (4și 5).

Muscle contraction occurs energetically with a succession of energy producing reactions, variable speed and reverse time.

This sequence can be highlighted following local variations in pH during contraction:

- alkaline phase, contractual, of unknown significance;
- acidification phase corresponding ATP cleavage.

In terms of thermodynamic energy supplied muscle must be equal to that which he issued in the form of mechanical work and heat energy phosphate bonds. Mechanical efficiency of muscle, expressed in percentage nutrient chemical energy used for muscle activity, up to 20-25% under optimal conditions, 75-80% of energy is released as heat.

Underlying nervous system activity is reflex function, which performs the connection between different segments of the body and between the body and the environment. Reflex arc is the physiological response to the action of a stimulus that acts on a specific receptor field and has an anatomical substrate called reflex arc (fig 4).

It consists of the receiver, about relating (sensitive nerve), center reflex (located at different levels of the central nervous system), about efferent (usually the motor nerve) and organ effector (muscle, gland). Producing a reflex arc reflex requires integrity, leading to damage any component of qualitative and quantitative changes reflex response.

The reflex arc

Depending on the mechanism is conditional and unconditional reflexes are (fig.4). Unconditional are innate (cough, blink, etc.) and the subject is developed during life. Depending on the number of

Ovidius University Annals, Series Physical Education and Sport / SCIENCE, MOVEMENT AND HEALTH
Vol. XVI, ISSUE 2 Supplement, 2016, Romania
The journal is indexed in: Ebsco, SPORTDiscus, INDEX COPERNICUS JOURNAL MASTER LIST,
DOAJ DIRECTORY OF OPEN ACCES JOURNALS, Caby, Gale Cengace Learning, Cabell's Directories

synapses interposed on the trajectory reflex arc, reflexes are monosynaptic and polysynaptic.

Monosynaptic reflexes: fiber axon synapses directly associated with medullary moto-neuron without interposition of intercalary neurons. The route of transmission is high speed driving and short latency time (in milliseconds 1-2) are strictly limited and does not irradiate (increasing the intensity of the stimulus is therefore only produce a stronger reflex contractions).

Polysynaptic reflexes: the path is characterized by reflex arc of one or more interneurons. Their time is longer reflex (8-12 milliseconds) and reflex response is proportional to the intensity of the stimulus trigger. The application of excitatory intensity gradually increased engine response involves increasingly more muscle groups.

Flexion reflex is a reflex defense, caused by a harmful agent (touching a hot object, stinging, electricity), which stimulates pain receptors (free nerve endings in the skin of the hand, for example). It consists of a contraction.

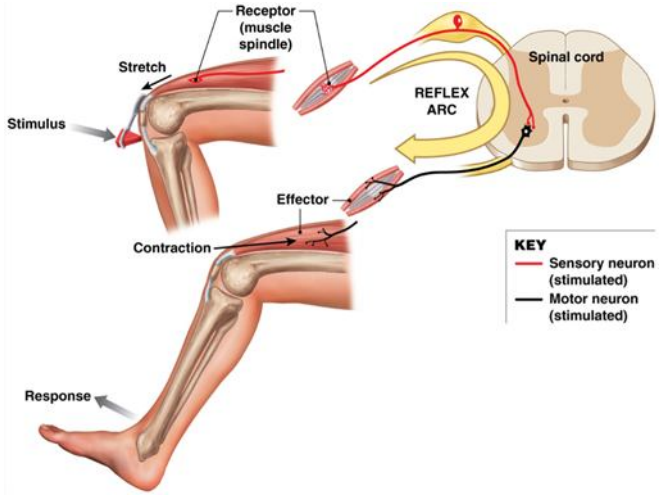

Fig. 4 Reflex arc, (6).

Polysynaptic reflex arc includes a variable number of intercalary neurons, located between the neuron and the somatosensory and somatomotor latency is longer and obeys the law irradiation.

The main somatic reflexes are reflexes miotatics and spinal nociceptive reflex and walk.

