RESEARCH PAPER

Russian Current as A Treatment Approach for Muscle Strengthening - A Comprehensive Review

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ABSTRACT
Russian current, initially developed by Russian scientists in the 1970s, is a form of electrical stimulation used to enhance muscle strength and function. This comprehensive review evaluates the efficacy of Russian current therapy for muscle strengthening, neuromuscular adaptation, and rehabilitation. Russian current delivers alternating currents at a frequency of 2,500 Hz, which effectively stimulates motor nerves and recruits both fast-twitch (Type II) and slow-twitch (Type I) muscle fibers. Its ability to recruit a larger pool of motor units than voluntary contractions alone enhance muscle hypertrophy, strength, and endurance. The therapy typically follows a 10/50/10 regimen — 10 seconds of stimulation, 50 seconds of rest, repeated for 10 minutes — to prevent muscle fatigue and optimize contraction patterns. Multiple studies have demonstrated its effectiveness in improving muscle strength and functional outcomes in various clinical populations, including patients with periarthritis, foot drop, osteoarthritis, and muscle weakness post-burn injury. Russian current has been shown to improve peak torque, neuromuscular coordination, and muscle cross-sectional area through increased motor unit recruitment and protein synthesis. Despite its potential, Russian current remains underutilized due to the lack of standardized protocols and limited large-scale clinical trials. This review highlights the need for further research to establish optimal treatment parameters and broaden clinical applications. Russian current therapy represents a promising adjunct to traditional strength training, providing a targeted approach to muscle rehabilitation and performance enhancement. Its ability to improve muscle strength and functional capacity underscores its therapeutic potential in both rehabilitation and athletic performance settings.

Keywords: *Physiotherapy, muscle strengthening, rehabilitation*

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INTRODUCTION

Russian current was originally developed by Russian scientists in the 1970s as a means to enhance muscle strength and function. Russian Current has gained popularity due to its ability to effectively stimulate muscle contractions and achieve various therapeutic and performance benefits.

Russian current, in particular, has been used in physical therapy and sports training to help strengthen muscles, improve muscle endurance, and aid in muscle recovery. (1)

Russian currents are evenly alternating currents with a frequency of 2,500 Hz. This frequency range is particularly effective at stimulating motor nerves and recruiting a wide range of muscle fibers, including both fast-twitch and slow-twitch muscle fibers. (1) Russian current therapy has historical roots in Russia and Eastern Europe, where it was initially developed. As a result, it may not have gained widespread recognition or research attention as much as it should have been. Russian current therapy can be highly individualized, with parameters like frequency, intensity, and electrode placement needing adjustment for each patient. This complexity can make large-scale clinical trials for making successful research. Russian current has specific applications, primarily in rehabilitation and muscle strengthening. It may not be as widely used or researched as treatments for more prevalent medical conditions yet rehabilitation of musculoskeletal conditions, muscle re-education and to improve muscle strength Russian electrical stimulation has shown great effect which can lead to better quality of life. Due to the lack of standardized protocols for Russian current, an underrated outcome is delivered. Hence, this comprehensive review aims to bring attention to the evidence-based treatment approach towards Russian Current. The objectives of the review are as follows to review the articles on muscle strengthening as a treatment

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approach by Russian Current, to gain a comprehensive understanding of the existing body of knowledge, to evaluate the methodologies, research design, and approaches used in previous studies and identifying theories, concepts, and perceptions of the articles.

WORKING OF RUSSIAN CURRENT

These are applied with a series of separate bursts, i.e., polyphasic AC waveforms. with a frequency of 50 Hz and a burst duty cycle of 50% (Fig no:1). The duty cycle is the proportion of on-time contractions that are typically strong and mimic the patterns of muscle activation seen during voluntary muscle contractions and the off time which is when there is no electrical stimulation or muscle contraction, it allows the muscle to relax and recover briefly before the next cycle of stimulation the summation of both the on and off time expressed as a percentage. This balanced cycling is used to prevent muscle fatigue and excessive stress during the treatment session with a duty cycle of 50%. (1) Russian electrical stimulation is applied in the usual way with electrodes applied over the muscle belly, The treatment regimen commonly followed is a 10/50/10 treatment regimen. It means the simulation is applied for a 10-second "on" period, followed by a 50-second off period with a recommended treatment time of 10 minutes per stimulation session. (2) The objective is to increase a muscle's ability to generate force. Russian Current is applied, it stimulates these motor nerves, leading to muscle contractions. The Russian Current is an electrical stimulation therapy that uses specific frequencies and waveforms to target muscle groups, providing a unique approach to muscle strengthening.

