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Electrical muscle stimulation and its advantages

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Abstract

Suppose a series of stimuli stimulate an inactive muscle. In that case, the first few contractions are usually small and disorganized. The role of relaxation in them is relatively incomplete. With the continuation of the muscle work, larger contractions follow, i.e. the force of contraction is stronger. The relaxation is complete, and this is due to the warm-up exercises during the first contractions in the muscle. The same, during which the wastes of vital activities are formed in the muscle, as well as heat generation, which raises the temperature of the muscle, i.e. (thermal factors and vital wastes), are the ones that work to expand the blood vessels. Hence, the blood supply to the muscle tissues increases due to the blood flow inside the medium blood vessels, and this improves the functional condition. The efficiency of the muscle increases due to the arrival of a sufficient amount of oxygen and nutrients carried by the blood. This research discussed the concept of electrical stimulation of the muscle, how it works, and the method of implementing this stimulation in the sports field, leading to the results of the research and a list of sources and references.

Keywords: Muscle stimulation, disorganized, electrical stimulation

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Search problem:

Warming up means raising the temperature of the muscles by causing simple muscle contractions that produce heat energy. Warming the muscles involved in the effort before starting the exercise is necessary to better perform the effort and protect the muscles, and if the muscle is involved in the activity without heating, it leads to the tearing of the muscle fibers in the areas of contact with it. Tendon; Especially in violent and sudden sports, performing warm-up and muscle contraction and relaxation exercises reduces the role of contraction and relaxation of the simple inotropic curve and increases the height of the contraction curve at the same time.

If the inactive muscles are stimulated by a series of stimuli, the first few contractions are usually small and disorganized, and the role of relaxation in them is relatively incomplete. Then as the muscle continues to work, followed by larger contractions, that is, the force from the contraction is stronger and the relaxation is complete, due to warm-up exercises during the first contractions of the muscles, the same during which the remnants of vital activities were formed in the muscle, as well as heat generation, which increases the temperature of the muscles (thermal factors and vital waste) that expand blood vessels, and thus the blood supply to muscle tissue increases due to intravascular blood flow Hematological medium, this improves the functional state. Access to an adequate amount of oxygen and nutrients carried in the blood.

In sports and due to lack of warm-up, muscle fibers are torn, usually in the opposite muscles of the symmetrical muscles, which contract at a high intensity during the effort (because they relax slowly and incompletely when the symmetric muscles contract), thus impairing movement and coordination, and on the other hand, the force of muscle contraction. Their tendons are in the areas where they connect to the bones.

The concept of electrical muscle stimulation:

Electrical muscle stimulation technically means muscle contraction by giving electrical waves to the muscle. These electrical waves are generated by a special electronic device. These waves are distributed through the ends of the electrodes wires to the surface of the skin directly above the muscles that will be stimulated, and in general, the electrodes are lined with adhesive Until they stick on the skin and facilitate the arrival of the waves to the stimulating muscle, and these waves are similar to the latent action of the waves coming from the central nervous system to stimulate the muscle to contract.

The term electrical muscle stimulation is recent in training, as it is considered as a technical supplement in sports exercises to help develop muscle strength, which has a peculiarity in skilful performance, as there has recently been a noticeable interest in using electrical muscle stimulation as a method of qualitative training, especially after the success of electrical stimulation. In the

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therapeutic aspect, especially in psychological treatments and for many types of deficiencies in the nervous and muscular systems, and this type of training is one of the highest levels of specialization in the development of muscle strength in quantity, quality and timing. This method relies on the technique of stimulating the muscles through an electrical variable whose intensity, duration, and muscle groups required to be stimulated to contractions are controlled.

The muscle contraction in electrical stimulation does not occur through voluntary nerve impulses directed through the central nervous system but rather through electrical stimulation of the muscle, either directly by placing the electrode directly over the muscle, or this stimulation is done indirectly by stimulating the nerve supplying the muscle, which leads to its contraction.

