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REVIEW ARTICLE

Effects of Electrotherapy on Delayed Onset Muscle Soreness (DOMS)

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ABSTRACT

In this article, the reasons for the occurrence of Delayed Onset Muscle Soreness (DOMS) and the effect of electrotherapy on it were discussed. Electrotherapy is a non-invasive and easy method to treat DOMS and muscle fatigue. As a result of intense and abnormal exercise, the creatine phosphokinase enzyme in the muscle increases and DOMS occur. DOMS can be treated with electrotherapy techniques such as micro-current electrotherapy. Micro-currents devices reduce the severity of DOMS symptoms by maintaining intracellular calcium homeostasis. Devices such as Transcutaneous Electrical Nerve Stimulation (TENS) and Micro-Current Electrical Therapy (MET) belong to the category of micro-currents. The number of electrotherapy sessions after the occurrence of DOMS and the frequency of electrotherapy devices are two important factors in the treatment of DOMS. TENS conducts electrical current to the body through electrodes that attach to the skin, and helping to reduce pain by releasing endorphins, a natural painkiller, and blocking the passage of pain to the brain. MET uses resonant frequencies to aid in deeper and longer treatment, increase the body's production of natural catalysts in the healing process, and is more useful in chronic pain than TENS. Research has shown that electrotherapy has been shown to improve DOMS symptoms.

ABBREVIATIONS

DOMS: Delayed Onset Muscle Soreness; TENS: Transcutaneous Electrical Nerve Stimulation; MET: Micro-Current Electrical Therapy; CPK: Creatine Phosphokinase; GCM; Gastrocnemius Muscle; CP: Cerebral Palsy

BACKGROUND

Delayed Onset Muscle Soreness (DOMS) is a sensation of discomfort in the muscles that occurs 24 to 72 hours after exercise. The aim of this study is to find out whether electrotherapy will be useful in treating delayed onset muscle soreness, and what kind of devices have the most therapeutic effect in these cases? In this article, we examine the causes of delayed onset muscle soreness and the mechanism of its occurrence in the body, as well as a variety of common electrotherapy methods, including micro-current devices in the treatment of this problem.

What is "DOMS" and when does it happen?

DOMS is a common occurrence among athletes and its symptoms are usually tingling and a feeling of pain in the trained muscle. While DOMS are very common, the mechanism and methods of treatment and its effect on athletic performance are unclear [1].

DOMS usually occurs at the beginning of the sports season, when the athlete returns to training after a period of inactivity. However, DOMS can also occur between training seasons, when an athlete's training system or training volume and intensity increase [1].

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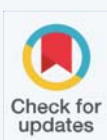
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Intense eccentric activity causes micro-injuries to the muscle, and the more abnormal and intense training, the micro-injuries increase and cause DOMS. Important factors in the occurrence of DOMS are the intensity, duration and volume of training. 6 hypotheses for the DOMS mechanism are presented: lactic acid, muscle spasm, connective tissue damage, muscle damage, inflammation and the enzyme efflux theories [1,2].

Muscle fatigue

When we work too much on one muscle, we get muscle fatigue. Muscle fatigue leads to: muscle weakness, muscle tremors, decreased skin sensory strength, accumulation of metabolites in muscle fiber, and incomplete motor command in the motor cortex [2].

Electrotherapy

Electrotherapy is a non-invasive method used to treat motor injuries. It works by applying electrical current to muscles and tendons, causing muscle contraction and stimulating the underlying nerves. In fact, electrotherapy trains the nerves in the body to reduce spasms [2]. TENS (Transcutaneous Electrical Nerve Stimulation) is a non-invasive, user-friendly device that generates electrical currents and transmits it to the body through electrodes on the surface of the skin to activate the underlying nerves. TENS is used to treat DOMS and reduce muscle fatigue [2,3].

In 2017, J-S Wang conducted an experiment on 20 healthy men in their twenties and concluded: "GCM muscle tone and stiffness significantly decreased and muscle contraction significantly increased in both the TENS and CT groups one day after the intervention ($p < 0.05$). Two days after the intervention, both groups' GCM muscle tone and stiffness decreased and muscle contraction increased, but lateral GCM muscle tone and stiffness significantly decreased only in the TENS group ($p < 0.05$) [2].

In the treatment of electrical nerve stimulation, electricity is used to facilitate and accelerate the healing of damaged tissues. The specialist uses a set of energy waves to create specific physical and chemical changes in the body. Electrical signals block the path of nerve signals responsible for causing pain, stimulate the process of cell repair and regeneration, and release the hormone endorphins, which, as a natural analgesic, help reduce pain. TENS reduces pain in a variety of ways, such as preventing the pain message from reaching the brain, stimulating the body to produce more endorphins, or improving blood circulation [3,4].

Function of micro-current

Devices that work with micro-currents can increase the production of collagen protein in fibroblasts and tenocytes. MET (Micro-Current Electrical Therapy) device that works like TENS devices with micro-current can be useful in

reducing swelling and pain and increasing the range of motion in patients [5].

After intense physical activity, Creatine Phosphokinase (CPK) in the muscle increases. In the experiment that was performed in Aug 2006 by "Bridget Farham", it was shown that in the treatment with micro-currents in electrotherapy, this enzyme was reduced in the target group in DOMS [6]. MET can be very effective in relieving pain. Chaung's study showed that at 100-500 mA, the transfer of amino acids increases by 30-40%, and at 500 mA, adenosine triphosphate will increase by 500% [7].

MET uses resonant frequency waveforms that reduce pain. In the MET treatment process, the body's electrical activity and pathological changes affect the biological circuits, increasing the Nordenstrom (a major catalyst in the treatment process) and resulting in longer therapies. Outcomes will vary from patient to patient, although the goal of MET is to achieve complete pain relief. But factors such as the technology used, the patient's history in previous medical interventions, the patient's pathology will be important and the most important variable in the treatment process is the position of the electrodes. However, it seems that the degree of chronic pain is not an important factor in this treatment and the results of this treatment appear in most patients after one or two minutes in each treatment session.

Instead of placing electrodes on the spinal nerves, use bilateral therapy. Place one electrode in the path of the spinal nerves and the other electrode in the area of pain. With this method, the main pain is eliminated.

The time to stop treatment with these devices is when the patient no longer feels pain. And even if you feel muscle stiffness, treatment for that session should be stopped because MET does not reduce muscle stiffness [8].

CONCLUSIONS

We conclude that:

- Electrotherapy with devices that work with micro-current, will be effective in the treatment of delayed onset muscle soreness.
- Micro-currents reduce the severity of symptoms in muscle injury by maintaining intracellular calcium homeostasis after intense muscle-damaging activity.
- Research has shown that increasing the frequency in electrotherapy devices and the repetition of electrotherapy sessions can help treat DOMS.
- If we want to compare the two treatments of TENS and MET, MET is more economical and MET also works better than TENS for long-term treatments.

DECLARATIONS

Authors' contributions

SH did all the research on her own. She read and approved the final manuscript.

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