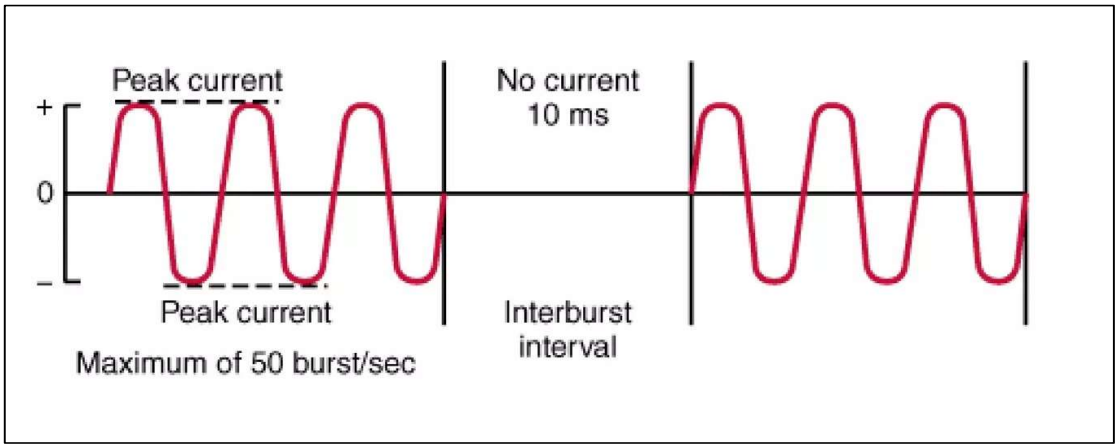

Figure 1: Working of Russian Current

EFFECT ON MUSCLE STRENGTHENING

Russian Current can recruit a mix of both fast-twitch and slow-twitch muscle fibers within a muscle. fibers with a small diameter known as type I, slow, or slow twitch fibers. Large diameter type II fibers, also known as quick fibers or fast twitch fibers. The majority of human skeletal muscles are composed of both kinds of fibers. It has been determined that type II muscle fiber is selectively increased following muscle stimulation by electrical stimulation. Type II muscle fibers have more specialized resistance than type I muscle fibers and a selective increase in type II muscle fiber increases general muscle strength. (3)

Increasing a muscle's capacity to produce force is the goal. When Russian Current is used, it activates these motor nerves, causing contractions in the muscles. Furthermore, it is best to combine this kind of stimulus with exercise. The following methods are typically followed to reduce muscular spasms and achieve muscle growth and strength. Russian Current electrical stimulation therapy targets particular muscle areas with particular frequencies and waveforms, offering a distinctive method of muscle building. The employment of this current is theoretically justified by the fact that virtually all of a muscle's motor units can contract synchronously in response to maximal electrical stimulation, an outcome that is not possible with voluntary contraction. Stronger muscle contraction results from this, leading to increased muscular hypertrophy. (2) The repeated stress imposed on the muscle tissue during Russian current-induced contractions can stimulate muscle protein synthesis and contribute to muscle hypertrophy over time. This is thought to occur through adaptations in muscle fiber recruitment patterns, enhanced neuromuscular coordination, and potential metabolic adaptations within the muscle tissue. Additionally, the enhanced muscle activation and recruitment patterns facilitated by the Russian current may lead to improvements in muscular strength and power output. (2)

MOTOR UNIT RECRUITMENT

Motor Unit Recruitment in Russian Current has been shown to recruit a greater number of motor units compared to voluntary contractions alone. Motor units are composed

of a motor neuron and the muscle fibers it innervates. By recruiting a larger pool of motor units, RC can effectively engage a greater proportion of muscle fibers within the targeted muscle, leading to more robust muscle contractions. (4)