Figure showing electrical stimulation of a muscle

And Bushra Kazem Abdul-Ridha (2005) states, quoting Benton (Benton 1980), "It requires the electrical stimulus to contract the muscle to stimulate the motor nerve at a specific motor point. This motor point is located at the entrance to the motor nerve of the muscle, and the motor point is set through the surface of the skin. It is the place where the greatest muscle contraction is provoked with the least amount of current, as these sites can be used to create rhythmic muscle contractions to eliminate spasm or improve muscle strength". .This type of training is also called the term electrical training, and despite the lack of sufficient studies on the uses of this method in sports training and consequently the lack of clarity regarding the side effects of its long-term uses, the goal of winning world championships, has largely led to the secrecy The results of these uses.

Electrical stimulation is a process directed at the muscle to be stimulated directly in isolation from the auxiliary, fixing or corresponding muscles at work through special electrodes placed on the muscle directly, which are connected to a special device for electrical stimulation that directs electrical waves to the muscle for the purpose of stimulating it involuntarily.

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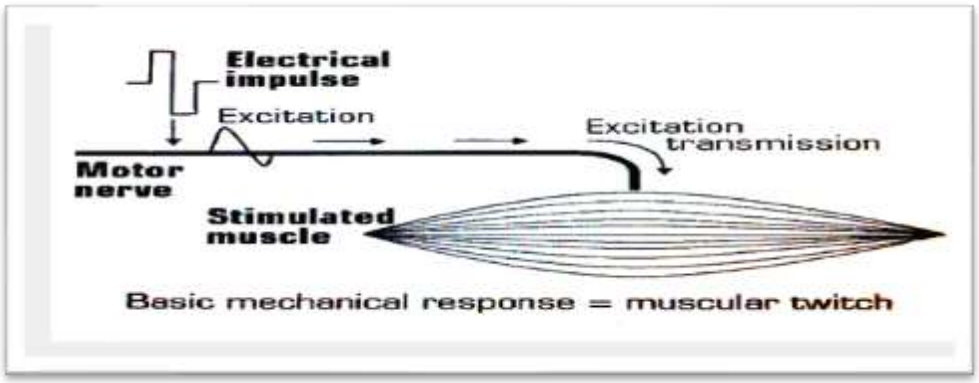
How does electrical muscle stimulation work?

The brain is primarily responsible for the commands that come to the working muscle in relation to voluntary or voluntary action as it is known, and that the brain sends commands to the nerve fibers through electrical signals, this signal is then transmitted to the muscle fibers, for the purpose of contraction. The brain is also the real responsible for the electrical stimulation of the muscle, as well as monitoring the progress of the production of the electrical stimulus during voluntary contractions, as the stimulus is sent in the form of electrical waves to the nerve fibers, to excite them, and these excitement are transmitted to the muscle fibers, causing the basic response to movement (muscular tension), which is finally formed. The basic requirements for muscular contraction, that this muscular response is completely identical to what is drawn in the brain of voluntary control of the muscle as a result of the instructions coming from it to control muscular work. Through the foregoing, we find that the muscle cannot work without electrical stimuli or signals coming from the brain. In other words, the muscle cannot distinguish between commands, whether coming from the brain or through stimulation, as shown in the figure below. The devices used in stimulation, especially talking ones Specifies (the number of waves per second, contraction time, rest time, total program time), and the muscle is subject to change according to the type of work, and according to the number of muscle fibers involved in the work. The different devices used and according to the specificity of muscle contraction, as there are different types of muscle fibers, including slow, medium and fast fibers, and fast fibers are known to control the activities of the fast sprint, while in marathon running we need slow fibers greatly. Thus, the progression of muscle work is accurate and according to the type of goal specified for it (muscle strengthening, increased blood flow, general strengthening, etc.).



Electric waves can also stimulate sensitive nerve fibers to obtain a pain reliever or reduce the effectiveness of pain, or by tactile stimulation of the group of nerve

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fibers that transmit pain in the nervous system, and stimulation by another type of sensitive fibers that have a role in creating and increasing the production of endorphin peptides Nervousness, which has a role in reducing pain. Electrical stimulation combined with a pain reduction program can treat acute or chronic pain in well-injured muscles.

Hassan Ahmed and others (1996) add to the use of electrical stimulation for the purpose of treatment, “Where several clinical sessions have recently been conducted to inhibit or reduce pain by electrical stimulation of large sensory nerve fibers. posterior sensory columns".