Miotatics reflexes are sharp contraction of a muscle in response to stretching his tendon. They are monosynaptic. Receptors are represented by proprioceptors muscle - the muscle spindles. Miotatics reflexes have role in maintaining muscle tone and posture.

Nociceptives reflex withdrawal of a member consisting of response to painful stimulation thereof. These are reflexes of defense - polysynaptic reflexes. Reflex walk. Overcoming rhythmic movements characteristic of a member, consisting of flexion to its previous followed by extension to the rear. Flexion occurs again and the cycle repeats. These alternating works is done by mutual inhibition of neuronal circuits created between spinal neurons that contracts the muscles agonists and antagonists who contracted muscles (7).

Development of quality basic motive - force simulator using the swimming conditions

Improve neuromuscular control, especially to the specific, from the outset it was the main goal that I had in mind, assuming that with increasing its quality, and other parameters will be much improved. Both correct form of movement, the length of traction (so important in swimming), as well as increases in strength, speed and power mentioned is because the main effect that it has information on sports training,

namely increased neuromuscular control, both the general as and the specific.

Simulator training covers a wide range of conditions working methods. Training is individualized depending on the processes swimming and auditions of each athlete. To get information as accurate and closer to the level of training of athletes is proposed to workout simulator tests of control and verification. After analysis tests, as well as specific training supported by athletes in the pool, go to training schedules customized simulator pursued that in them to intervene on or improve certain parameters (strength, speed, length).

In the first phase is introduced into a workout program specifically aimed precisely planned objective. Through a computer program is offered athlete "A" as a model, a certain level of traction on the arms, gradually increasing level up to the amount proposed. This value is close to the maximum force the athlete can develop during a race, and the maximum can be determined through a maximal tests conducted by sports, for example, a distance of 100 m. Us to be more precise illustration to present concrete situation.

During training an annual cycle, besides the development parameter force will pursue other issues: raising the level of force, optimizing the length of the drive arm to limit physiological symmetrization parameters of action of the arms by means other than those used swimming basin, adjusting the parameters involved in specific movement (length traction, pulling force for action for recovery).

Discussions

We propose the following tests coded: TEST 1 year requirements are performing 20 cycles crawl style, the force of the proposed model athlete gradually increasing to 3.8 daN. The realization of force proposed the athlete determines the amount of notes on each execution this is reflected in the value of the note averages end of the year.

The average mark in the month planned is the value obtained (the higher average mark is higher the exercise is performed more correctly the maximum grade is 10). In this situation average thrust level indicates a relative compliance with the conditionality of exercise. TEST 2 requirements exercise: performing 25 cycles crawl, gradually increasing the force up to 4 daN. Scores and be slight fluctuations in the evolution of the notes exercise. Thus the average force will indicate that the exercise is conducted with ease and continuity with the transition from one stage to another force and the force required 4 daN is easily supported. So it will be obvious increase of force, given that the number of cycles required increases, so enabling the athlete to "mobilize" more force in a sample.

Due to the increasing strength and power on the active motion crawl, the athlete can develop the samples resistant (400m, 800m, 1500m) greater force than the current one. This leads to greater automation of movement which, in one race, the athlete gives them the opportunity to focus more on how they distribute effort and race tactics. Thus, we can say that after performing this type of exercise will athlete realized the importance of dosing effort in a race and will learn how to do this. (Ignat, 2006).

During training simulator Athlete is offered conditions to take direct knowledge of the values of the movement parameters and according to some references in real time to correct any deficiencies.

One of the general principles (Cioroiu, 2014) underlying conditions for achieving a sports simulator, is providing instant information strictly necessary to check and continue reorganization of the movement that correlates with the energy potential time changes. The coupling of the computer allows taking signals from the transducers, processing, and displaying in real time, as the variation graphics or numerical values of those parameters of interest.

By manipulating information in sports training is not only correct form of movement, but also the length of traction occur increased strength, speed and power, which are the main consequences of introducing information in real-time sports training. In fact it boosts neuromuscular control general and specific.