The state of constant, passive, partial contraction of muscle with a specific vigor and tension is known as muscle tone. It might also mean the muscle's resistance to stretching. The significance of muscle tone is Maintaining proper posture is mostly dependent on muscle tone. Different bodily parts can move due to changes in muscle tone. Every skeletal muscle has a certain level of muscular tone. But the tone is more in the antigravity muscles, like the neck, trunk, and lower limb extensors. Control of Muscle Tone Although gamma motor neuron discharges provide muscle tone, several supraspinal centers located throughout the brain constantly maintain and regulate it. While some of these centers use facilitatory impulses to raise muscle tone, others use inhibitory impulses to lower muscle tone. Long-term exposure to Russian Current may lead to neuromuscular adaptations, including changes in motor unit recruitment strategies, alterations in muscle fiber type composition, and improvements in neuromuscular coordination and control. These adaptations can contribute to enhanced muscle performance and functional capacity. (3)

Increasing the muscle's cross-sectional area and increasing the tension per unit of that cross-sectional 2 area are the main goals of strength training. This applies to everyone, regardless of age. Increased muscle fiber size and an increase in capillaries to the muscle provide a larger mean fiber area in the muscle, which is what causes the bigger cross-section, or hypertrophy, linked to weight training. The reason for the size increase is thought to be either a separation or an increase in the size of the actual myofibrils. (5) The idea that the muscle fibers themselves might split is put forth by some researchers, although it hasn't been verified by human experimentation. The neurological influence on the development of strength is shown in the rise in tension per unit of cross-section. Early in the strength growth process, improvements in motor unit recruitment, firing rates, and synchronization are mostly attributed to the nervous system adapting. As the fibers become of higher quality, hypertrophy ensues.

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REVIEW OF LITERATURE

At Saveetha College of Physiotherapy, Saveetha University, Chennai, Drs. P. Vinoth and S. Senthilkumar et al. (2018) did a study on the effectiveness of Russian current combined with shoulder exercises to enhance shoulder abduction in patients with peri-arthritis. Their study was to determine the effectiveness of Russian current combined with exercises in treating peri arthritis shoulder by contrasting it with the traditional treatment of shortwave diathermy combined with exercises. 30 people between the ages of 40 and 60 made up Group B, the control group, and Group A, the experimental group. The VAS Pain Scale and the Goniometer were the outcome measures that were employed. They concluded that using Russian current with workouts significantly improved the range of motion and reduced pain. (6)

At the Loma Linda Veterans Administration Hospital in California, TINA J. WANG, MD;

KYUNGJE SUNG et al. (2019) studied the use of Russian Stimulation/Functional Electrical Stimulation in the Treatment of Foot drops caused by Lumbar Radiculopathy. Their study's goal was to cure foot drop caused by lumbar radiculopathy with FES using the Russian stimulation method. Manual muscle testing was used as the end measure. They concluded that, for individuals with lumbar radiculopathy leading to foot drop, FES with Russian stimulation may be a useful nonsurgical option. (7)

A COMPARISON OF DIFFERENT QUADRICEPS FEMORIS ISOMETRIC STRENGTHENING METHODS IN HEALTHY YOUNG WOMEN was the title of a study done at Pamukkale University in Turkey in 2020 by Bilge BA\AKCI ÇALIK, PhD, PT et al. Their research sought to assess the effects of Russian current, high voltage pulsed galvanic stimulation (HVPG), and isometric training on young, healthy women's quadriceps femoris (QF) isometric muscle strength. An isokinetic dynamometer was used as their outcome measure. They concluded that isometric exercise, HVPG, and Russian current applications all increased isometric muscle strength in healthy QF like that of isometric exercise. (8)

At the PiWestern University of Health Sciences (DMS), Pomona, California, Selkowitz DM, Rossman EG, Fitzpatrick S, et al. (2014) studied the effect of burst-modulated alternating current carrier frequency on the current amplitude required to maximally tolerate electrically stimulated quadriceps femoris knee extension torque. Their study set out to find out how medium frequency burst-modulated alternating current affected the current amplitude required to provide the highest possible electrically stimulated isometric knee extension torque while maintaining maximal tolerance. The study included ten individuals in good health. They concluded that producing quadriceps femoris knee extension torque is

almost twice as efficient with a carrier frequency of 2500 Hz. (9)

At the Exercise Research Laboratory, School of Physical Education, Brazil, Marco Aurélio Vaz, PhD, Fernando Amâncio Aragão, PhD, et al. (2013) studied the effects of Russian current and low-frequency pulsed current on the degree of discomfort and current amplitude at 10% maximal knee extensor torque. The goal of their study was to compare the discomfort and current amplitude between low frequency current and Russian current. In the study, 22 healthy participants underwent electrical knee extensor submaximal contractions that were maintained for 10 seconds. Maximum voluntary isometric contraction and a visual analogue scale were the outcome measures employed.