• Electrical muscle stimulation in the sports field:

Electrical stimulation is no different from any other training method related to sports, especially when it comes to the effect of recent technical progress and the most scientific view that has begun to bear fruit while being given in sports training, as the basics that control the stimulation of nerve and muscle cells by electrical waves have been known since the beginning Twentieth century. The first attempts to use electrical stimulation with sports training were made at the Scientific Academy of Sports in Moscow by Professor Coates. The results he obtained, which were very encouraging as a result of the increase in muscle strength during training for three weeks, proved that the value of the development in muscle strength reached 35%, which is much greater than what was expected, as the expected reached 5% - 15%, and this is a wonderful achievement. , but the problem that Kotz faced is that the electrical stimulation during its application was very annoying to the athletes, as they found themselves subjected to sessions close to torture as a result of the needle prick inside the muscle, which causes pain in the athletes during the stimulation.

In late 1979, physiologist McDonnell conducted a lot of research on these mechanisms in determining muscle performance, however, he found that electrical stimulation could not be used due to very high voltages and the impossibility of creating a huge muscle contraction. But advances in electronics make access to microprocessors radically changed this situation, as it became possible to protect against the risk of burning and eliminate any electrical pain as a result of the use of high-quality devices for electrical stimulation instead of the strange tools that were used to train the muscle.

Recently most sports have taken this direction in training, Italian volleyball players used to use difficult plyometric exercises and training sessions with heavy weights in training, but now it has been reduced due to the use of electrical stimulation. As well as the few injuries that can occur as a result of using these two methods frequently. This method was also applied to younger volleyball players so that they were able to jump vertically for a distance of 43 inches (109.22 cm), and this method also began to spread to football, and electrical stimulation gave great benefits to athletes with cartilage injuries and continuing training. As a result of the increase in research in the medical and sports fields,

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the improvements in performance as a result of the use of electrical stimulation were clearly evident, and in sports after using this method, it began to gradually reduce the use of weight training, for example swimming, as it also began to conduct experiments and research using this method. The technology that was able to improve the performance of swimmers.

But what concerns us in this topic is that the ability of this method to use an external electrical source to stimulate the muscle leads to a noticeable increase in the absolute strength and the actual force, it can gradually decrease and thus increase the results of muscle contraction in its maximum strength by raising the value of the differential threshold for stimulation and thus increases the results of Muscular contraction is at its maximum strength, and several studies have been conducted, all of which have reported excellent results, but the regulation of training doses and rates of use with the rest of the other training methods is still being studied. The recent emergence of this term in training has contributed to covering that aspect of muscular strength that has a peculiarity in skillful performance, and the exercises of this type of training are the utmost specialization in developing muscular strength in quantity, quality and timing. Electrical muscle stimulation as a method of specific training, especially after the success of electrical stimulation in the therapeutic aspect of several types of deficiencies in the nervous and muscular system.

And for the purpose of understanding how electrical stimulation works or is used in the sports field, we explain the method used by the scientist Kumiti (1988) on how to conduct electrical stimulation and as follows:

- The number of muscle groups that can be trained: 3, maximum.
- The appropriate frequency is between 50 - 100 hertz, and the higher the frequency, the more the training field is shifted in the direction of the explosive force.
- The duration of the warning continuation is 3-10 seconds..... depending on the training objective, and as the figure below shows, which arises from the different durations of continuation of the stimulus, different training effects. The duration of a short muscle contraction leads to a speed-strength training. While long periods of stimulation lead to an increase in muscle mass.
- Rest periods between sets: When performing high-intensity alert sets that are mainly directed to develop two levels of maximum strength and explosive power, the rest periods between sets should last from 3-5 minutes. Otherwise, rest periods of 50 seconds are sufficient.