In specialty literature, Popa, Andreescu and Ignat, 2010 say that: "by increasing neuromuscular control is obtained right-left symmetrization of all parameters of interest and characterize the specific movement of a swimmer: mean values strength, speed, power and traction length". It was found that providing information in real time by swimming simulator, leads to correcting the shape of movement in a very short time, much shorter than it would do so in normal training. It used a special computer which illustrates the absolute position of the movement arms.

This program requires a particular athlete beginning and end of the movement, enabling us to intervene (through verbal methods and other auxiliary methods) both during construction and after its completion. If these conditions imposed are not met, the program removes their respective cycles,

thus forcing the sport to correct the focus is on quality of movement.

If you do not meet the conditions, the athlete can work two to three times more until the correct movements and performs number of cycles required.

Conclusions

1. System allows detection and awareness of technical mistakes and proprioceptive sensations related to specific movement (attack - traction - release);

2. By providing real-time information is made "here and now" motion control and correction;

3. To achieve the correction of asymmetry found is necessary both offering a model of traction length, and one form of force the athlete must follow during construction.

Aknowledgements

Thanks to everyone who helped me to realize this material, which I have provided bibliographic materials.

References

Cioroiu SG, http://www.scribd.com/doc/22327941/SANATATE-inot, accesat 2014, ora 14.00;

Botnar Y, http://documents.tips/documents/structura-muschilor.html, accesat 2015, ora 13.10;

Harduveli L, http://documents.tips/documents/forta-elastica-musculara.html, accesat 2015, ora 12.00;

Ignat C, 2006, Development perimeter using force in swimming conditions simulator, National Research Institute for Sport, Bucuresti, http://www.sportscience.ro/html/articole_conf_2006_-_29.html - accesat 07.06.2010;

Popa E, Andreescu L, Ignat C, 2001, Asymmetries of power arm length traction and left - right movement swimming. Correction by providing real-time information, http://www.sportscience.ro/html/articole_conf_2001 -_50.html -accesat 07.06.2010);

(1)https://www.google.ro/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwj4mdDWxMPMAhUKtBoKHdcoB8gQjRwIBw&url=http%3A%2F%2Fswimmingpedia.blogspot.com%2F2013%2F06%2Ftehnica-corecta-de-inot-03.html&psig=AFQjCNFTu6m2BCavTxBO2BYGj9F4KSNHQA&ust=1462558372272893, accesat 2016, ora 21.41;

(2)(http://www.agerpres.ro/flux-documentare/2015/03/25/stiinta-legea-lui-arhimede-09-48-35, accesat 2016, ora 19.12);

(3)https://www.google.ro/search?q=Human+body+muscles+image&newwindow=1&tbm=isch&imgil=DPX46WJLCqid_M%253A%25, accesat 2016, ora21.26;

(4)http://www.referatele.com/referate/noi/2/2fiziologie.php, accesat 2016, ora 15.20;

(5)http://cristiankinetoterapy.blogspot.ro/2012/06/mecanismul-biochimic-al-contractiei.html#.VyuB-3pS36c, accesat 2012, ora 10.19

(6)https://www.google.ro/search?tbm=isch&tbs=rimg%3ACac-QbE67aJlIjgAMDvdEfgBDu2vvEMGLnpgozl_1hPM1VmU6a4ynKVSPXsTuBK6wcmIFVI7pW_1hHmKsTIxDn2iytjSoSCQAwO90R-AEOEV4oWKi3nKB_1KhIJ7a-8QwYuemARVt1NSicRcE0qEgmjOX-E8zVWZREETSF6XigOTSoSCTprjKcpVI9eEVbdTUonEXBNKhIJxO4ErrByYgURqwi_1bNr-JGYqEglUjulb-EeYqxGMsnqPFXrCCioSCRMjEOfaLK2NEduzVFSEuUuN&q=imagini%20placa%20motorie%2C&ved=0ahUKEwjwgbmZrMPMAhXIzRoKHRu2Aj4Q9C8ICQ&dpr=0.9&biw=1525&bih=708#imgrc=c6sNIpd8ZQWN8M%3A, accesat 2016, ora 21.22.

(7)http://www.scribd.com/doc/2215234/Sistemul-nervos-3-, accesat 2014, ora 15.30;