When the degree of discomfort was evaluated, they came to the conclusion that low-frequency pulsed current worked better than Russian current. (10)

At Ravi Nair Physiotherapy College, DMIMS (DU), Wardha, AShiSh WASudeorAo Bele1, Mohd Irshad Qureshi et al. (2012) did a study on the Impact of Electrotherapy or Muscle Training on Quality of Life in Urinary Incontinence in Male Geriatric Population-A Protocol. The purpose of this study is to determine how muscular training or electrotherapy affects quality of life in older male incontinence patients. The 81 participants in the study were split into three groups, each of which was given exercises in Pelvic Floor Muscle Training (PFMT), Russian current stimulation, and faradic stimulation, in that order. The Incontinence Questionnaire (31Q)19, Perineometer, (ICIQ-UISF)20, MUSIQ, and IIQ-7 were the outcome measures used. They came to the conclusion that electrotherapy or muscle strength training can lessen urinary incontinence in the elderly male population. (11)

The Krannert School of Physical Therapy, University of Indianapolis, USA, hosted a study on muscle force production with low and medium frequency burst modulated biphasic pulsed currents in 2013. James W. Bellew, PT, EdD, et al. This work uses BMBPC with low- and medium-frequency carrier currents to investigate evoked forces. The percent maximal isometric knee extensor forces (%MVIF) in 23 subjects were compared using a cross-over design between low and medium kilohertz carrier frequencies while using BMBPC. Maximum voluntary isometric contraction (MVIC) and visual analogue scale (VAS) were used as outcome measures. They came to the conclusion that low-frequency carrier current combined with burst-modulated biphasic pulsed current produces forces that roughly correspond to maximal volitional force. When utilizing NMES, these findings provide fresh information with significant therapeutic implications. (12)

Sr. No	Tittle	Author	Study Design	Aim	Nos. of Patients	Gender	Age	Outcome Measure	Conclusion
1	A study on efficacy of Russian current with shoulder abduction in periarthritis of shoulder	Dr. P. Vinoth Dr. S Senthilkumar	Experimental study	Russian Current with shoulder exercise can reduce pain, improve shoulder abduction range in patient with periarthritis of shoulder	60	Male and Female	35-70 years	Visual Analogue Scale and Goniometer	Russian Current With Shoulder exercise could be an effective intervention in the reduction of pain, increasing the shoulder abduction range in periarthritis of shoulder.
2	Effectiveness of Faradic and Russian Current on plantar flexor	G. Shankar Ganesh Ranjita Kumari	Comparative study	The Aim of this study was to determine the effectivenes	83	54 Male and 29 Female	Mean age 57 years	Goniometer, Modified Modified Ashworth	Adding Electrical Stimulation to exercises are associated with low to medium effect sizes (0.5)

	muscles spasticity, ankle motor recovery and functional gait in stroke patients.	Monalisa Pattnaik		s of Faradic and Russian current in the reduction of ankle plantarflexor spasticity and improving moter recovery in patient post stroke.				Scale (MMAS), Modified Emory Functional Ambulation Profile(mEFAP)	in reducing spasticity and improving ankle range of motion.
3	A case report of a 57-year-old male having post fracture stiffness of right shoulder with supraspinatus tear. A case report.	Nikita Deshmukh Vaidehi Kannao Waqar Nagvi	A case report	The aim is pain relief and movement normalization.	1	Male	57 years	Goniometer Measurement	Females are more likely to develop frozen shoulders than male after 45 years, physiotherapy is the most important manual therapy and electrotherapy is beneficial.
4	Russian Current vs High Voltage Current with Isokinetic training on quadriceps muscle strength and endurance	Bihter Akinoglu Tugba Kocahan	Comparative study	The aim of the study is to compare the effect of Russian current and high voltage pulsed current (HVPC) on the strength and endurance of the quadriceps muscles.	10	male	14-16 years	Isokinetic Device	It was determined that peak torque value of knee extensor quadriceps muscle endurance value and total amount of work done increases in both groups at the end of the training.
5	Quadriceps femoris muscle torque and fatigue generated by neuromuscular electrical stimulation with three different waveforms.	Yochened Laufer Jule Deanne Ries Peter M Leininger	Experimental study	The aim of this study is to compare the ability of three different waveforms to generate isometric contraction of Quadriceps femoris	30	15 males 15 females	22-38 years	MVIC	Result Indicated that the monophasic and biphasic waveform generated contractions with greater torque than the polyphasic waveform.