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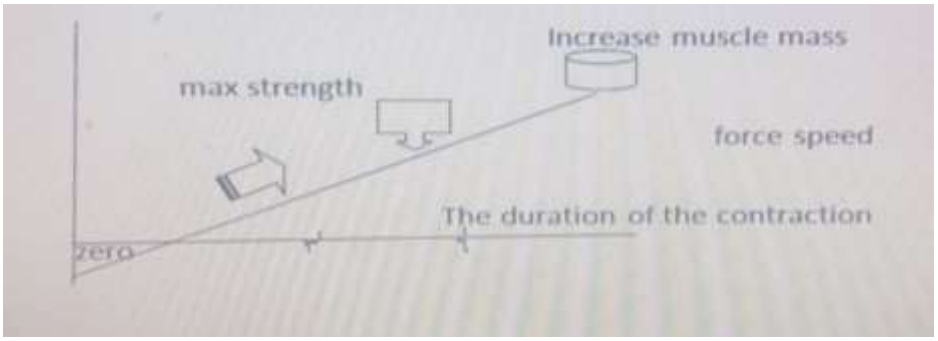

Figure showing the effect of the duration of contraction on the level of increase in muscle size and in determining the capacity of the force being trained.

When performing a normal stimulation and normal rest periods, the duration of the pregnancy is a total of ten minutes for each muscle group, but the abdominal muscles can be stimulated in particular and up to 20 minutes in one training unit. This type of training can also be used in the context of differentiated training as well as in conjunction with other training methods.

Muhammad Hassan Allawi and Abul-Ela Ahmed Abdel-Fattah indicate that electrical stimulation can engage the largest number of muscle fibers when contracting at once, and this does not happen in the case of voluntary contraction, as there is always a part of the muscle fibers that has not contracted.

This indicates that when walking, for example, some elements of the working muscle are used, but in electrical stimulation, the number of contributing muscle fibers is greater, but it is clear that the work in these two activities is very different. In the second example, if it is repeated enough, it can improve the performance of the athlete, so the work of the maximum number of muscle fibers by stimulation can be done if we can control the nature and amount of work so that it improves a certain type of muscle performance.

- **Disadvantages of electrical muscle stimulation:**

As for the disadvantages of electrical stimulation, both researchers agreed that:

• Eliminates the role of the functions of neural regulatory cycles and consensus devices (conformance and organizational processes do not have any role in this training).

• In this training type, the motor units that participate in the work are called in a manner completely opposite to the method used when performing training in a traditional manner, while in the traditional method (voluntary work) at the beginning, small and slow motor units are called, and when the level of force use is increased, motor units are called Bigger and faster (stronger) until at the end of the path the motor units that comprise the strongest fibers are called in. Thus, in this type of training, the normal stimulation method (voluntary action) is turned upside down, as it uses a stimulation model that is not in line with the normal

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stimulation sequence, and thus the electrical stimulation does not contribute to improving the neuromuscular compatibility.

• When using the direct stimulation method, the superficial muscle fibers are stimulated with a degree of intensity (above the maximum), while the intensity level of the stimulus does not reach the level of the excitation threshold for a large part of the deep fibers, especially in the very strong (thick) muscles.... Thus, these fibers do not participate in contraction process.

• Disrupting the mechanisms of psychological and physiological protection against fatigue due to that alert that arises from outside the human body, and this leads to the possibility of the emergence of many damages.

• Results:

Each training method has its advantages and disadvantages, and the following are the most important results that the researcher reached with regard to the advantages of electrical stimulation:-

- Increases muscle strength.
- Leads to the emergence of a strong stimulus for muscle growth.
- Increases the speed of muscle contraction.
- Increases and improves muscle improvement after competition or strong training units, which is considered a healing method.

It prevents early muscle fatigue and saves the effort done by the nervous system because it performs the same tasks that the nervous system does by alerting the muscle fibers.

It engages a large amount of muscle fibers, much larger than the fibers recruited by the brain when contracting a muscle.

- It can be used to train specific muscle groups in isolation, so it can be used in rehabilitation after injuries.

Improves self-control of motivation.

- Relieves the pain.

Improves muscle elasticity.

It can recruit muscle fibers that cannot function during voluntary contraction of the muscle.

- Increased range of motion.
- Increases resistance.
- Increases endurance.
- Develops explosive power.

Increase blood flow to the stimulating muscle.

- When continuing this type of training for a period of 30 minutes, the same result is achieved by performing traditional training that lasts for two hours. Accordingly, the main advantages of electrical stimulation lie in addition to the possibility of using it as rehabilitation training in the possibility of reaching the maximum amount of muscle hypertrophy in Shortly.

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