				muscle torque and fatigue generated by NMES.					
6	Wrist extensor torque production and	Alex R Ward Warwick G Oliver	RCT	Aim to compare 2 forms of monophasic pulsed	32	Male and Female	19-55 years		Russian Current elicited lower mean torque than those
	discomfort associated with low frequency and burst modulated kilohertz-frequency current.	Danielle Buccela		currents with 2 forms of burst modulated current was conducted to establish whether different amounts of wrist extensor torque were produced and athlete discomfort varied with stimulus type.					elicited by Aussie Current and monophasic pulsed current. The Russian and Aussie Current elicited significantly less discomfort than the 2 monophasic pulsed current.
7	Russian Current stimulation functional electrical stimulation in the treatment of foot drop resulting from lumbar radiculopathy. A case study.	Tina J Wang Kyungje Sung	A Case Study	Aim is to utilize Russian Stimulation in 3 cases to improve outcome in foot drop secondary to lumbar radiculopathy.	3	Male and female	35 years, 60 years, 56 years	Manual Muscle Testing	Findings suggest that FES using Russian stimulation might serve as an effective non-surgical option for patient with lumbar radiculopathy resulting in foot drop.
8	Bilateral effect of unilateral isokinetic concentric training and Russian current stimulation	Amira Hussin Draz1 , Amr Almaz Abdel-aziem	Experimental study	the purpose of this study was to compare between unilateral isokinetic concentric training and	60	male	21-24 years	Biodex Multi-joint System 3, Biodex, Shirley, NY, used to measure the isokinetic	Isokinetic training and Russian current stimulation have equal level of effectiveness in improving the concentric

	on quadriceps strength.			Russian current stimulation on the quadriceps strength of ipsilateral and contralateral limbs				concentric peak torque.	strength of the contralateral and ipsilateral quadriceps muscle.
9	Effect of Russian Current on Quadriceps muscle strengthening subjects with primary Osteoarthritis of knee. A Randomized Control Trial.	Snehal R Dharmayat Sonal S Nerurhar	A Randomized Control Trial Experimental Study.	Aim of the study is to know the effect of Russian Current stimulation on quadriceps muscle strength in patients with primary Osteoarthritis of knee.	30	Male and Female	50 years	Visual Analogue Scale WOMAC osteoarthritis Index for functional disability. Hand Dynamometer.	Russian Stimulation is effective in increasing muscle strength and secondarily improving the functional ability in subjects with primary Osteoarthritis knee.
10	Impact of Electrotherapy muscle strength training on quality of life in urinary incontinence of Male Geriatic population. A protocol.	Ashish Wasudeorao Mohd Irshad Qureshi		To find the impact of electrotherapy or training of muscle on quality of life in male geriatric population of incontinence of urine.	81	Only males		3 Incontinence Questionnaire (31Q)19 Perineometer (ICIQ-UISF)20 MUSIQ IIQ-7	The study concluded probably that the electrical stimulation and muscle strength training will reduce the urinary incontinence symptoms of male geriatric population

RESULT

The Initial Search resulted in a total of 69 articles (PubMed: 20, Google Scholar: 41, EBSCOhost: 8) (Figure 2). We identified few more articles after reference checking of relevant studies. 19 full-text articles were approved for review after duplicates and unpublished articles were eliminated, and several were included as references.

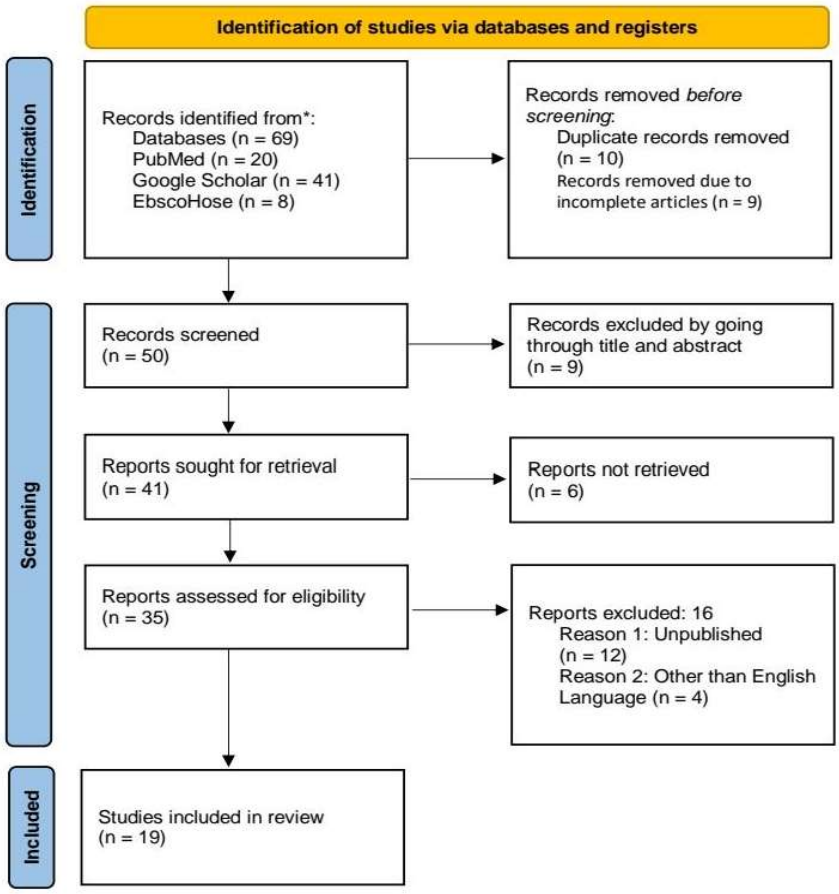

Figure 2: Study flow diagram (Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA))

DISCUSSION

This comprehensive review aimed to determine Russian Current as an effective approach for muscle strengthening. In healthy athletes, Russian current stimulation has proven to be an effective means of enhancing muscle strength.

While it is usual practice to combine electrotherapy with exercises to strengthen the pelvic floor muscles, Ashish Wasudeorao Bele et al. evaluated that no study has been done on the effects of either treatment alone. There aren't many studies on how the Russian current strengthens a weak pelvic floor. Numerous studies combine strength training exercises with electrical stimulation, a form of electrotherapy, to strengthen the pelvic floor muscles. The possibility of Russian current to strengthen athletes' muscles, especially their larger muscles, has also been investigated. Urge urine incontinence has showed potential when treated with tibial nerve stimulation. Spatiotemporal nerve stimulation has been proven useful in cases of refractory patients. (12)

Anand B. Heggannavar et al. studied the effects of Russian Current on strengthening the quadriceps muscle in Indian patients suffering from osteoarthritis of the knee. Randomly, the subjects were split into two groups. Group B underwent ten days of Russian current stimulation, Short Wave Diathermy (SWD), and exercise. Group A received SWD alone. While both groups engaged in static exercises, Group B also experienced stimulation with Russian currents. An intragroup comparison between the two groups revealed substantial differences in strength before and after treatment, which may have been brought on by the training program. However, the group stimulated with Russian currents exhibited a greater gain than the exercise-only group, indicating that the Russian current can also help increase muscle strength. (13)

Amr Almaz Abdel-aziem et al. assessed the impact of Russian current stimulation on the peak torque of the quadriceps muscles in burn patients who have recovered. The duration of the therapy was four weeks. Peak concentrated torque in the quadriceps was measured both before and after the intervention at a walking speed and rotation angle of 30°/s. Both the Russian group and the control group showed a significant increase in quadriceps peak torque after four weeks of therapy. When it came to peak torque, the Russian group's post-value was significantly higher than the control groups. Furthermore, there was a discernible increase in the post-values for

ambulation speed for both the Russian and Control groups; the Russian group's post-value was much higher than the Control groups. (14)

CONCLUSION

Russian current, also known as Russian stimulation, has shown promising results as a treatment approach for muscle strengthening. The use of this electrical stimulation method has demonstrated its effectiveness in improving muscle strength, enhancing endurance, and promoting muscle hypertrophy. While further research is needed to fully understand the underlying mechanisms and optimize its application, current evidence suggests that Russian current can be a valuable adjunct to traditional strength training programs. Its ability to target specific muscle groups, reduce muscle atrophy, and enhance neuromuscular activation makes it a potentially beneficial option for individuals seeking to optimize their muscle-strengthening regimen. However, it is crucial to consult with healthcare professionals or qualified practitioners before incorporating Russian current as electrotherapy into a fitness or rehabilitation plan to ensure its safe and appropriate use for Individual needs and conditions.

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